Prevention and Management of childhood obesity and its psychological and health comorbidities

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Abstract

Childhood obesity has serious physical, psychological, and social repercussions and is a widespread global health concern. The prevention and Management of pediatric obesity are examined in this publication, focusing on the disease's intricate origin and the variety of approaches needed to combat it. A combination of environmental influences, behavioral patterns, socioeconomic inequities, and genetic predispositions are responsible for the increasing frequency of childhood obesity. Childhood obesity raises severe long-term comorbidities, such as type 2 diabetes, cardiovascular disease, and mental health issues, in addition to acute health hazards.

A comprehensive strategy incorporating individual, family, school, community, and policy interventions is required for effective prevention techniques. Essential tactics include encouraging community participation, putting supportive laws into place, raising awareness and educating people, and using technology innovations like telemedicine and smartphone apps to increase accessibility.

Lifestyle changes, medication for certain illnesses, and bariatric surgery for severe conditions are all part of management strategies. Psychological therapy is also provided to help with emotional difficulties.

To develop long-lasting solutions, this text emphasizes how crucial it is for families, educators, legislators, and medical experts to work together. By tackling obstacles, including social stigma, unequal access to healthcare, and cultural variations, as well as using cutting-edge technologies, the text seeks to offer practical insights for lessening the impact of childhood obesity and enhancing outcomes for impacted kids around the world.

Keywords: Childhood obesity, Comorbidities, Preventive strategies, Behavioral interventions, socioeconomic disparities, Policy-level reforms, Technological integration, Lifestyle modifications, Non-alcoholic steatohepatitis (NASH)

Introduction

A primary global health concern that affects millions of children from a variety of backgrounds is childhood obesity. This disorder, typified by an excessive buildup of body fat, frequently arises from an imbalance between energy expenditure and calorie intake. Changes in lifestyle patterns, including consuming more calorie-dense foods, engaging in less physical activity, and being more dependent on technology, which encourages sedentary behavior, have led to a rise in its prevalence in recent decades.

Obesity in children has effects that go beyond short-term health issues. Obese children are more likely to experience serious health problems, such as cardiovascular disease, non-alcoholic fatty liver disease, type 2

diabetes, and orthopedic disorders. Affected people also endure psychological effects like sadness, low self-esteem, and social stigma, which make their problems much worse [1].

Obesity is a serious problem for public health systems around the world because it persists from childhood into adulthood, increasing the risk of chronic illnesses and lowering life expectancy overall.

To lessen the increasing burden of pediatric obesity, prevention, and Management are crucial. Early intervention, which includes behavioral and environmental changes, must be the primary goal of strategies. To reduce the occurrence of this disorder, preventive interventions like encouraging balanced meals, increasing physical activity, and creating supportive family and community contexts are essential. To treat the complex physical and psychological comorbidities linked to obesity, effective management strategies are needed, such as lifestyle modifications, psychological assistance, and, in extreme situations, medical or surgical choices [3].

A cooperative effort involving families, educators, legislators, and healthcare experts is essential to adopt long-lasting remedies and enhance results for impacted children.

Epidemiology of Childhood obesity

Around the world, childhood obesity has become an epidemic, and its incidence is rising in different areas and among various demographic groups. All socioeconomic levels have seen an increase in childhood obesity, underscoring the pervasive effects of environmental and lifestyle changes.

Data show that the frequency of pediatric obesity has sharply increased over the past few decades on a global scale. In the United States, for example, the prevalence of obesity in children aged 6 to 11 years grew from about 7% in 1980 to 18% by 2010, while rates increased from 5% to 18% in teenagers aged 12 to 19. These numbers demonstrate the continued change in eating habits and decreased physical activity levels among youth [2].

Similar patterns have been observed in Europe and other industrialized countries, while urbanization and changes in food habits are also contributing to a surge in underdeveloped countries.

The prevalence of childhood obesity varies significantly by demographic. Research points to gender-based differences, with females predominating in some areas and boys frequently having more excellent obesity rates in others. Racial and ethnic disparities highlight the intricate socio-cultural elements that contribute to obesity since environmental factors and genetic predispositions disproportionately impact certain minority groups. For instance, Hispanic and African-American youngsters in the US have been found to have more excellent obesity rates than their Caucasian counterparts [1], [6].

Socioeconomic status (SES) is another important consideration. Lower SES is frequently linked to a higher prevalence of obesity in high-income nations, most likely as a result of less access to opportunities for physical activity and a nutritious diet. On the other hand, children from affluent homes are more likely to be obese in developing countries, which is likely due to their increased access to processed, high-calorie foods [4], [10].

These numbers have significant ramifications. The burden of comorbidities, such as type 2 diabetes, hypertension, and psychological distress, is increased by rising pediatric obesity rates, posing serious problems for healthcare systems. Understanding these epidemiological patterns is crucial for tackling the socioeconomic and cultural factors contributing to this public health emergency and focusing preventative and intervention efforts on specific communities [11].

Etiology and Risk Factors

A complex interaction of genetic, behavioral, environmental, and sociocultural factors leads to childhood obesity. Designing successful preventative and Management measures requires an understanding of these interconnected components.

Genetic Factors: Heritability and Genetic Predisposition

Studies indicate that 40–70% of the variation in body weight can be ascribed to heritable features, suggesting that genetic factors significantly contribute to the risk of juvenile obesity. Essential characteristics include genes that affect energy expenditure, appetite regulation, and fat storage, including the melanocortin-4 receptor and leptin genes. The body's energy balance may be upset by mutations in these genes, which raises the risk of obesity. Extreme examples of how genetic defects can lead to severe obesity include rare monogenic disorders like Prader-Willi syndrome and Bardet-Biedl syndrome, in addition to polygenic factors. A multimodal approach to intervention is necessary because obesity in most children results from the combined impact of numerous genes interacting with behavioral and environmental factors [5], [15].

Environmental and Behavioral Factors: Screen Time Habits, Diet, and Physical Activity

Behavioral patterns and environmental exposures significantly influence the development of childhood obesity. High consumption of calorie-dense, nutrient-poor foods such as sugary beverages, processed snacks, and fast food is a major driver of excessive weight gain. Low physical activity often accompanies these dietary behaviors as children increasingly lead sedentary lifestyles. Screen time, including time spent on televisions, computers, and smartphones, not only limits opportunities for physical activity but also encourages unhealthy eating habits, often influenced by advertisements for energy-dense foods. Such behaviors disrupt the balance between energy intake and expenditure, creating conditions conducive to weight gain over time [3], [4].

Socioeconomic Factors: Family Dynamics, Urbanization, and Resource Access

The risk of obesity is significantly influenced by socioeconomic position and cultural factors. Children from low-income families are disproportionately affected by obesity in high-income nations because they have less access to wholesome foods and secure areas for physical activity. In contrast, wealthy populations in developing countries are more likely to be obese due to the easier availability of processed and high-calorie foods. Children's habits are greatly influenced by family dynamics, particularly parental modeling of healthy eating and activity practices. For example, parents who lead sedentary lifestyles or eat poorly tend to instill similar habits in their kids. These trends are made worse by urbanization, which limits access to natural, nutrient-rich food sources, decreases opportunities for outdoor play, and increases reliance on convenience meals because of time restrictions [5].

Effects of Prenatal and Early Childhood Exposures on Development and Early Life

Children are predisposed to obesity in large part due to variables that occur early in life. Pregnancy-related maternal health conditions such as gestational diabetes and excessive weight gain raise the risk of obesity in kids. Under such circumstances, fetal overexposure to insulin and glucose may alter the child's metabolism and systems for storing fat. Obesity is especially likely to develop in babies who are born large for gestational age or who gain weight quickly during the first year of life. Although the effects of breastfeeding vary from study to study, it has been proposed that breastfeeding offers preventive benefits by encouraging healthier weight trajectories. Furthermore, there is a high correlation between later obesity and the age of adiposity rebound, which occurs when a child's BMI starts to increase following a natural fall in early infancy [7].

Thus, genetic predispositions and modifiable risk factors, including eating habits, physical activity levels, socioeconomic pressures, and early-life exposures, contribute to childhood obesity. Addressing these elements collectively calls for an all-encompassing and focused strategy to avoid and manage this expanding public health issue.

Psychological and Health Comorbidities

Numerous physical and psychological comorbidities linked to childhood obesity affect the child's quality of life and provide long-term health hazards that continue into adulthood. The significance of treating obesity as a complex problem with aspects related to both physical and mental health is highlighted by these comorbidities [3], [5].

Health Risks: Fatty Liver, Diabetes, Heart Disease, and Joint Problems

Obesity in children raises the chance of developing several chronic illnesses. One of the most alarming comorbidities is type 2 diabetes, which is fueled by insulin resistance brought on by excessive fat buildup, particularly central adiposity. Obese children are also more likely to experience cardiovascular problems that lead to long-term cardiovascular disease, such as dyslipidemia, hypertension, and early signs of atherosclerosis.

Childhood obesity very frequently results in non-alcoholic fatty liver disease (NAFLD). Liver fibrosis and non-alcoholic steatohepatitis (NASH), two more serious disorders that can develop from excessive fat accumulation in the liver, can eventually result in liver failure. In order to slow the progression of these disorders, early intervention is essential [7].

Children who are obese often have orthopedic problems because of the increased mechanical load on their growing bones and joints. This demographic is prone to conditions like Blount's disease, slipping capital femoral epiphysis, and persistent knee and back discomfort. These physical restrictions have the potential to further lower levels of physical activity, which would feed the vicious cycle of weight gain and inactivity [8].

Psychological Effects: Depression, Anxiety, Low Self-Esteem, Stigma

Obesity in children has significant psychological effects that are sometimes overlooked. Due to social pressures and an idealized body image, children who are obese often suffer from low self-esteem, feelings of inadequacy, and body dissatisfaction. Reduced engagement in social and physical activities, social disengagement, and difficulties in the classroom can result from these poor self-perceptions.

Children who are obese frequently experience anxiety and depression, which are commonly made worse by bullying and social stigmatization. These kids' exclusion and loneliness might make them feel powerless and raise their risk of developing mental disorders. According to studies, children who are obese are more likely to experience peer bullying and teasing, which can worsen their psychological problems.

Weight gain can be made worse by emotional turmoil, which can cause overeating or dependence on comfort foods. In a similar vein, the stigma attached to obesity may deter kids from exercising or getting help, which would be detrimental to their physical and emotional health [3].

Prevention Strategies

A multimodal strategy that considers family dynamics, school environments, individual actions, and larger community and policy activities is needed to avoid childhood obesity. Evidence-based approaches aim to lower the risk of obesity and the health consequences that go along with it by modifying lifestyle and environmental factors [4].

Personal Interventions: Diet, Exercise, and Counseling

The cornerstone of obesity prevention is individual-level tactics, which highlight the significance of healthy habits from an early age. Dietary recommendations include lowering the intake of calorie-dense, nutrient-poor items such as processed snacks, sugary drinks, and fast food while encouraging a balanced diet full of fruits, vegetables, whole grains, lean meats, and low-fat dairy. Mindful eating and portion control are other crucial elements.

Promoting physical activity is equally important. According to the World Health Organization, children should participate in moderate-to-intense physical exercise for at least 60 minutes per day. Sports, bicycling, walking, and active play can all fall under this category. These initiatives are enhanced by reducing sedentary behaviors, such as excessive screen time [8].

The goal of behavioral counseling is to develop enduring, healthful behaviors. Clinicians and counselors can assist children and families in setting reasonable objectives, overcoming obstacles, and creating long-lasting lifestyle changes suited to each person's needs and preferences by employing strategies like motivational interviewing [6], [13].

Family Approach: Parents' Role in a Supportive Home

Children's routines and actions are greatly influenced by their families. Creating a home environment that promotes active living and healthy eating is primarily the responsibility of parents and other caregivers. Other strategies include making meals at home, encouraging regular family mealtimes, and reducing the availability of unhealthy snacks at home.

Since children frequently imitate their parents' eating and activity habits, setting an example of positive conduct is crucial. Parents can also set screen usage rules and create active play routines. It has been demonstrated that family-based interventions that involve every member increase the efficacy of initiatives to prevent obesity by promoting a healthy culture in the home [1], [15].

School Programs: Health Education, Exercise, and Nutritious Meals

Given how much time children spend in educational settings, schools are crucial places to undertake obesity prevention programs. Comprehensive school-based programs incorporate health education to teach kids about the value of maintaining a healthy weight, physical exercise, and nutrition.

Students participate in frequent, structured physical activity thanks to physical education programs. Physical fitness is further supported via extracurricular sports and recess. Schools can also serve wholesome meals by adhering to nutritional recommendations, serving balanced breakfasts and lunches, and limiting the availability of sugary drinks and unhealthy snacks in cafeterias and vending machines.

The impact of school-based activities can be increased by working with communities and parents to promote these healthy behaviors [9].

Community and Policy Level Initiatives

Interventions at the community and policy levels are crucial to establishing settings that encourage healthy living. To promote physical exercise, urban planning projects can involve creating parks, playgrounds, bike lanes, and pedestrian-friendly infrastructure. Encouraging outdoor play and active commuting to school requires safe neighbors.

Controlling food marketing, especially ads aimed at kids might lessen their exposure to unhealthy food and drink options. Families are empowered to make educated decisions by policies that support the explicit

labeling of nutritional content. It has been demonstrated that taxes on sugar-filled beverages and other high-calorie, low-nutrient goods reduce consumption, lowering overall calorie intake [10].

Public awareness campaigns and farmer's markets are two community initiatives that can help increase access to fresh, healthful foods and inform people about the advantages of leading a healthy lifestyle [7].

Management of Childhood Obesity

A multidisciplinary strategy that considers the intricate interactions between behavioral, psychological, and physical aspects is necessary to manage pediatric obesity effectively. More invasive alternatives like surgery are saved for extreme instances, and strategies range from lifestyle changes to medical and psychological support.

Lifestyle Interventions: Focus on Diet, Exercise, and Behavioral Changes

The mainstay of managing childhood obesity is lifestyle modification. They include dietary, exercise, and behavioral changes to encourage a better lifestyle.

Dietary Changes: The goal is to increase the consumption of fruits, vegetables, whole grains, and lean proteins while decreasing the consumption of items high in calories and nutrients. To assist kids in having better relationships with food, portion control and mindful eating techniques are promoted [10].

Physical exercise: Every day, kids should participate in moderate-to-intense physical exercise for at least 60 minutes. To increase energy expenditure, it's also essential to cut back on sedentary habits like screen time.

Modifications in Behavior: Including techniques for goal-setting, self-monitoring, and reinforcement aids in maintaining wholesome routines. Programs for family-based lifestyles are especially good at establishing a nurturing atmosphere that encourages sustained adherence [4].

Medication Use: Metformin and Other Options in Select Cases

Children and adolescents with obesity who have not reacted well to lifestyle modifications and who also have comorbid conditions like type 2 diabetes or insulin resistance may benefit from pharmacological therapies [1], [6].

Metformin: This medication, primarily used to treat insulin resistance or prediabetes, increases insulin sensitivity and aids in mild weight loss. Teenagers who are obese and have type 2 diabetes or metabolic syndrome are frequently prescribed it.

Additional Drugs:

Orlistat and other anti-obesity drugs have been utilized in a few instances, but their usage is usually restricted because of their poor efficacy and adverse effect profiles. To guarantee a comprehensive strategy, pharmacotherapy is typically saved for adolescents and used in conjunction with rigorous lifestyle changes [13].

Surgical Intervention

Teenagers with extreme obesity (BMI ≥ 40 kg/m^2 or ≥ 35 kg/m^2 with significant comorbidities) who have not responded to other therapies may be candidates for bariatric surgery. It is only used when obesity presents serious and immediate harm to one's health.

In addition to exhibiting the capacity to follow post-operative lifestyle modifications, candidates must have reached near-final adult height. A psychological examination is also required to guarantee preparedness for the procedure and its aftermath [8].

Sleeve gastrectomy, adjustable gastric banding, and gastric bypass are common surgeries. Significant weight loss and improvements in comorbidities such as diabetes and hypertension are achieved with these operations; however, lifelong monitoring is necessary to track dietary inadequacies and mental health.

Limitations: Bariatric surgery should only be used as a last resort after all other treatments have been tried because it is intrusive, costly, and fraught with problems [4], [9].

Emotional and behavioral support

To address the emotional and behavioral issues related to obesity, psychological support is an essential part of managing the illness.

Counseling: Motivational interviewing and cognitive-behavioral therapy (CBT) are valuable techniques for assisting kids and families in making long-lasting lifestyle adjustments. These methods resolve negative self-perceptions, enhance emotional regulation, and increase self-efficacy.

Unhealthy eating habits can be made worse by the stigma, worry, and despair that children with obesity frequently experience. Better mental health outcomes are promoted, and these problems are lessened with the aid of psychological therapy.

Long-term success depends on a supportive home environment, which is ensured by involving the entire family in therapy sessions. Parents and caregivers are taught strategies for modeling healthy habits and reinforcing good improvements [2].

Barriers to Prevention and Management

There are many obstacles to successful prevention and Management of childhood obesity, including social, economic, healthcare, and cultural barriers, which must be addressed holistically to enhance outcomes.

Social Stigma

Children who are obese frequently experience negative stereotyping, bullying, and discrimination, as well as other forms of social stigma. This stigma can worsen the issue by discouraging individuals from getting care or engaging in physical activities, in addition to hurting their mental and self-esteem.

Stigma can be decreased by supporting awareness programs that encourage empathy and understanding, incorporating body-positive messaging into communities and schools, and putting anti-bullying rules into place. Another good way to shift the conversation is to promote conversations on health rather than weight [11].

Healthcare Access

A significant obstacle is the lack of healthcare services, especially for low-income or rural families. Many children are prevented from receiving prompt therapies due to a dearth of pediatric specialists, insufficient insurance coverage, and the high expense of treating obesity.

Access can be enhanced by investing in community-based projects, extending healthcare coverage, and funding obesity prevention programs. In places with a shortage of specialists, training primary care physicians to provide basic obesity care can also assist in closing the gap [10], [11].

Economic Disparities

Economic disparities significantly impact opportunities for physical activity and the availability of nutritious food. Lack of access to fresh produce, safe places to exercise, and affordable, high-calorie processed foods can be a problem for low-income families.

These differences can be addressed by policies that support the accessibility and affordability of healthy meals, such as taxes on sugar-filled beverages and subsidies for fruits and vegetables. Low-cost substitutes can also be found through community initiatives like urban gardens and farmer's markets. Improving parks, recreational facilities, and other public infrastructure guarantees equal possibilities for physical activity [6].

Cultural Barriers

Cultural norms and customs frequently influence dietary patterns and attitudes toward exercise. Higher body weight may be seen favorably in some cultures, whereas traditional diets may contain meals heavy in fat or calories in others. Additionally, families may be deterred from participating in obesity prevention programs by language challenges and mistrust of healthcare systems.

I. Creating culturally aware treatments suited to specific populations can increase effectiveness and engagement. Programs that encourage healthy behaviors are more likely to be embraced by target communities when community leaders work together and use culturally relevant messages. A diversified healthcare workforce and multilingual resources can also enhance trust and communication.

Policy reforms play a crucial role by supporting measures that encourage healthy behaviors, such as establishing nutrition standards in workplaces and schools and boosting financing for preventative programs. Offering easily accessible materials, workshops, and support groups prioritizing active living and a healthy diet, education, and awareness also gives families more control. By using applications and telehealth services to provide support to families in underprivileged areas, technological integration also provides scalable solutions, spanning accessibility barriers and guaranteeing complete treatment, which is depicted in figure no 1[7], [12], [13].

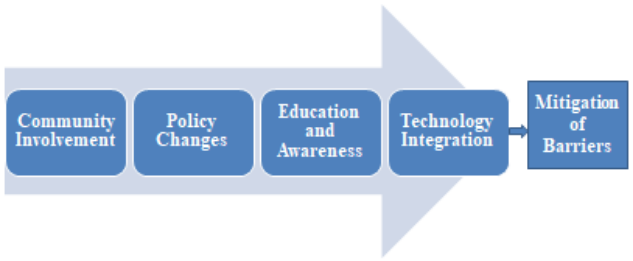

Figure no 1: Strategies to Overcome Barriers

Future Directions

Given that there has been progress in combating childhood obesity, several critical gaps still need to be filled to create long-term, practical solutions. Improving prevention and management techniques requires addressing these gaps through innovation and systemic approaches [1], [2].

Long-Term Efficacy of Interventions

Many current therapies only offer temporary advantages, and nothing is known about how to maintain favorable results over time. Research must consider strategies for sustaining healthy habits and avoiding weight gain throughout youth and adulthood. Longitudinal studies are crucial to assess the long-term effects of community initiatives, school-based programs, and lifestyle interventions. To guarantee that interventions have a long-lasting impact on children's health, these studies should also pinpoint elements that improve adherence and deter relapse [7].

Genetic Studies and Precision Medicine

Although the intricate relationship between genetic predispositions and environmental triggers is still poorly understood, the importance of genetics in childhood obesity is widely acknowledged. These linkages

could be better-understood thanks to developments in genomics and epigenetics. The effectiveness of prevention and treatment plans may be improved by precision medicine techniques, which use genetic information to provide specialized therapies for children who are more at risk. A more focused approach to treating obesity would be possible by examining how heredity affects people's reactions to pharmacological and lifestyle interventions [13].

Strategies for Systemic Change

Childhood obesity rates are significantly influenced by the larger environment, which includes elements like food systems, urban planning, and socioeconomic inequality. Important areas for improvement include laws that facilitate access to reasonably priced, healthful foods, fair urban planning that promotes exercise, and controls on marketing directed toward children. Assessing how fiscal policies, such as tariffs on sugar-filled beverages, affect eating habits in various demographics and environments might yield important information about scalable systemic fixes.

Role of Technology and Innovation

Technology provides strong tools for managing, preventing, and tracking pediatric obesity. Mobile apps, wearable technology, and telehealth platforms are examples of digital health solutions that can offer scaled and customized interventions. These technologies can be improved and incorporated into healthcare and educational systems with the support of research on the efficacy of technology-driven initiatives, such as gamified physical activity programs or AI-based nutritional tracking. To maximize the impact and accessibility of new technologies, it is imperative to investigate how they might be used in conjunction with conventional interventions [7], [9], [10].

Addressing Psychological and Social Determinants

Current approaches frequently ignore the psychological and social aspects of childhood obesity, such as stigma and mental health issues. More holistic care models would be produced by addressing social determinants of health, such as family relationships and cultural influences, and incorporating mental health assistance. Equally crucial topics for more research include creating environments that support acceptance and resilience and lowering stigma through inclusive messaging [14].

Global Collaboration and Equity-Focused Approaches

Global cooperation is necessary to create fair solutions for childhood obesity because it varies significantly across socioeconomic and cultural situations. Localized interventions can be guided by best practices found through comparative studies across varied groups. Creating cooperative networks to exchange information and assets helps guarantee that effective tactics are modified and applied globally [7], [15].

Conclusion

A complicated and multidimensional global health issue, childhood obesity necessitates prompt and ongoing care. This disorder has profound effects on physical and mental health and raises the burden of comorbidities like type 2 diabetes, cardiovascular disease, and mental health issues. It is caused by a combination of genetic, behavioral, environmental, and socioeconomic variables. To combat this epidemic, a comprehensive, multi-level strategy involving families, communities, schools, and legislators is needed.

Promoting healthy behaviors through community engagement, legislative changes, education, and technological integration is the primary goal of effective prevention measures. Evidence-based management measures, such as lifestyle changes, medication for certain conditions, and surgery for extreme situations, are equally crucial. Emotional well-being is also addressed through psychological therapy.

Cultural disparities, unequal access to healthcare, and social stigma must all be eliminated for these programs to succeed.

Families, lawmakers, educators, and medical professionals are among the stakeholders who must collaborate to provide fair and sustainable solutions. This effort can reduce childhood obesity rates, reduce the health costs of childhood obesity, and ensure better futures for children worldwide by combining innovative approaches with traditional strategies.

References

[1]. Childhood obesity: Overview and diseaseburden**,** Journal of Global Health Perspectives, vol. 5, pp. 123-132, 2018.

[2]. S. B. Barlow and the Expert Committee, "Expert committee recommendations regarding the prevention, assessment, and treatment of child and adolescent overweight and obesity: Summary report," Pediatrics, vol. 120, no. 4, pp. S164–S192, Dec. 2007.

[3]. Trends in childhood obesity: A review of global data," Pediatrics International, vol. 60, no. 4, pp. 345-356, 2018.

[4]. L. A. Baur and T. Lobstein, "Child and adolescent obesity: Part of a bigger picture," Lancet, vol. 385, no. 9986, pp. 2510–2520, Jun. 2015.

[5]. R. K. Davis, "Mental health implications of childhood obesity," Journal of Pediatric Psychology, vol. 44, no. 3, pp. 210-220, 2018.

[6]. S. Kumanyika, R. Parker, and A. Simons-Morton, "Environmental influences on childhood obesity: Ethnic and cultural influences in context," PhysiolBehav, vol. 86, no. 5, pp. 667–682, Dec. 2005.

[7]. World Health Organization, "Guidelines for childhood obesity prevention and physical activity," Geneva: WHO Press, 2018.

[8]. W. H. Dietz and S. L. Gortmaker, "Preventing obesity in children and adolescents," Annu Rev Public Health, vol. 22, pp. 337–353, May 2001.

[9]. S. K. Kumanyika and S. Grier, "Targeting interventions for ethnic minority and low-income populations," Future Child, vol. 16, no. 1, pp. 187–207, Spring 2006.

[10]. D. S. Freedman, Z. Mei, S. R. Srinivasan, G. S. Berenson, and W. H. Dietz, "Cardiovascular risk factors and excess adiposity among overweight children and adolescents: The Bogalusa Heart Study," JAMA, vol. 288, no. 14, pp. 1811–1817, Oct. 2002.

[11]. R. M. Puhl and J. D. Latner, "Stigma, obesity, and the health of the nation's children," Psychol Bull, vol. 133, no. 4, pp. 557–580, Jul. 2007.

[12]. L. L. Birch and J. O. Fisher, "Development of eating behaviors among children and adolescents," Pediatrics, vol. 101, no. 3, pp. 539–549, Mar. 1998.

[13]. S. A. Faith, B. Saelens, D. E. Wilfley, and K. A. Allison, "Behavioral and social influences on food choice," Nutr Rev, vol. 59, no. 3, pp. S19–S39, Mar. 2001.

[14]. D. S. Ludwig, K. E. Peterson, and S. L. Gortmaker, "Relation between consumption of sugar-sweetened drinks and childhood obesity: A prospective, observational analysis," Lancet, vol. 357, no. 9255, pp. 505–508, Feb. 2001.

[15]. S. Kumanyika, R. Parker, and A. Simons-Morton, "Environmental influences on childhood obesity: Ethnic and cultural influences in context," PhysiolBehav, vol. 86, no. 5, pp. 667–682, Dec. 2005.