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## Exploring Modern Trends and Prevention Strategies for Childhood Obesity: A Comprehensive Literature Review

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**Exploring Modern Trends and Prevention Strategies for Childhood Obesity:  
A Comprehensive Literature Review**

An Undergraduate Honors Thesis  
Submitted in Partial Fulfillment of  
University Honors Program Requirements  
University of Nebraska-Lincoln

by

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### **Abstract**

This literature review seeks to provide an overview of the current research on childhood obesity. The study examines the prevalence and causes of childhood obesity, including genetic, environmental, and behavioral factors. The review also discusses the health consequences associated with childhood obesity, such as the increased risk for chronic diseases and psychological and social problems. Additionally, the review explores the effectiveness of interventions designed to prevent childhood obesity, including individual lifestyle modifications, education from health practitioners and school programs, and global, national, and state programs to promote wellness. The literature review concludes that childhood obesity is a complex and multifactorial issue requiring a comprehensive and interdisciplinary approach. The review identifies gaps in the existing research and suggests areas for future investigation, emphasizing the need for evidence-based interventions and for increased recognition and funding to reduce the prevalence of childhood obesity and its associated chronic diseases.

**Key Words:** “Nutrition” “Childhood” “Obesity” “Risks” “Prevention” “Health Education”  
“Health Interventions”

## **1. Introduction**

Childhood obesity is a critical public health concern that has gained increasing attention in recent years. Rates of obesity among children have risen steadily over the past few decades both in the United States and in many other countries (World Health Organization, 2018). This trend is particularly concerning given the significant health implications of obesity in childhood, including increased risk of chronic diseases such as cardiovascular disease, diabetes, and certain types of cancer as well negative psychological and social consequences (Sanyaolu et al., 2019; Yan et al., 2014).

Given the prevalence and severity of this issue, many studies have been conducted to explore its causes, consequences, and potential interventions. The causes of childhood obesity are complex and multifactorial. There is no single cause of childhood obesity, rather, it is the result of the interplay between genetic, environmental, and behavioral factors. The environment in which children grow up plays a significant role in the development of obesity, with factors such as access to healthy food, opportunities for physical activity, and social and economic conditions all influencing a child's risk of becoming obese (Sanyaolu et al., 2019). Moreover, individual factors such as dietary habits, physical activity levels, sleep patterns, and chronic stress also play a critical role in the development of childhood obesity (Nga et al., 2019). There remain conflicting findings and varying perspectives on the root causes of childhood obesity and the most effective approaches for large-scale prevention.

This literature review aims to provide a comprehensive overview of the current state of knowledge on childhood obesity, including its prevalence and trends, risk factors, psychological and physical health outcomes, economic costs, and potential prevention strategies. Ultimately,

the goal of this review is to provide a foundation for future research and interventions that can help to mitigate the burden of childhood obesity on individuals and society as a whole.

## **2. Prevalence & Trends in Childhood Obesity**

According to the CDC, childhood obesity specifically refers to a “body mass index (BMI) at or above the 95th percentile of...sex-specific BMI-for-age growth charts” (CDC, 2022). The prevalence of childhood obesity in the United States is alarmingly high and has been on the rise for decades. From 2017 to 2021, nearly 14.7 million children and adolescents aged 2-19 years old were affected, representing 19.7% of this age group. The prevalence of obesity varied across age ranges, with the highest rates observed among 12-19 year-olds (CDC, 2022).

Disparities in childhood obesity persist with higher rates seen among certain racial, ethnic, and socioeconomic populations. Those that seem to be more susceptible to obesity include Hispanic children at 26.2% prevalence and non-Hispanic Black children at 24.8%. This is compared to 16.6% seen among non-Hispanic White children and only 9.0% among non-Hispanic Asian children (CDC, 2022). Additionally, the income and level of education of the head of the household appear to play a role in the likelihood of childhood obesity. A prevalence of 18.9% to 19.9% is seen in the lowest-income and middle-income groups. In contrast, prevalence among the highest income group is lower at 10.9%. Prevalence also tends to decrease as the education level rises (CDC, 2022).

Rates of childhood obesity have risen in recent years, both in the United States and globally. According to the CDC, in the past two decades, the obesity rate among children and adolescents in the U.S. increased from 14% to 18.5% (2022). Looking back three decades, the prevalence in children has more than doubled and in adolescents, it has more than tripled

(Sanyaolu et al., 2019). Note that these statistics do not include data since the COVID-19 pandemic era.

Global trends mirror those observed in the U.S. The most recent report from the World Health Organization (WHO) in 2019 showed that an estimated 38.2 million children under the age of five were overweight or obese - a staggering 5.6%. Additionally, the proportion of children of all ages with overweight or obesity has risen over time, from 4% in 1975 to 18% by 2016 (Polak-Szczybyło, 2023). WHO estimated this jump to be more than 10-fold, from 11 million to 124 million school-aged children and adolescents with obesity (World Health Organization, 2018). Since these reports, the COVID-19 pandemic in 2020 has led to further weight gain among children and adolescents due to isolation measures resulting in increased consumption of high-calorie meals and sugary foods, reduced physical activity, and limited access to healthy food (Polak-Szczybyło, 2023).

### **3. Risk Factors for Childhood Obesity**

Obesity, in its most simple explanation, is the result of a positive energy balance. Energy balance refers to the sum of energy that is consumed through food and drink compared to that which is expended through the resting metabolic rate, thermic effect of food, and physical activity. When energy intake is greater than expenditure, body fat is gained (Hill et al., 2013). The equation is simple, but contrary to the belief of many, weight loss and maintenance are not. Energy balance is regulated by a complex physiologic control system determined by genetics and epigenetic changes and affected by a wide range of behavioral factors to which the body responds. Some of these that will be discussed include diet, physical activity, and sleep. Additionally, behavioral choices are influenced greatly by environmental factors like health

education, accessibility of healthy options, marketing, and technology. There is no single cause for the increasing prevalence of childhood obesity, and it would be nearly impossible to formulate a comprehensive list. However, some of the most certain risk factors are described here.

### **3.1. Genetics**

Obesity can run in families, and some children are simply more susceptible to developing elevated levels of body fat. Genotype plays a significant role in the development of childhood obesity by influencing how body weight is regulated, one way being through hormones.

Leptin is a hormone produced by adipocytes that regulates satiety. According to an article by Ramos-Lobo and Donato, the genotype can influence leptin secretion through several mechanisms. One important gene related to leptin secretion is the LEP gene, which codes for the hormone. Certain genetic variations in the LEP gene have been associated with changes in leptin production and secretion. Other genes involved in leptin signaling, such as the LEPR gene, can also impact leptin secretion and function (Ramos-Lobo & Donato, 2017).

Insulin is another hormone, and its functions include regulating blood sugar levels and fat storage. When blood sugar levels are chronically high, there will be excess circulating insulin. Over time, the body becomes insulin resistant, and excess blood sugar is stored as fat. These mechanisms lead to both weight gain and type 2 diabetes (Wondmkun, 2020). Regarding insulin secretion, one article states that genetic factors can influence insulin secretion and sensitivity. Several genes have been implicated in the regulation of insulin secretion, including the TCF7L2 gene. Variations in this gene have been associated with impaired insulin secretion and increased risk of type 2 diabetes and obesity (Ramos-Lobo & Donato, 2017).

Dysregulation of leptin and insulin signaling can also contribute to the development of obesity. In particular, leptin resistance can lead to increased appetite and decreased energy expenditure, while insulin resistance can impair glucose uptake and lead to elevated blood glucose levels. In susceptible individuals, an obesogenic environment can quickly lead to both leptin and insulin resistance and a greater likelihood of positive energy balance and weight gain. (Ramos-Lobo & Donato, 2017).

These are just a few mechanisms by which genetics affect the likelihood of a child to develop overweight or obesity. Not all children will struggle to maintain a healthy weight because of genetics, but for those who do, it may feel like their body is working against them. This aspect of obesity should lead us to empathy for both children and parents, even as we consider risk factors that are within their control.

### **3.2. Dietary Habits**

One systematic review article states, "The increased prevalence of overweight, obesity, hypertension, type 2 diabetes, stroke, and other non-communicable diseases is partly due to the growth of unhealthy food choices" (Vecchio & Cavallo, 2019). Children who have poor eating habits and regularly consume fast and processed foods, sugary drinks, and calorically dense meals are at increased risk for obesity (Calcaterra et al., 2023). Each of these factors leads to overconsumption of calories and low nutrient intake. Examples of poor behavioral habits that have been shown to increase the incidence of childhood obesity include inadequate portion control, irregular meals, constant grazing during the day, eating during screen time, and eating in response to boredom, stress, or loneliness (Styne et al., 2017).



To lower the risk of developing obesity, calorie intake can be reduced by eating more nutrient-dense foods such as fruits and vegetables and less dietary fat and refined carbohydrates. However, many children and adolescents eat less than 3 servings of fruits and vegetables per day, significantly less than the recommended 5 to 7 servings as suggested by the U.S. Department of Agriculture (Styne et al., 2017). This inadequate consumption of dietary fiber may contribute to excessive weight gain, emphasizing the importance of encouraging vegetable and whole-fruit intake.

Children and adolescents today are consuming more sugar-sweetened beverages (SSBs) than ever before, with larger portion sizes contributing to increased consumption. These drinks, which contain free sugars, are a significant contributor to dietary sugar intake. According to the ‘What We Eat in America’ analysis in 2016, “24% of added sugar intake came from SSBs in people older than 1 year old, specifically 16% from soft drinks, 5% from fruit drinks, 2% from sport and energy drinks and 1% from other sources” (Calcaterra et al., 2023).

SSB intake is linked to both weight gain and obesity-associated diseases. The main mechanism for weight is that drinking beverages with large amounts of sugar does not increase satiety. Because of this, a child will not feel full and continue to eat even though enough calories have been consumed to meet their energy needs (Calcaterra et al., 2023). Limiting SSB consumption by children, including fruit juices, and increasing knowledge of their health effects can help prevent obesity and related complications. Future research is needed to investigate the long-term effects of SSBs on health outcomes and to more fully understand how added sugars impact the body’s energy regulation.

**Table 1***Practical Dietary and Eating Habit Recommendations for Children and Parents*

|   |
|---|
| <b>Dietary Recommendations</b>  |
| Decrease consumption of fast food and processed foods.                            |
| Consume fruits, vegetables, fish, and whole grains.                               |
| Reduce intake of dietary fat and refined carbohydrates.                           |
| Reduce or eliminate sugar-sweetened beverages from the diet.                      |
| Encourage the consumption of whole fruits rather than fruit juice.                |
| <b>Eating Habits</b>  |
| Learn appropriate portion sizes and practice portion control.                     |
| Eat regular meals and avoid “grazing” during the day, especially in the evenings. |
| Recognize unhealthy eating cues like boredom, stress, screen time, etc.           |

*Note.* Recommendations were obtained from (Styne et al., 2017).

### **3.3. Marketing**

The increasing prevalence of obesity can be attributed in part to the easy availability and affordability of high-calorie foods, which are heavily marketed and promoted. The price of unhealthy foods like McDonald's and Coca-Cola has decreased over time, while the price of fruits and vegetables has increased (Sanyaolu et al., 2019). Additionally, companies tend to spend more money promoting sugary beverages over low-calorie options, resulting in a higher likelihood of children being exposed to unhealthy food (Meléndez-Illanes et al., 2022). The foods that influencers promote do not support healthy eating. This high exposure to high-fat,

sugar, and salt products among children is a significant public health concern that should not be underestimated. Efforts should be directed towards limiting children and adolescents' exposure to the marketing of unhealthy food through channels like digital media. The findings of various studies agree that it is crucial to protect all children's rights against harmful marketing (Meléndez-Illanes et al., 2022). In their 2018 report, WHO stated, “Children need to be supported by food environments where the healthy choice is an easy and affordable choice, and they need to be protected from exposure to powerful marketing of foods and beverages.”

### **3.4. Physical Inactivity & Technology**

Modern physical activity levels and excessive technology use have significant impacts on childhood obesity. The majority of adolescents do not get enough physical activity, “with some 81% of adolescents globally...falling below minimum recommended levels” (World Health Organization, 2018) which leads to less energy output and a greater likelihood for positive energy balance and weight gain.

One contributor is that fewer children in the U.S. are walking or biking to school. This percentage of children has decreased significantly from 42% in the 1960s to only 16% today (Sanyaolu et al., 2019). This could be due to several factors such as distance, convenience, weather, lack of sidewalks, or safety concerns. Additionally, only 13.8% of elementary, middle, and high schools provide adequate physical education classes for at least four hours each week (Sanyaolu et al., 2019). It seems it is becoming increasingly difficult for children to utilize active transportation and find opportunities for active play.

Furthermore, the increasing popularity of technology, such as smartphones and tablets, has become an integral part of life for many households. Alotaibi et al state, "Technology use

among children is one of the predicting factors for physical inactivity" with children spending up to 11 hours each day on screens (2020). Contributing to weight gain, screen time tends to be coupled with snacking and excess eating in addition to already reduced physical activity levels (Alotaibi et al., 2020). Technology-dependent children also have impaired quality of life and are often affected emotionally, socially, and academically. Excessive screen time use reduces children's opportunities to interact and socialize with others which can foster unhealthy lifestyle habits (Alotaibi et al., 2020).

Overall, physical activity is essential for maintaining normal body weight, stabilizing blood pressure and glucose levels, and improving sleep patterns as well as immune response and metabolism (Alotaibi et al., 2020). When children do not burn enough calories through physical activity and consume more calories than they expend, they are at risk of gaining weight and developing associated chronic conditions.

## **Table 2**

### *Practical Recommendations for Physical Activity & Screentime for Children*

|  |
|--|
| Engage in at least one hour per day of moderate to vigorous intensity physical activity. |
| Participate in sports and/or physical education classes at school.                       |
| Reduce screentime. Less than 5 hours each week is optimal.                               |
| Do not utilize screen time during meals or snack time.                                   |
| Participate in active housework or chores.   |

*Note.* Recommendations were obtained from (Styne et al., 2017; Alotaibi et al., 2020).

### 3.5. Stress

Stress has been linked to an increased risk of childhood obesity. When children experience chronic stress, they may develop a preference for sugary and high-fat foods, leading to increased energy intake and weight gain (Nga et al., 2019). Likewise, stress can reduce a child's ability to resist overeating and lead to excess weight gain. In turn, being overweight can lead to even more stress and drive to eat (Nga et al., 2019). To break this harmful cycle of emotional tension, overeating, and high BMI, it is necessary to identify and address stressors for children and adolescents. Some examples of stressors that children and adolescents face include academic pressure, peer relationships, social media, school and life transitions, and familial conflict. Healthy coping mechanisms that can be used to manage stress include self-soothing techniques, breathing exercises, calming or mind-occupying activities, exercise, self-affirmations, and journaling (Children's Hospital Colorado, 2023).

#### Table 3

##### *Practical Recommendations for Parents to Manage Stress with Children*

|  |
|--|
| Discuss stress with children and identify potential chronic stressors. |
| Teach healthy coping skills for stress and emotional tension.          |

*Note.* Recommendations were obtained from (Nga et al., 2019).

### 3.6. Sleep

In recent years, research has shown a correlation between sleep deprivation and obesity risk in children. Disordered sleep patterns, such as inadequate sleep duration, poor sleep quality, and late bedtimes, have been linked to several risk factors for childhood obesity. These include sedentary behaviors like screen time, unhealthy eating habits, and hormonal changes such as

insulin resistance (Jebeile et al., 2022). While there is a limited amount of research that focuses on using sleep as a method to treat obesity in children, interventions to improve sleep hygiene, particularly in preschool-aged children, have been found to result in decreased weight gain (Jebeile et al., 2022). Encouraging consistent bedtime routines, regular sleep-wake times, and reduced screen time in the evening may have multiple benefits and positively impact other weight-related behaviors.

**Table 4**

*Sleep Recommendations for Each Age Group*

|                         |                             |
|-------------------------|-----------------------------|
| Infants (0-3 months)    | 14-17 hours, including naps |
| Infants (4-12 months)   | 12-16 hours, including naps |
| Toddlers (1-2 years)    | 11-14 hours, including naps |
| Preschool (3-5 years)   | 10-13 hours, including naps |
| School-Age (6-13 years) | 9-12 hours                  |
| Teens (14-17 years)     | 8-10 hours                  |

*Note.* Recommendations were obtained from (Nemours Children’s Health & Gavin, 2021).

### **3.7. Education and Accessibility**

The availability of unhealthy foods, health illiteracy, and limited self-regulatory skills prevent many children and parents from adhering to healthy lifestyles. Though they recognize the need for change and even desire it, they may not know what changes are truly healthy or may not have the time, ability, or resources to implement them. While education on health can improve choices and BMI, families in medically underserved areas or in developing countries

may not have the opportunity to improve their body weight status due to poor infrastructure, lack of resources, and a shortage of trained personnel (Nga et al., 2019). Additionally, low-income parents may not be able to make meals with their children, spend time doing physical activity as a family, or pay for programs that will provide opportunities for their children to eat healthily, be active, and learn healthy habits outside of their home (Alotaibi et al., 2020). Often parents do their best with what they already know and the resources they have. These are reasons the burden of children's health cannot be up to parents alone and what they can afford.

#### **4. A Culture of “Fat Shaming”**

In the United States today, we tend to see an attitude of weight bias towards overweight and obesity in both adults and children. Fatphobia is defined by Boston Medical Center as “the implicit and explicit bias of overweight individuals that is rooted in a sense of blame and presumed moral failing” (2023), and it leads to a culture of “fat shaming.” This attitude includes the beliefs that someone overweight cannot be healthy, that some body shapes are more desirable than others, and that losing weight should be a primary goal in healthcare. This is also known as a weight normative approach which will be discussed further later in this review.

Children experience fat shaming in many ways. Some social media and advertising include only people of certain body types. Resources intending to encourage weight loss may show pictures of overweight kids which instead promote feelings of shame, disgust, or rejection, feelings which can quickly lead to bias and prejudice. Using negative language like "obesity epidemic" promotes fear, and using defining language like "obese child" communicates to children that their weight is their identity. These practices are damaging to the well-being of children, especially when they come from parents or other trusted adults. Under this stigma,

children with excess weight are likely to feel shame or embarrassment about their body or weight, and this can lead to depression or depressive symptoms. These symptoms may, in turn, promote unhealthy eating and lifestyle patterns - a vicious cycle of malnutrition and poor health (Grossniklaus et al., 2010).

## **5. Consequences of Childhood Obesity**

Childhood obesity is a prominent issue in health and medicine today because it poses significant risks to children's health and well-being. Excess weight in childhood is directly associated with a wide range of psychological and physiological processes which often persist through adulthood. Some consequences are related to culture and social factors, but there are also lifelong chronic issues that can arise from metabolic processes. As such, childhood obesity requires attention and action to mitigate the negative consequences that can impact the lives of millions of children. Recognizing these potential consequences is crucial to understanding the scope of the problem of childhood obesity, promoting healthy lifestyles, and preventing long-term health problems.

### **5.1. Psychological, Emotional, and Social Health**

Childhood obesity has significant psychological effects that can persist into adulthood. As mentioned by Polak-Szczybyło, “Obesity and depression are undeniably linked” with depression in childhood often leading to obesity in adulthood. Additionally, obesity in adolescence is associated with an increased risk of depression in adulthood (2023). Adolescents with obesity are more likely to experience negative self-esteem, body dissatisfaction, and social isolation, which can exacerbate mental health issues like depression (Sanyaolu et al., 2019).



Unfortunately, children with obesity may also face weight-based stigma and bullying, which can have further negative impacts on their mental health. This stigma can lead to harmful behaviors such as binge eating, avoidance of healthcare services, and social isolation, which in turn can worsen obesity and create barriers to behavior change (Sanyaolu et al., 2019).

Moreover, childhood obesity can have broader social and emotional impacts on children's well-being. Poor academic performance and lower quality of life have both been associated with childhood obesity (Sanyaolu et al., 2019). While physical health outcomes are often the result of physiological processes, the causes of mental health outcomes tend to be more social and cultural in nature. Thus, it is important to address the issue of childhood obesity in a holistic way that addresses both physical and mental health outcomes.

## **5.2. Physical Health**

Obesity is strongly associated with several comorbid diseases. These include hypertension, high cholesterol, cardiovascular disease, type 2 diabetes, stroke, several common cancers, osteoarthritis, metabolic syndrome, menstruation problems, and sleep trouble (World Health Organization, 2018; Yan et al., 2014). Several of these associated diseases are leading causes of death globally, and, “according to the World Health Organization (2016), 2.8 million global deaths (5%) are attributable to obesity” (Vecchio & Cavallo, 2019). These are not solely problems to deal with in adulthood as “obese children express the same comorbidities that are associated with being overweight and obese as adults” (Polak-Szczybyło, 2023). According to the same study, prolonged exposure in childhood to the inflammation caused by obesity increases the risk of developing many of these comorbidities at an early age, and “an increased

BMI in childhood is a predictor of the occurrence of metabolic syndrome in adulthood” (Polak-Szczybyło, 2023).

One mechanism by which obesity can lead to chronic disease is through low-grade chronic inflammation (LGCI). The cells that store fat in the body, adipocytes, play a role in producing cytokines, and these proteins are important regulators of the immune system. In obesity, increased production of pro-inflammatory cytokines leads to LGCI. The severity of LGCI is directly related to the amount of adipose tissue, and the risk of metabolic syndrome increases with worsening obesity. Inflammatory marker levels are highest in obese children, and there is a strong relationship between waist circumference, body mass index, and the level of pro-inflammatory markers (Polak-Szczybyło, 2023). When inflammation becomes chronic, it can contribute to the development and progression of non-communicable diseases by damaging tissues and promoting insulin resistance, atherosclerosis, and other harmful processes (Polak-Szczybyło, 2023). This is just one reason why the incidence of non-communicable diseases is much higher in children with obesity.

It is not possible to claim that obesity *causes* these chronic health problems because there are so many contributing factors. However, at minimum, it is clear that the same lifestyle factors which lead to excess body weight also lead to chronic disease. Healthy lifestyle modification and the weight loss that accompanies it can significantly reduce these risks (Pi-Sunyer, 2009).

### **5.3. Economic Cost**

Childhood obesity not only takes a toll on children's health but also poses a significant financial burden on the healthcare system and society as a whole. In the U.S., the increased BMI

among children and adolescents has led to billions of dollars in additional healthcare costs (Styne et al., 2017). The cost of childhood obesity is expected to rise as the number of overweight and obese children continues to increase. According to The Brookings Institution, if every child and adolescent with obesity in the U.S. became an adult with obesity, "the individual average cost would be >\$92,000, and the societal costs during their lifetimes might be >\$1.1 trillion" (Styne et al., 2017). Overall, the topic of childhood obesity and its associated chronic diseases is a major public concern "due to the enormous economic costs and burden on human well-being" (Vecchio & Cavallo, 2019).

## **6. Prevention Strategies**

Childhood obesity is a significant health concern globally, and parents, health practitioners, schools, and government programs all have a critical role to play in preventing it. Parents play a pivotal role by choosing to breastfeed and shaping children's eating habits as they mature. Health practitioners must monitor the growth of children and provide parents with nutrition and health education, while schools can help instill healthy lifestyles through comprehensive physical education and health education curriculums. Lastly, global, national, and state programs are needed to cast a vision for healthy lifestyles for children and to provide funding. Only a comprehensive, multi-level, and multi-sectoral approach will effectively address this issue of childhood obesity and begin to reverse global trends.

### **6.1. The Role of Parents**

Parents play a crucial role in preventing childhood obesity by establishing healthy habits and shaping their children's food preferences and eating behaviors. Breastfeeding has been found to be a significant protective factor against childhood obesity (Yan et al., 2014). Globally,

parents are advised to follow the WHO recommendations of exclusive breastfeeding for the first 6 months, followed by breastfeeding supplemented with additional foods for the first 2 years or beyond (Yan et al., 2014). In the U.S., the CDC guideline is that infants should continue to breastfeed for 12 months rather than 2 years (CDC, 2022). Formula feeding provides excessive fat and protein, which have been associated with adiposity in early childhood. On the other hand, breast milk has a moderate number of calories and nutrients, such as protein, sugar, water, and fat, which may vary depending on the mother's diet and time and the child's needs (Yan et al., 2014). The decision to breastfeed an infant is the first important decision towards raising a child. However, some women are unable to breastfeed for various practical or financial reasons, and in these cases, a pediatrician should be consulted about the best options for the mother and child.

As a child grows up, parents should model healthy eating habits and provide a diverse range of healthy food options. Active parental involvement and role-modeling practices are beneficial in promoting positive food-related behaviors, especially in young children. Providing a range of healthy foods will enhance the quality of a child's diet and increase their acceptance of different types of foods (Mahmood et al., 2021). Additionally, research suggests that a combination of encouragement and moderate restriction practices is the most effective strategy for parent feeding practices. Moderate restrictions involve gradually decreasing and limiting unhealthy food, rather than strictly forbidding it. These practices tend to have a positive impact on dietary behaviors and are associated with consuming fewer calories, eating more fruits, and consuming fewer fatty snacks and sweets. In contrast, restrictive parental feeding practices were associated with overeating, particularly among preschool-age children (Mahmood et al., 2021). Lastly, children should not be pressured to eat. As seen in the Quebec Longitudinal Study of

Child Development, children who had a better family environment, with less pressure to eat, had lower levels of soft drink consumption and higher levels of fitness (Mahmood et al., 2021).

The home food environment, including the availability and accessibility of food and the frequency of eating out, also greatly influences children's dietary behaviors. Studies have shown that cooking at home and having shared family meals at least three times a week are associated with healthier dietary habits and normal body weight in children and adolescents (Mahmood et al., 2021). It is recommended that parents be provided with information and guidance on not only what to feed their children but also how to feed them. Health promotion strategies should also target parents' unhealthy eating habits, so they can improve their diet and serve as positive role models for their children (Mahmood et al., 2021).

### **Table 5**

#### *More Practical Recommendations for Parents*

|   |
|---|
| Breastfeed exclusively for the first 6 months, if possible, followed by breastfeeding supplemented with additional foods for 1-2 years. |
| Model healthy eating habits and provide a diverse range of healthy food options.  |
| Use both encouragement and moderate restriction practices.  |
| Do not force or bribe children to eat.  |
| Do not use food as a reward or punishment.  |
| Have shared family meals at least three times per week.   |

*Note.* Recommendations were obtained from (Yan et al., 2014; Mahmood et al., 2021; CDC, 2021; CDC, 2022).

## 6.2. The Role of Health Practitioners

Health practitioners play a crucial role in preventing childhood obesity by monitoring child growth and development, communicating health and nutrition information to parents, and promoting dietary and activity education. To effectively reduce the risk of childhood obesity, clinicians should involve the entire family in obesity prevention efforts and assess family function to address stressors that could contribute to obesity (Styne et al., 2017). However, it is important to note that health practitioners may not always be adequately trained in nutrition and preventive medicine. According to Crowley et al., nutrition is inadequately incorporated into medical education with many medical students lacking nutrition knowledge (2019). Establishing a global or national benchmark for the required level of nutrition education for medical students would make a great impact in the fight against childhood obesity.

When it comes to the discussion and treatment of childhood obesity by health practitioners, it is important to avoid stigmatizing weight. One strategy to effectively prevent this is to adopt a weight-inclusive approach rather than a weight normative approach. Weight normative approaches focus on weight and weight loss as markers of health and can easily lead to shame. Whereas, a weight-inclusive approach looks to other markers and promotes healthy behaviors without focusing solely on weight (Tylka et al., 2014). It is important to recognize that people come in all shapes and sizes, and this is not the best indicator of health. What matters most is behavior modification to avoid the lifelong consequences of obesity-associated diseases, NOT the number on the scale. Thus, the best practical advice for clinicians to give is not "lose 10 pounds" but practical advice for incremental behavior modification. These goals should be attainable and measurable and include an explanation that is related to health markers other than

weight (Styne et al., 2017). An example for a patient who often eats fast food could be, “try eating fast food only 4 times each week instead of 5 times, so we can continue to lower your cholesterol and blood pressure.” Throughout this review article, advice for practical behavior modification is included to emphasize these ideas and provide examples for clinicians and parents. See Tables 1-5.

### **6.3. The Role of Schools**

Schools play a crucial role in preventing childhood obesity. As written by Ashford in the Omaha World-Herald, “schools are at the front line of preventing and mitigating childhood obesity. Especially for elementary-age children, offering nutritious food, a comprehensive physical education curriculum, and robust health education can help instill healthy habits” (2022). However, the effectiveness of school-based interventions in preventing childhood obesity is mixed (Nga et al., 2019).

Health education in schools should focus on equipping children with the knowledge and skills to make healthy food choices and promote physical activity. Currently, “US students receive less than 8 hours of required nutrition education each school year, far below the 40 to 50 hours needed to affect behavior change,” and, “the percentage of schools providing required instruction on nutrition and dietary behaviors decreased from 84.6% to 74.1% between 2000 and 2014” (CDC, 2023). Nutrition education in schools is clearly lacking and should be implemented more thoroughly to effectively reduce the incidence of obesity in school-age children and adolescents. With nutrition education, activity-based methodologies, such as plays, games, and cooking have been effective in motivating young students to develop healthy eating habits (Nga et al., 2019). School-based physical activity interventions include physical education classes,

physical break times, and after-school activities. Additionally, reducing school stress and pressure can have positive effects on BMI in children and adolescents (Nga et al., 2019).

Effective interventions in schools to prevent childhood obesity include a variety of strategies. These include having teachers act as role models, implementing school policies that promote healthy food and beverage choices while limiting unhealthy snacks, and increasing physical activity through changes in the schoolyard, recess rules, and physical education classes. Involving parents in the intervention, utilizing incentives and social marketing techniques, and collaborating with local stakeholders have also been found to increase the effectiveness of each intervention strategy (Lambrinou et al., 2020). Programs that solely focus on educating parents without promoting environmental and policy changes are less effective. Additionally, cultural adaptations are recommended to increase the acceptance of interventions among specific or vulnerable populations (Lambrinou et al., 2020).

Although many people support these ideas, schools require additional funding and a suitable platform to effectively implement them. More attention from global, national, and state programs will be necessary for these interventions to be widely successful.

#### **6.4. Global, National, and State Programs**

Childhood obesity is a global issue that requires a collaborative effort between countries, national organizations, and state-level programs to address. While individual intervention is most effective from parents, clinicians, and schools, broader programs are needed to cast vision and provide funding. On the large scale, the World Health Organization has set global targets for halting the increase in obesity, and while progress has been made, most countries are still off-



track to meet these targets (World Health Organization, 2018). “For the last three decades, no country has shown a significant decrease in obesity” (Nga et al., 2019).

On the national stage, the United States has established Healthy People 2030 through the Office of Disease Prevention and Health Promotion (OASH). The objectives of Healthy People 2030 are to improve the health and well-being of Americans by the year 2030 by promoting health equity, eliminating disparities, and providing evidence-based interventions in areas like nutrition, physical activity, mental health, substance abuse, and chronic disease prevention. Some specific targets to reduce childhood obesity include increasing the proportion of schools that provide healthy foods and beverages, increasing the percentage of children and adolescents who meet the physical activity guidelines and reducing the percentage of children and adolescents who consume sugar-sweetened beverages (OASH, 2023). These efforts are ongoing, but little progress has been made. Specifically, the OASH website states that there is “little or no detectable change” in the objective to “reduce the proportion of children and adolescents with obesity” (OASH, 2023).

Also in the U.S., the CDC promotes 47 high-impact obesity prevention standards for Early Care and Education (ECE). These standards promote healthy eating and physical activity among young children in ECE settings like childcare centers, preschools, and Head Start programs. They guide healthy food and beverage options, active play, screen time limits, staff training, family engagement, and community partnerships. The implementation of these standards varies by state and ECE setting but has been shown to help lower BMI in children when implemented (CDC, 2021).

Funding health education is an essential part of preventing pediatric obesity, as treating children and adolescents with obesity can be challenging and often requires changes in diet, physical activity, and environment. Intensive interventions involving lifestyle changes, regular communication with both the patient and their family, and education on nutrition, exercise, and behavior modification are often not adequately reimbursed by health insurance plans, making it difficult to provide these services (Styne et al., 2017). Furthermore, there is a lack of recognition at both the national and international levels of the importance of addressing obesity prevention and treatment (Styne et al., 2017). It will be important to work with policymakers to increase awareness of this issue.

At the state level, Nebraska has implemented policies and programs to promote healthy eating and physical activity in schools, such as banning sugary drinks and snacks, offering healthy meal options, and providing opportunities for physical activity during the school day. One initiative in Nebraska is the farm-to-school programs that connect schools with local farmers and food producers. In 2021, the Farm to School Act was passed which provided funding for these programs and allowed schools to spend “more than \$3 million on locally produced dairy, meat, fruits, and vegetables” in the following school year (Ashford, 2022). Another Nebraska program very close to home is Partnership for a Healthy Lincoln, which aims to promote wellness by decreasing obesity rates and encouraging fitness in schools (Healthy Lincoln, 2023).

Addressing childhood obesity requires a multi-level approach that involves global targets, national objectives, state and community programs, and funding for health education. Nebraska's programs serve as an example of local efforts to promote healthy lifestyles and prevent pediatric

obesity. However, more extensive implementation of community- and school-based initiatives is needed for the trends in childhood obesity to begin to change.

## **7. Conclusion**

The studies reviewed in this literature demonstrate the importance of preventing childhood obesity to mitigate associated lifelong risks of chronic mental and physical health problems. However, preventing childhood obesity means addressing a complex issue with no singular factor. Evidence demonstrates that some of the most important risk factors in children include poor dietary habits, physical inactivity, excessive screen time, chronic stress, insufficient sleep, and poor nutrition and health education. Despite the intervention efforts that have taken place, the rates of childhood obesity continue to rise. To effectively address this issue, it will be necessary to implement more comprehensive and far-reaching strategies which include parents, health practitioners, schools, and national and state wellness programs. By taking steps to implement already well-researched advice, it may be possible to reverse the trend of childhood obesity and promote healthier lifestyles for children and adolescents. However, gaps in the literature remain on which intervention strategies are the most helpful and cost-effective. To date, there has been limited success in using a singular strategy; therefore, it is probable that a combination of strategies will be necessary.

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