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*Review Article*

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## **A Comprehensive Review on the Etiology of Childhood Obesity: A Comparative Analysis between Western Medicine and Traditional Chinese Medicine (TCM)**

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Childhood obesity has emerged as a critical public health issue in the United States and many other economically affluent and transitioning countries [1-3]. As the number of obese individuals has risen, so have obesity-related conditions [2]. Hence, it is imperative for healthcare professionals to identify overweight or obese children to provide appropriate counseling and treatment.

In affluent countries worldwide, there is a high prevalence of overweight and obesity in children [2,18]. Directly comparing prevalence rates between countries is challenging due to differences in definitions and data collected at different times. The use of International Obesity Task Force (IOTF) standards generally leads to lower prevalence estimates than other standards [19,20]. However, research employing comparable statistics reveals particularly high rates (over 30 percent) in most North and South American countries, as well as the United Kingdom, Greece, Italy, Malta, Portugal, and Spain [21]. Somewhat lower rates are observed in Nordic countries, France, and Central Europe [2]. In Russia and most Eastern European countries, the prevalence of overweight is lower (around 15 percent) but increasing. In China, the prevalence of childhood overweight is approximately half that of the United States, but rates are significantly higher in younger children than adolescents [22].

## **Trends**

Globally, childhood overweight and obesity have increased over the last 50 years in various countries, whether affluent or resource-poor. However, several higher-income countries have experienced recent stagnation or decline in these trends [18]. The rate of childhood obesity growth in middle- and low-income countries is approximately 30% higher than in high-income countries [32,33]. Stagnation in childhood obesity prevalence has been reported in population studies in Australia [34,35] and France [36], while declining rates were recorded in Germany [37], Switzerland [38], Spain [39], and Canada [40], as well as among preschoolers in New Zealand [41].

## **Changes Related to Coronavirus Disease 2019 (COVID-19)**

The COVID-19 pandemic has been associated with an increase in childhood obesity in several countries [42-45]. For instance, in a California healthcare system, obesity prevalence increased across all age groups in the first year of the pandemic, with the highest impact observed in children aged 5 to 11, where obesity prevalence rose from 19% to 26% [42]. Similar trends were noted in a national sample [46]. Other studies

indicate that the pandemic exacerbated obesity risk factors, disproportionately affecting urban and low-income populations [45,47,48].

## **Environmental Factors**

Childhood obesity is strongly influenced by environmental factors, whether sedentary lifestyle or higher caloric intake. Specific environmental influences contribute to discussions and substantial research. While these factors explain only part of obesity risk, they are crucial treatment targets as they are modifiable [70,71].

In our research context, it's essential to highlight the close connection between childhood obesity and the surrounding environment. This can result from a sedentary lifestyle or excessive caloric intake relative to children's needs. The specific effects of the environment on obesity are extensively explored in the literature and supported by significant research. Although the environment can only partially explain childhood obesity risk, it represents a crucial factor in treatment strategies as it is modifiable. This research focuses on identifying and evaluating specific environmental factors contributing to the rising incidence of childhood obesity with the goal of developing effective prevention and treatment approaches.

In this regard, we will examine the increasing trends in the glycemic index of foods, the impact of sugary beverages, the effects of larger portion sizes for prepared foods and fast-food services, decreased family presence during meals, reduced levels of structured physical activity, and increased screen time for computer, electronic, or digital gaming activities. Additionally, we will scrutinize the nutritional content of school meals and the impact of elements of the built environment, such as the availability of sidewalks and playgrounds. All these aspects will be addressed from the perspective of their contribution to the increasing rates of childhood obesity.

## **Sugar-Sweetened Beverages**

Increasing evidence suggests that the consumption of sugar-sweetened beverages, including fruit juices, plays a significant role in the development of obesity in certain groups [81-83]. According to representative national surveys for U.S. children, sugar-sweetened beverages provide an average of 270 kilocalories per day, representing between 10 and 15 percent of the total caloric intake [84]. A randomized study highlighted that reducing the consumption of sugar-sweetened beverages in overweight and obese adolescents led to a modest decrease in body mass index (BMI) [85]. In another randomized study conducted on children aged 5

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to 12, mostly with normal weight, daily consumption of artificially sweetened beverages was associated with lower weight gain and fat accumulation compared to the consumption of sugar-sweetened beverages [86].

In all these studies, the observed effect size was relatively small. However, these findings support the idea that population-level interventions targeting the reduction of sugar-sweetened beverage consumption through means such as changes in school or public policies, including taxing these products, can bring significant benefits [87-91].

### **Recreational Screen Time**

Devices and the format of media screen usage are continually evolving, and their recreational use (i.e., outside of school or academic activities) should be appropriately considered when establishing clinical goals. A randomized study suggests that a significant reduction in media screen usage can enhance the effectiveness of physical activities [92].

### **Research associating screen time with obesity has also focused on specific types of media:**

Television: TV watching is probably the most well-established environmental influence on childhood obesity development. Time spent in front of the TV or even the presence of a TV in a child's room correlates directly with the prevalence of obesity in children and adolescents [93-99], although some studies have reported a weaker correlation [100-102]. Effects may persist into adulthood: in two longitudinal studies on cohorts, it was observed that watching TV starting at  $\geq 5$  years old was independently associated with increased BMI at ages 26-30 [103,104]. Several mechanisms have been proposed to explain this association [105-108]:

Replacement of physical activity: Time spent in front of media screens may replace physical activity, contributing to the increased risk of obesity.

Depression of metabolic rate: Prolonged exposure to media screens may lead to a decrease in the metabolic rate, favoring fat accumulation.

Adverse effects on diet quality: Another possible mechanism is related to the negative effects of media screens on diet quality. It is theorized that food advertisements and exposure to food content during viewing can influence food consumption, independent of hunger.

TV effects on sleep: Time spent in front of the TV may affect sleep quality, negatively influencing weight

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regulation.

A study provides evidence that the effects of TV on obesity are primarily mediated by changes in caloric intake. In a randomized study, reducing screen time (TV and computer) for four- to seven-year-old children with overweight led to a decrease in both BMI and caloric intake over two years, with no significant changes in physical activity [106]. Similar associations between TV time and caloric intake were highlighted in studies with older youth or those without overweight [109].

Video Games: The use of electronic games has also been associated with childhood obesity [110,111]. However, the effect appears to be less robust than for TV watching [112,113]. This may be because many video games include body movements that require energy expenditure [114]. Nevertheless, an observational study in children aged 10 to 13 revealed an association between an increase in video game usage and an elevated risk of overweight [115]. In a study on adolescents, the presence of a TV or computer in the bedroom, along with more extended playing time, was independently associated with an increased risk of overweight [116].

### **Built Environment**

Elements of the built environment, such as the availability of sidewalks, parks, and playgrounds, influence physical activity levels in children [119,120]. A cross-sectional study conducted in a large cohort of U.S. children reported that neighborhoods with more parks or playgrounds had a lower prevalence of obesity [121]. Other studies have corroborated these findings, emphasizing the importance of safe and accessible spaces for outdoor activities [122,123]. In addition to recreational spaces, the design of neighborhoods and the presence of sidewalks also impact physical activity levels. A systematic review highlighted that neighborhood walkability is associated with increased physical activity and lower obesity rates in children and adolescents [124].

### **School Environment**

Schools play a vital role in shaping the behavior and health of children, including dietary habits and physical activity levels [129,130]. The school environment significantly influences childhood obesity, and interventions targeting this setting have the potential for substantial impact. Several aspects of the school environment are critical in understanding and addressing childhood obesity:

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**School Meals:** The nutritional content of school meals is a crucial factor in the development and prevention of childhood obesity. A systematic review found that interventions aimed at improving the nutritional quality of school meals had a positive impact on children's dietary behaviors and weight status [133]. In the United States, the National School Lunch Program (NSLP) provides subsidized meals to over 30 million children each school day, making it a critical component of children's diets [134]. However, the nutritional quality of school meals has been a subject of debate, with concerns raised about excessive calories, added sugars, and inadequate fruit and vegetable servings [135,136]. Addressing the nutritional content of school meals is a key strategy in the battle against childhood obesity.

**Physical Education and Activity:** Physical education (PE) is an essential component of the school environment that can contribute to the prevention of childhood obesity. A systematic review and meta-analysis found that increased time dedicated to PE was associated with improvements in body mass index (BMI) and overall physical activity levels among school-aged children [137]. However, challenges exist in ensuring that all children receive an adequate amount of PE, as disparities may exist based on factors such as socioeconomic status and school resources [138]. Implementing policies and interventions that prioritize and enhance PE in schools is crucial for addressing childhood obesity.

**Screen Time in Schools:** The prevalence of screen time in schools has risen with increased access to technology. While technology can offer educational benefits, excessive screen time in schools may contribute to sedentary behavior and potentially impact childhood obesity. It is essential to strike a balance between leveraging technology for educational purposes and ensuring that students engage in sufficient physical activity during the school day. [139]Addressing screen time policies in schools is an integral part of a comprehensive approach to childhood obesity prevention.

## **Future Directions**

As childhood obesity remains a complex and multifaceted issue, ongoing research is essential to further our understanding and inform effective prevention and intervention strategies. Several areas warrant attention in future investigations:

**Genetic and Epigenetic Factors:** Research exploring the genetic and epigenetic factors contributing to childhood obesity can provide valuable insights into individual susceptibility and potential targeted interventions.[135] Understanding the interplay between genetics, epigenetics, and environmental influences

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is crucial for developing personalized approaches to obesity prevention and treatment.

Cultural and Socioeconomic Influences: Examining the impact of cultural and socioeconomic factors on childhood obesity rates is vital for addressing health disparities. Tailoring interventions to specific cultural contexts and considering socioeconomic determinants can enhance the effectiveness of obesity prevention strategies.

Community-Based Interventions: Collaborative efforts involving communities, schools, healthcare providers, and policymakers are essential for successful childhood obesity prevention. Community-based interventions that integrate multiple stakeholders and address environmental, social, and cultural factors can create sustainable and impactful changes.

Digital Health Solutions: The integration of digital health technologies, such as mobile applications and wearable devices, holds promise for childhood obesity prevention and management. These technologies can facilitate behavior tracking, provide personalized feedback, and offer educational resources to children and their families.

Policy Advocacy: Advocating for evidence-based policies at local, national, and global levels is crucial for creating environments that support healthy behaviors. Policy initiatives related to nutrition, physical activity, and screen time regulations can significantly contribute to childhood obesity prevention.

### **Traditional Chinese Medicine (TCM) Diagnosis of Childhood Obesity**

In Traditional Chinese Medicine (TCM), childhood obesity is understood through the lens of imbalances in the body's vital energy (Qi), the flow of blood, and the harmony of organ systems. TCM diagnoses are based on patterns of disharmony, considering factors such as constitution, lifestyle, and emotional well-being.[139]

#### 1. Spleen and Stomach Imbalance:

- Etiology:
  - Dietary Factors: Excessive consumption of greasy, sweet, and processed foods can weaken the Spleen, leading to Dampness and Phlegm accumulation.
  - Sedentary Lifestyle: Lack of physical activity contributes to a sluggish metabolism, hindering the Spleen's transformative functions.
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- Emotional Stress: Chronic stress or worry can weaken the Spleen Qi, affecting its ability to transport nutrients.[140]

## 2. Liver Qi Stagnation:

- Etiology:

- Emotional Factors: Frustration, anger, or unresolved emotions can lead to Liver Qi stagnation.

- Irregular Lifestyle: Disruptions in daily routine, lack of regular exercise, and poor sleep can contribute to stagnant Qi flow.

- Unhealthy Diet: Consumption of spicy or greasy foods may exacerbate Liver Qi stagnation.[141]

## 3. Kidney Yang Deficiency:

- Etiology:

- Constitutional Weakness: Some individuals may have a constitutional predisposition to Kidney Yang Deficiency.

- Excessive Cold Exposure: Prolonged exposure to cold environments or consumption of cold foods weakens Kidney Yang.

- Overexertion: Excessive physical or sexual activity can deplete Kidney Yang[140].

## 4. Blood Stasis and Phlegm Obstruction:

- Etiology:

- Long-Term Obesity: Chronic obesity may lead to poor circulation, resulting in Blood stasis.

- Unhealthy Diet: A diet high in fatty, greasy foods contributes to Phlegm accumulation.

- Lack of Physical Activity: Sedentary behavior exacerbates Blood stasis and Phlegm accumulation[141].



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**Integrative Approach:**

- Holistic Assessment: Integrating TCM and Western medicine assessments for a comprehensive understanding.
- Individualized Treatment Plans: Tailoring interventions based on the unique combination of TCM syndromes and biomedical factors.
- Lifestyle Modifications: Incorporating TCM dietary principles, stress-reducing techniques, and therapeutic movement alongside conventional approaches.

Understanding the etiology of each TCM syndrome allows for a more targeted and personalized approach to treatment, addressing both the root causes and manifestations of childhood obesity.

**Conclusion**

Childhood obesity is a multifaceted public health challenge with far-reaching implications for individuals and society. Addressing this issue requires a comprehensive understanding of the complex interplay between genetic, environmental, and behavioral factors. While progress has been made in elucidating the determinants of childhood obesity, much work remains to develop effective prevention and intervention strategies.

This comprehensive review provides an in-depth analysis of the etiology of childhood obesity, examining both Western medicine and Traditional Chinese Medicine (TCM) perspectives. By integrating insights from diverse disciplines, this review aims to contribute to a holistic understanding of childhood obesity and inform future research and clinical approaches.

The evidence presented highlights the importance of considering individual and environmental factors in obesity prevention and treatment. From genetic and epigenetic influences to the impact of the built environment and school settings, a nuanced approach is essential for addressing the complexities of childhood obesity.

By exploring the integration of Western medicine and Traditional Chinese Medicine, this review offers a unique perspective on potential synergies and complementary strategies. Traditional Chinese Medicine's emphasis on holistic well-being, balance, and individualized care aligns with the broader goals of promoting health and preventing disease. Collaborative efforts that draw on the strengths of both medical traditions may enhance the effectiveness of interventions and contribute to more personalized and culturally sensitive

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approaches to childhood obesity.

In conclusion, addressing childhood obesity requires a multifaceted and interdisciplinary approach that considers diverse perspectives and engages stakeholders across various sectors. The insights gained from this comprehensive review can guide future research endeavors, inform clinical practices, and inspire collaborative efforts to combat childhood obesity and promote the health and well-being of current and future generations.

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