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Nutrition-Related to Overweight and Obesity among Chinese Children and Adolescents: A Review Based on the Socio-Ecological Model

Lishan Tang[1*], Mingxue Zhang[1*], Weijun Li[2], Linfeng Mo[1], Dechan Tan[1#], Wei Peng[3]

[1]Medicine and Health Science College, Guangzhou Huashang Vocational College, Guangzhou, China
[2]Medicine and Health Science College, Guangzhou Huashang College, Guangzhou, China
[3]Department of Public Health, Medical Center Hospital of Qionglai City, Chengdu, China
Email: #tandchan@163.com

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Abstract

The prevalence of overweight and obesity among Chinese children and adolescents has increased rapidly in the past decades, which has emerged as a crucial public health concern. The review synthesizes current literature to understand the multifaceted factors contributing to this epidemic through the lens of the Socio-Ecological Model (SEM). The model emphasizes the interplay between individual, interpersonal, societal, and physical environmental influences. Recognizing the risk factors of childhood obesity by using SEM would help policymakers, health professionals, and community leaders to develop comprehensive strategies to promote healthier eating behaviours and reduce obesity prevalence in this vulnerable population, which would help to tackle the problem effectively.

Keywords

Socio-Ecological Model, Childhood Obesity, Obesity Determinants

1. Introduction

Over the past three decades, the prevalence of overweight and obesity has grown at an alarming rate in the world. The term "obesity" is defined as a body mass index (BMI) that equals or exceeds the 95th percentile of the age- and gender-specific BMI distribution, which reflects the presence or risk of related chronic diseases in most cases [1] [2]. In China, there has been a rapid increase in the prevalence of

*Co-first authors.
#Corresponding author.

overweight and obesity among children and adolescents. This phenomenon could be attributed to the country's transition towards industrialization and economic globalization, which may result in changes in dietary habits [3] [4]. Also, developed urbanization led to sedentary lifestyles, which reduced physical activity time and increased the risk of overweight and obesity [5]. Childhood is a key stage in the lifecycle of mental and physical health. The health and nutritional status of childhood is not only related to the health of adults but also affects the long-term development of the country [6]. Therefore, researchers should implement effective interventions to control childhood obesity [7] [8]. The reason why the prevalence of childhood obesity could be complex. To examine the determinants of childhood overweight and obesity, the Socio-Ecological Model (SEM) was applied in this research, which grouped the determinants into five dimensions, including Macrolevel factors (societal), Physical environmental influences, Interpersonal influence (family and peer characteristics), Intrapersonal influence (individual), interventions and policies. By assessing the factors, researchers and policymakers could make interventions such as health promotion in healthy dietary habits, advocating to control the advertising of unhealthy food, guiding parental feeding scientifically, improving the healthcare policies, and making propaganda about nutrition and health in school and community to control the epidemic of childhood and adolescent obesity.

2. Geographic Area Profile

China is a country in East Asia that has the most population (1.4 billion) in the world. There are 55 minority ethnic groups, and 74.5% of Chinese have no religion. Due to the differences in geography and climate in China, each area has its own eating habits and cooking methods. People with beliefs or religions may maintain traditional eating patterns [6].

As the economy develops and living standards improve in China, the prevalence of overweight and obesity among children and adolescents (aged 6 - 17 years) has increased rapidly from 15.5% in 2010 to 24.2% in 2022 [9]. China has the highest proportion of obese and overweight children worldwide [10]. Childhood obesity can be a risk factor that may lead to disability and premature death in early adulthood [11] [12]. Children with obesity and overweight may have a higher chance of developing noncommunicable diseases (NCDs), including type 2 diabetes, cardiovascular diseases, musculoskeletal disorders, and kinds of cancer at a younger age [13]-[17]. There have been nearly 2.6 million children's deaths attributed to overweight and obesity [18].

The prevalence of childhood obesity has rapidly increased in China owing to unhealthy eating habits and low levels of physical activity [19]. It also resulted from the changes in society's global nutrition transformation [18]. To solve the problem, it requires a multidisciplinary population-based method, which needs cooperation between diverse sections and departments. Being overweight and obese brings a huge social and economic burden [3]. China has a high burden of obesity-

related NCDs. In 2011, NCDs led to 6.9 million of all deaths and 167.3 million of all disability-adjusted life years lost, which accounted for 94.8% and 89.1%, respectively [20]. In China, the expenditure of NCDs caused by obesity accounted for a large proportion. The medical expenditures for diseases related to obesity and overweight were 24.35 billion Yuan (3.8 billion US dollars), accounting for 2.5% of China's national healthcare expenditures [21]. It should be mentioned that there may be stigma and discrimination about obesity and overweight among children [22]. They are more likely to feel depressed and anxious or even isolated in school, which may lead to psychological problems [22]. Obesity may affect the interpersonal relationships of children in schools [22].

The characteristics of childhood obesity in China, including the prevalence of obesity and overweight in boys, is higher than that in girls; there are more overweight and obese children in urban areas than in rural areas, and people with higher socioeconomic status (SES) are more likely to be overweight [23]. According to data from the China Chronic Disease and Nutrition Surveillance (CNNS) in 2012, boys (7.8%) had a higher prevalence of obesity than girls (4.8%) [20] [23]. For children and adolescents, the prevalence of overweight in the urban city was 10.6%, while in rural areas, it was 7.5% in 2012 [20]. Regarding regional variations, there are clusters of overweight and obesity among children in the North and Northeast. The place that had the highest prevalence was Beijing, the capital of China [20]. It showed that the prevalence was lower in coastal regions, including Hainan, Guangdong. The different cultural backgrounds, economic development, social welfare, and lifestyle factors may lead to the different distributions of prevalence, not only because of the different geographic locations [24]. In addition, the minority group in China had a higher prevalence of overweight and obesity. It may be related to their special and traditional eating patterns, which conflict with the modern nutritional model [24]. With increasing socioeconomic status (SES) among children, the prevalence of obesity and overweight will also increase [24]. This may be because children can buy more food they like and do not need to consider their prices.

3. Socio-Ecological Frame

3.1. Macrolevel Factors (Societal)

With long-term poverty and famine in the last century, the Chinese had a traditional view that fatness represents abundance and happiness [6]. Beliefs have not kept pace with the changes in socioeconomic status and have led to overconsumption and energy imbalance of food. The policy of one child made the whole family overfeed their only child and increased the prevalence of obesity and overweight [6]. Min's research shows that children who were only children had approximately four times the likelihood of being overweight or obese compared to those with brothers or sisters (OR = 4.53, 95% CI: 1.65 - 12.40) [25]. Research also shows that parents would like to spend money rather than take time to look after their children, which leads to children eating food with high energy, high sugar, and high

fat [26]. With increasing screen time on mobile media devices, children were more likely to eat more while they watch media. Screen media exposure increases the energy intake of children [27]. Sleep deprivation was also associated with childhood obesity. Inadequate sleeping time might change the hormonal level, which affects the appetite and satiety of children [3]. Some cross-sectional studies showed that there was a relationship between sleep duration and overweight. People who sleep less than 9 hours per day would have 3.8 times the likelihood than people who sleep 11 hours to be overweight and obese [28].

Also, excess energy consumption during media device use can lead to obesity [29]. As an increasing number of children spend time on their mobile devices, they lack physical activity. In addition, they may be exposed to incorrect information, which can lead to unhealthy lifestyles [3]. Children are now exposed to marketing in new media, including websites, apps, and games sponsored by food companies [29]. Some studies have shown that food advertising will impact food preference and food intake in children. In Xian's research, around 20% of the children would request their parents to buy advertised foods [30]. Most children under six years old cannot distinguish between television programming and advertising [3]. Additionally, there are many product placements for television programs. Children tend to buy food shown on television because they think it will be cool [3]. Food advertising impacts the dietary habits of children because they always show low-nutrition food, which contains higher energy and saturated fat [3]. Also, children who watch television and use mobile phones frequently are more likely to eat potato chips and sweetened soft drinks. There is also some evidence that there is a relationship between TV time and extra energy intake [3]. Some meta-analyses have shown that the risk of obesity among children will increase by 13% as they watch television every additional hour per day [27]. The food companies provide more food that contains high energy and saturated fat, and children cannot resist the temptation [31]. However, it can also harm children's health. Children are more likely to consume these foods than fresh vegetables and fruits in their daily lives. It is essential to establish regulations and policies on food labelling, fast food expansion, and marketing and to educate children on nutrition knowledge.

3.2. Physical Environmental Influences

The community environment may have an indirect influence on children's health status [3]. With urbanization, there are more processed foods that contain high energy-dense and sweetened. Fast food restaurants are popular among children, and they are always near the school. The type of food vendors in a neighbourhood will impact people's eating habits [3]. For instance, if there are more fast-food restaurants and snack food stores in a community, the residents may have more risks of being obese [32]. In some schools, the retail store will sell many kinds of snacks and drinks [19]. Drinking too many sugar-sweetened beverages will gain weight and may lead to type 2 diabetes (T2D). It is interesting to find that the

community where near the supermarkets will have a lower prevalence of obesity compared to the areas that do not have malls or supermarkets. The main reason may be that the residents can easily get fresh fruits and vegetables every day and will not need to store large amounts of food [33]. When food is available and high-quality, people's food types may change. Also, the price of food can impact the food pattern, and socioeconomic status is also a factor that affects people's food choices [24]. The reason why the prevalence of obesity among some socioeconomically disadvantaged groups becomes higher may be that fresh fruits and vegetables may be expensive to them, so they tend to choose food with lower prices. In this case, they are more likely to consume food with energy-dense content, which has poor nutrients.

3.3. Interpersonal Influence (Family and Peer Characteristics)

Evidence shows that children who do not have physical education and a healthy diet will not have an awareness of getting a healthy lifestyle, and they will tend to be obese [34]. Children and adolescents spend more time on homework rather than doing exercises. Sometimes, the school will even cancel the extracurricular physical activities [6]. Ren's research showed that heavy weekday homework was positively associated with childhood obesity [35]. The family environment will impact the eating patterns of children [36]. In China, children may lack education about obesity and its related harm. Most parents hold the view that children can eat whatever they want, and it does not matter if they eat too much because they need to grow up with energy [3]. Especially some children who are raised by grandparents. The grandparents may not have enough health knowledge, and they spoil their kids [37]. The grandparents commonly have inappropriate perceptions, like the diseases related to obesity can only happen in adults. They may feed their children with much more meat and oil, and they think it is good for children [37]. There is evidence showing that children who live with their grandparents in China are more likely to become obese. In the cross-sectional study, children fed by grandparents had a higher risk of being overweight and obese (adjusted OR = 2.03; 95% CI: 1.19 - 3.47) [36]. Sometimes, the grandparents will give children snacks as a reward when the children behave well [36] [37]. In addition, the grandchildren will be overprotected from doing physical household chores by their grandparents [36].

For children, although they begin to show a tendency to autonomy in food choices, their eating behaviour is still immature, and they are always influenced by their peers [38]. Sometimes, they will imitate the eating behaviours of their peers, and they cannot distinguish between right and wrong. It may result in them eating more junk foods and less fresh vegetables and fruits [38]. They tend to eat similar foods to their peers and friends, which may not be healthy. Research also showed that if children have a close friend with a high BMI, then their BMI will be the same as that of their friends [39]. This may be because they have the same eating habits and interact with each other.

3.4. Intrapersonal Influence (Individual)

Some people who migrate to the city may keep their old eating habits. For instance, the only way for people who live in high-altitude pastoral areas to intake salt is by drinking milk tea in the past [19]. However, when these groups of people migrate to the city, they will eat like the urban residents. They add salt when they cook, and they eat snacks that contain high salt. At the same time, they also drink salty milk tea [19]. This kind of eating pattern leads to hypertension and obesity among the group of people [19]. In undeveloped and low-income areas, children may face the phenomenon of the double burden of nutrition [40]. Some children may have a slow-growing development compared to the children who live in the developed areas. However, the nutritional transformation has changed their eating patterns [40]. The children like to eat puffed food and sugar-sweetened beverages, which leads to obesity and overweight. It shows that in some areas, the children may have both malnutrition and overnutrition [40].

Children who are obese and overweight are more likely to choose energy-dense foods as a lifestyle [19]. Studies showed that BMI is positively related to dietary patterns, which include much more meats, eggs, fats, and oils. There is a negative association between BMI and taking vegetables, beans, fruits, and grains [31].

In addition, the food preferences of children have a high relationship with their parents' eating patterns [19]. For instance, if children are exposed to green vegetables frequently and repeatedly, their preference and consumption of this kind of food will increase [41]. What should be mentioned is that if children eat more meals outside, their food preferences will change. The restaurants will provide food that contains more salt and oil to make the meal more delicious [32].

4. Intervention and Policies

To control childhood obesity, pilot intervention programmes have been implemented, including interventions based on schools and communities. The interventions will provide more knowledge about a balanced diet and healthy life habits. Providing the children with more fresh fruits and vegetables in school and decreasing the supply of snacks and drinks that contain high energy, high saturated fat, and high sugar [7] [42]-[44]. Also, the Chinese Government is putting in place the strategy named "Healthy China 2030 Initiative". This is a policy that aims to decrease the disparities in health and help people to have a better lifestyle. It will focus on solving problems such as the lack of micronutrients and excessive intake of fats and other high-calorie foods among children and adolescents. Guiding a balanced diet and taking interventions for the target population, including children and adolescents. Urging the children and adolescents to do physical exercises three times per week to control obesity [45]-[47].

5. Conclusion

Childhood obesity is a global public health issue. There is a high prevalence of obesity and overweight among children and adolescents in recent years. The reason

why people get obese is complex, but it can be prevented if treated carefully. By recognizing the interplay of various risk factors, public health interventions can be more effective in combating obesity among children and adolescents. Children and adolescents are associated with the future of a country. Therefore, it is very important to take action to help them control weight and prevent diseases related to obesity and overweight. Early-life interventions would also help bring economic benefits to the nation. It needs help from society, especially cooperation from cross-department and multidisciplinary teams. It cannot be an individual problem. It should be mentioned that schools and families should be involved in the implementation strategies to intervene to be sustainable and effective. Health promotion in healthy dietary choices among schools, families, and communities would be helpful to control the prevalence of childhood obesity. Also, the relevant department should control unhealthy food advertisements on television and social media to prevent children from being attracted by sweetened drinks, high-energy, high-fat, and junk food. By modifying dietary habits and food choices and doing regular physical activity instead of being sedentary, children and adolescents could have a healthy physical status and keep a normal BMI and body fat rate. The research about a minority group of people in China is not enough. There should be more personalized customization interventions for different groups of people, considering their geographical, cultural, educational, and SES.

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Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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