A Narrative Review of Intervention Strategies, Physical Inactivity and Screen Time in Pakistani Teenagers

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Abstract. In Pakistan, childhood obesity is becoming a more severe community health concern with long-term implications. This systematic review helps in assessing the risk factors of overweight and obesity in Pakistani children and adolescents. To support the global strategy to reduce risk factors for obesity, We conducted a systematic literature review in accordance with PRISMA guidelines, searching all major and pertinent databases, including PubMed, Science Direct, Embase, and PakMedinet, to find primary articles on overweight and obesity in Pakistan. The evidence on physical activity (PA) and sedentary behaviour in the Middle East and North Africa (MENA) region was synthesized. Adolescent sedentary behaviour is a growing concern globally, including in Pakistan, due to its association with negative physical and psychological health outcomes, and fragmented time agility training has emerged as a potential solution to address these issues. The proposed study assesses the effects of an organized six-week agility training program on stress, mood, and sedentary behaviour among Pakistani adolescents between the ages of 12 and 18. The findings highlight the need for targeted interventions to address these risk factors and prevent overweight and obesity from developing in Pakistan. To fully understand the complex interactions among the factors contributing to childhood obesity in Pakistan, more thorough research is needed. Keywords: Body mass index (BMI), Cardiovascular disease (CVS), socioeconomic status (SES) and Physical activity (PA).

Contents

1. Introduction

6. Childhood and adolescent obesity has become a notable community health concern in the era of twenty-first century. Childhood and teenage obesity have dramatically increased globally, in both developing and developed countries, the World Health Organization (WHO) warned [1]. Fat buildup in adipocytes is a hallmark of the condition, which is caused by ingesting more calories than the body needs for growth, development, and physical exercise. This buildup of excess fat has been classified as overweight or obesity based on a person's height and body weight [2]. Weight in kg/(height in m2) is the body mass index (BMI), which is regarded as a universal indicator of obesity [3]. Because it frequently increases the danger of young adults' mortality and morbidity rates as well as their likelihood of becoming fat as adults, early childhood obesity is important [4,5,6,7]. Obesity has been associated with a number of chronic illnesses, such as metabolic syndrome, high blood pressure, hyperlipidemia, early childhood renal problems, CVS disease, and glucose intolerance [5,6]. Obesity has been linked to a significant rise in type 2 diabetes in children over the past 20 years [7]. Over the past three decades, there has been a more than tenfold increase in the prevalence of obesity among school-age children and adolescents worldwide [8,9]. Overweight and obesity rates are on the rise in low- and middle-income countries, particularly in urban areas [10]. Pakistan is ranked 10th out of 188 countries in terms of obesity, with 50% of its citizens being obese or overweight. The World Obesity Federation predicts that 5.4 million school-age children in Pakistan will be obese by 2030 [11]. Even if some studies provide useful insights into the potential causes of overweight and obesity, the problem is still mainly ignored in the area, and it seems that there isn't enough evidence from individual

studies to support appropriate action. Thus, it is necessary to conduct a thorough and well-structured study in the form of a systematic review that focuses on the possible risk factors for overweight and obesity in Pakistani children. This study attempts to identify and assess the risk factors for overweight and obesity in Pakistani children and adolescents by integrating the data already available from pertinent studies [12]. This systematic review's three primary objectives are described. Its main objective is to conduct a comprehensive literature search in order to determine the risk factors that lead to overweight and obesity in Pakistani youth. It also tries to categorize and rank these risk factors by putting them into different groups, including socioeconomic status, food habits, physical activity, etc., in order to determine the most significant contributors. In order to address this pressing public health concern in Pakistan, it will also look for and draw attention to any gaps in the current literature, opening doors for additional research and the development of targeted interventions.Aside from all of this, the review's interdisciplinary approach may provide a deep and comprehensive understanding of the risk factors contributing to overweight and obesity in Pakistani children, as well as helpful recommendations for effective initiatives and policies. Through a thorough literature search, it will identify the most crucial factors, assisting researchers, medical experts, and legislators. Ultimately, this will improve the health and well-being of the country's young and adolescents [13].

2. Material and Methods

2.1 Protocol: For this study, a systematic review, following PRISMA guidelines, was used to evaluate the available data on the risk factors of overweight and obesity in children and adolescents in Pakistan. Instead of doing a primary investigation, a systematic review was chosen due to the requirement for a sizable sample size and trustworthy data. Review research has the advantage of making it possible to provide information from the available evidence that is reliable, verifiable, and objective. The general review question was constructed using the PICO framework. The population of Pakistan consisted of children and adolescents between the ages of 0 and 18. The primary outcome indicator for identifying overweight and obesity was BMI.

2.2 Data Sources: Using a range of electronic resources, primary research articles published in Pakistan over the past ten years were found. The databases PubMed, Science Direct, Embase, and PakMedinet were searched. Moreover, full-text article bibliographies were examined for any additional pertinent research. "Obesity," "childhood," "overweight," "early life obesity," "etiology," "causes," "determinants," "factors," "risk factors," "Pakistan," and a They were joined using the Boolean operators "AND" and "OR."

2.3 Studies selection: This systematic review's inclusion criteria were cross-sectional studies with individuals ages 0–18 that were carried out in Pakistan. All included studies had to be documented in peer-reviewed sources, and only English-language publications from the last ten years were taken into account. Studies carried out outside of Pakistan, those with participants older than 18, and those without a clear focus on childhood and adolescent obesity were all excluded.

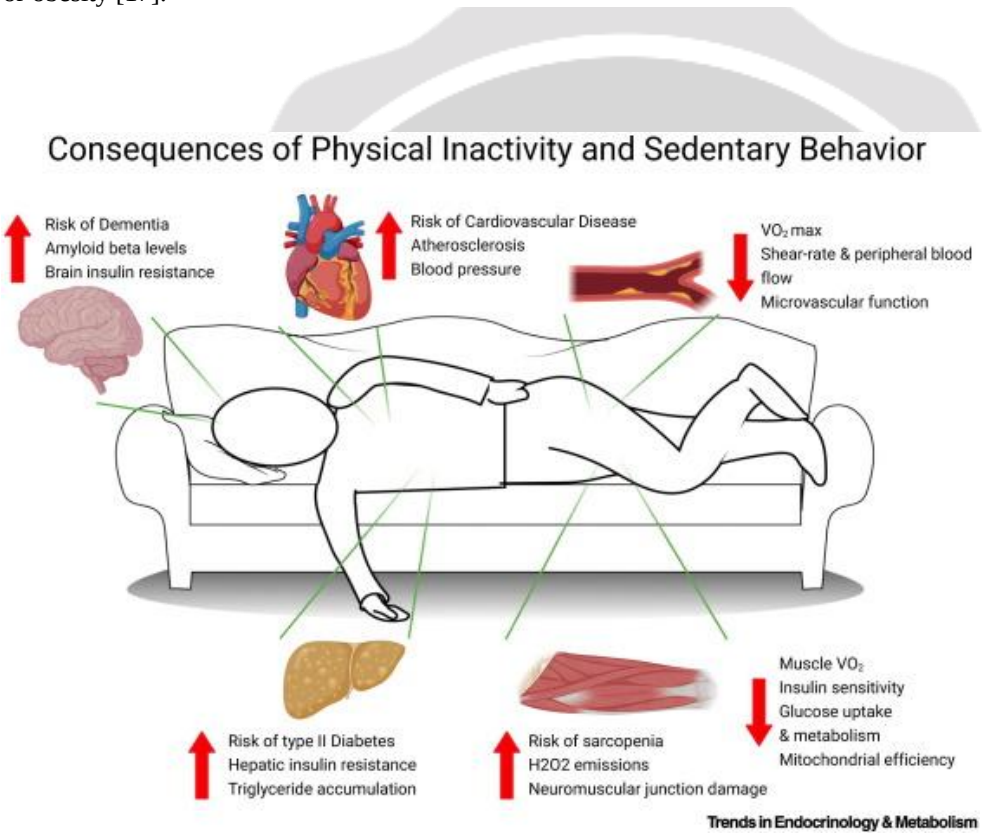
3 Results

Out of the 101 studies that were initially chosen for this systematic review, 11 studies satisfied the inclusion and exclusion criteria. Primary research carried out in Pakistan, published in English, full text accessible from 2013 to

2023, peer-reviewed publications, and a population under the age of 18 were the requirements for inclusion. Non-Pakistani studies, non-English-language studies, full-text studies that were not available, non-peer-reviewed publications, and research with people older than 18 years were all excluded.

3.1 The risk factors of overweight and obesity: Overweight and obesity in children have been linked to a number of risk factors. The specifics are as follows:

3.2 Lack of physical activity: Six separate research have consistently found this to be a major predictor of childhood and teenage obesity and overweight [14,15,16]. The results of the empirical investigations demonstrate a strong association between low energy expenditure and a high BMI and low levels of total physical activity, which include walking, cycling, and housework. However, other research indicates that this component is not linked to overweight or obesity [17].



3.3 TV/Computer games: Five studies found this characteristic to be a significant predictor of childhood and teenage obesity and overweight [18,19,20]. The studies show that a higher BMI is associated with lower levels of physical activity and more time spent playing video games or watching TV. One study examines the consequences of watching TV for more than two hours every day, while another examines the impacts of watching for just one hour. Furthermore, another study demonstrates that this component is not linked to overweight or obesity.

3.4 Inadequate participation in outdoor games: Inadequate engagement in outdoor games has been identified as a major contributing factor to the prevalence of obesity and overweight in children and adolescents by three independent studies [21]. Research has indicated a positive correlation between a high body mass index and a lack of engagement in outdoor recreational activities like cricket, badminton, or football. However, according to another study, it is not a major influence [22].

3.5 Family history of obesity: Family history of obesity has been identified as a noteworthy variable in independent studies and is a major predictor of obesity and overweight among the adolescent, child, and teen populations. When one or both of the progenitors are fat or overweight, there is a significant link between a raised BMI and a higher risk of becoming obesity, according to empirical study [23, 24].

3.6 Excessive fast-food consumption: Fast food that is deficient in nutrients is a significant risk factor for the development of obesity and excess weight in children, adolescents, and adolescent populations, according to seven different studies [25, 26]. Regular use of low-nutrition fast food items including pizza, French fries, hamburgers, and sodas has been shown in empirical investigations to be positively correlated with a higher body mass index (BMI) and a lower level of nutritional excellence.

3.7 High-calorie diet: A few noteworthy studies have frequently demonstrated the impact of a high-calorie diet on the prevalence of childhood and teenage obesity and overweight [27,28,29]. High calorie consumption, particularly from fats and carbs, has been shown to be positively associated with a higher BMI and worse satisfaction levels in empirical studies. Additionally, a study found that 45% of participants who were overweight or obese had consumed energy drinks [30].

3.8 Excessive consumption of mixed vegetables along with continuous high caloric food as a remedy to avoid obesity and overweight: According to certain research, eating a diet rich in mixed veggies is a common cause of obesity [31,32,33]. Despite the fact that replacing a high-calorie diet with vegetables is typically overlooked, these data imply that individuals believe eating a mixed vegetable diet may prevent children and adolescents from becoming overweight or obese. Because the vegetables increase the already high caloric intake, this results in an even higher calorie intake. The findings of the conducted research show a significant correlation between an increase in BMI and a misguided attempt at weight loss and a greater consumption of a variety of vegetables, including cauliflower, spinach, carrots, and cabbage. Furthermore, it has been discovered that many try to lose weight by consuming excessive amounts of mixed vegetables and a green diet in addition to a constant intake of high-calorie foods, rather than using these as a substitute for a high-calorie diet [34].

3.9 Socioeconomic status: A total of seven research have demonstrated that the social socioeconomic status (SES) variable is a significant predictor of overweight and obesity in the population of children and adolescents [35]. more socioeconomic status—more especially, more income—has been positively correlated with a higher BMI, according to research. Furthermore, it was shown that people with higher BMIs also had greater access to unhealthy dietary options.

4 Discussion

This systematic review's identified and categorized different risk variables linked to the incidence of obesity and overweight in Pakistan's child and adolescent populations. This thorough assessment comprised eleven studies that used cross-sectional study approaches and were carried out in different cities throughout Pakistan. The incidence of obesity and overweight in children and adolescents ranged from 5.8% to 23%, which suggests Pakistan has a higher prevalence rate than the global average. The global age-standardized percentage of obesity in adolescents and children aged 5 to 19 years rose from 0.7 percent in 1975 to 5.6 percent for girls and from 0.9 percent in 1975 to 7.8 percent

for boys, according to a 2016 study published in The Lancet [36]. The estimated prevalence of obesity and overweight differed greatly amongst the studies because of variations in the criteria, methods, and demographics employed for the diagnosis and evaluation of these illnesses. Eight risk factors that have been consistently reported in the chosen studies have been successfully identified by the thorough analysis carried out in this study. [37] These hobbies included technological entertainment, such as watching television or playing computer games, which did not require any significant physical effort. Furthermore, there weren't many outside games, which are usually linked to more physical activity. In addition, the person's family history suggested a tendency toward obesity. There was widespread eating of fast food that was low in nutrients and high in calories. On the other hand, the person also consumed a variety of vegetables, which might have helped create a more well-rounded nutritional profile. Last but not least, one aspect to take into account in this situation was the person's social and economic standing. Behavioral, biological, nutritional, and environmental are the four different domains into which the risk factors found in this study can be divided [38, 39]. Numerous behavioral risk factors were identified by the study, such as watching TV or playing video games on computers, not getting enough exercise in general, and not engaging in enough outdoor activities. The characteristics that shown a significant link with inactive behaviors and lower energy consumption in the children, adolescents, and teenage demographic were elucidated by the current study. Long-term computer gaming or television watching has been positively associated with an elevated risk of obesity and excess body weight, according to empirical research [40,41,42]. Similarly, it is important to remember that a lack of regular general physical exercise, such as walking, cycling, or performing housework, has been linked to an increased risk of obesity; around 80% of teenagers globally do not engage in adequate physical activity [43]. Notably, it has been demonstrated that a lack of engagement in outdoor recreational activities like cricket, badminton, or football raises the associated risk. The observed findings are in line with past research demonstrating that physical inactivity has a significant impact on childhood and adolescent obesity rates [44, 45]. This study found that having a family history of obesity was one of the biological risk factors. Genetic predisposition and the effect of parental influence on children during the childhood and adolescent growth phases were shown to be correlated with the observed phenomenon. Research studies have demonstrated that having one or both parents who are overweight or obese increases the likelihood of developing overweight and obesity by 1.7 to 2.9 times compared to those who do not have such parental traits [46,47,48]. offspring of obese moms were shown to have a 28% obesity prevalence, while offspring of non-obese or non-overweight mothers had a lower obesity rate of 8%. The prevalence of obesity was reported to be 24% among children whose father was obese, compared to 9% among children whose father was not obese or overweight [49]. The current finding is consistent with other research showing a strong correlation between parental obesity and the risk of childhood and teenage obesity.

A high-calorie diet, a diet that included a variety of vegetables, and the consumption of fast food that is low in nutrients were all considered dietary risk factors. The current study looked at the possible relationships between a number of variables and the dietary patterns and nutritional status of a group of kids and teenagers. Empirical studies have demonstrated that frequent consumption of nutrient-poor fast food items, such as pizza, French fries, hamburgers, or soda, was associated with a significant increase in the risk of being overweight or obese. On the other hand, consuming large amounts of calories, especially from fat and sugar, was associated with increased risk [50,51]. On the other hand, it was discovered that a higher intake of a wide variety of vegetables, such as but not restricted to carrots, spinach, cabbage, and cauliflower, when substituted for high-calorie foods, reduced the risk [52]. The current results are in line with earlier studies that showed how dietary patterns significantly affect the prevalence of childhood and teenage obesity [53]. The impact of socioeconomic status is included in the environmental risk factor that is being studied. In the children, adolescents, and adolescent populations, the observed phenomenon showed a strong link with environmental factors and socioeconomic variables. Empirical studies have demonstrated that those with low socioeconomic status—defined as having less money, less education, or poor living conditions—are less likely to become overweight or obese, with a significant decrease in risk. The prevalence of obesity and socioeconomic status (SES), which is impacted by the degree of prosperity in the nation being studied, are negatively correlated. There is a negative relationship between obesity and socioeconomic status (SES) in countries with greater income levels. On the other hand, the opposite pattern is seen in countries with lower economic levels [54].

The current systematic review demonstrates noteworthy qualities in its use of a thorough and transparent methodology, use of extensive search strategies, application of strict inclusion and exclusion criteria, and assessment of the quality of the chosen papers. There are some limitations to the current systematic review that should be discussed. First and foremost, it is critical to recognize that the inclusion criteria were limited to research that was published solely in English. Consequently, this method might have introduced a language bias by unintentionally excluding out relevant research done in other languages. Second, it is important to note that only cross-sectional research were included in the review. Although cross-sectional designs provide useful information on correlations, they naturally make it more

difficult to determine causal linkages and may limit how broadly the results can be applied. Furthermore, we took into consideration a chronology of the previous 10 years, which may have resulted in the inclusion of possibly out-of-date data in our analysis due to the goal of identifying a high number of risk factors and the small number of studies that are now available. Therefore, it is advised that one be aware of the study's limitations for safe and successful results before considering the results, using them for clinical practice, or educating patients [55,56]. The current systematic review provides a thorough examination of the body of research on the risk factors involved in overweight and obesity in Pakistani children and adolescents. For a number of stakeholders, including legislators, medical professionals, educators, parents, and the general public, the study's conclusions have important ramifications. This review is a useful tool for making informed decisions and directing actions for managing and preventing this urgent public health issue since it synthesizes the existing data. According to the results of this thorough systematic review, more research in the form of longitudinal studies and intervention trials is necessary to determine the effectiveness of interventions meant to reduce the prevalence of overweight and obesity among Pakistan's younger population as well as to establish causal relationships [57,58].

4.1 Intervention Effects on Physical Activity: The results show that the adolescents' initial PA levels in both the experimental and control groups were extremely low. No teenager in any group was performing at a high PA, and it ranged from low to moderately high. When compared to the initial mean PA, the average PA level in the intervention group increased significantly, and at the post-test, the average PA of the adolescents in the intervention group was greater than that of the control group. The main conclusions imply that, at the two time points, a significant interaction effect from the multilevel intervention was found for PA involvement in the intervention group as opposed to the control group. Additionally, the individual group impact and a significant effect from baseline to the 8-week post-test were found. From moderately low to moderately high, the PA level was raised. The study supports the findings of Si and his colleagues [59,60], who investigated the effectiveness and long-term effects of an intervention based on interpersonal and organizational level elements from the social-ecological model to encourage school-based physical activity among teenagers aged 13 to 15. The duration and daily PA showed significant intervention effects, according to the authors. Additionally, the outcome was consistent with the randomized controlled trial of [61], who investigated how a multicomponent strategy may significantly raise schoolchildren's PA levels. This suggests that the combined influence of time and group is helpful in explaining the PA behaviors of teenagers in the classroom. Additionally, the average weekly minutes of the school-age teenagers in the experimental group were significantly different from those in the control group [62].

4.2 Intervention Effects on Individual Level Factors: Based on PA's individual, interpersonal, and organizational correlates, the current study concluded that the intervention had a considerable impact. Our study's results are consistent with Hynynen's comprehensive review [63], where he found that teenagers' PA increased significantly following the intervention due to a large increase in self-efficacy. According to earlier studies, adolescents who have higher levels of self-efficacy for PA also typically have higher levels of PA [64]. Our study's findings are also consistent with a previous exercise-motivation-based intervention that sought to raise teenagers' PA. The significance of exercise motivation for enhancing PA behavior was validated by the researchers (Schwarzer et al., 2011). Furthermore, there is evidence from both theory and research that higher levels of PA are a result of increased motivation [65]. Additionally, the current study found that teenagers' PA was significantly explained by an intervention based on their attitude toward exercise. According to earlier studies, there is a strong correlation between teenagers' PA in Pakistan and their attitude toward exercise [66].

4.3 Intervention Effects on Interpersonal Factors: It has been repeatedly observed that social support for PA improves PA behavior in school-age teenagers [67]. Furthermore, the current study concluded that incorporating PA into the contexts of peers, family, and teachers considerably raised PA among teenagers in school. The authors of a prior intervention study proposed that a social support-based intervention greatly raised school PA [68], which may help to explain our findings. Accordingly, a recent study conducted in Pakistan showed that family support for PA significantly predicts school-age adolescents' PA behavior [69, 70]. Support from peers, parents, and instructors was found to be a major predictor of PA behavior in a systematic assessment of social-ecological factors influencing school adolescents' engagement in PA [71]. Additionally, studies involving teenagers from low-income neighborhoods demonstrated the noteworthy impact of teacher-provided social support [72]. Furthermore, the findings of the current study support the conclusion drawn from earlier research, which indicated that teenagers' participation in PA is

encouraged by positive peer connections [73]. The results of Kiyani and his colleagues' investigation into the predictors of PA among Pakistani pupils in schools, however, contradict those of the current study. Surprisingly, the findings showed that the PA of the school adolescents was unrelated to the perceived support of classmates and teachers [74]. This could be because the study was carried out while the nation was experiencing a COVID pandemic and schools were only partially operational. Therefore, it can be beneficial to implement interventions that increase the effect of peers, parents, and teachers on adolescents' PA behavior.

4.4 Intervention Effects on Organizational Factors: Additionally, the study looked at a number of organizational elements that were crucial in enhancing the PA behavior of teenagers. In particular, with the exception of PA equipment, PA facility, PA safety, PA policy, and PA culture all positively explained teenagers' PA. These results are in line with what other researchers have already found [75,76]. Therefore, the establishment of PA habits among students is facilitated by the supply of institutional factors in terms of facilities, safety, policy measures, and sports culture [77]. Accordingly, a review of institutionally based treatments examined how PA in adolescents is significantly impacted by availability, accessibility, greening school sports facilities, and the awareness, application, propaganda, and sports culture environment [78]. Our study's findings, however, ran counter to the notion that more PA equipment equated to improved PA. The researchers discovered that the school policy and environment-based intervention had a clear impact on promoting teenagers' health. The current study's results are consistent with a prior study that proposed that school-based interventions to improve PA must take into account the school environment. The most recent empirical research and systematic review, in contrast to the current study, produced conflicting results on the relationships between PA and school PA policy. Age disparities in the study samples could be the cause of the opposite outcomes. Further research in this area is advised since organizational characteristics may also indirectly affect PA behavior through personal or social support [79].

4.5 Implications: Given the efficacy of individual, family, and school-level interventions for boosting PA of the individuals, the findings of this study have significant educational and health implications for teenagers. According to the findings, interventions that focus on organizational, interpersonal, and individual aspects may help increase the likelihood that people will participate in sports and PA activities. Furthermore, it is undeniable that the social-ecological model's individual and interpersonal levels better explain PA participation. On the other hand, the target variable's variance was less explained by organizational characteristics. Furthermore, the prior study found that interpersonal and individual factors mediated the effects of organizational aspects on PA, and that organizational level factors had an indirect impact on PA. Additionally, by offering the tools required to eliminate time and financial barriers to PA, educational and health institutions could promote support for PA practice in the family and organizations from parents, peers, and teachers [80].

4.6 Limitations and Future Directions: The study has certain limitations, despite its many strengths, which include a solid foundation in a social-ecological model, planning and carrying out a school-based intervention in a South Asian nation like Pakistan, and taking into account the multilevel factors on adolescents' PA. For instance, the study gathered information on PA behavior and its associations with individuals, relationships, and organizations using self-reported measures. In the future, self-report measurements and objective PA measures might have different outcomes. In order to account for clustering within classes and schools, future intervention studies should also employ sample sizes that are sufficiently big to enable multilevel analysis. The study's findings are predicated on a single facet of the informants, like teenagers. Further research should take into account and triangulate the information gathered by parents, teachers, or classmates regarding many elements affecting kids' PA, even if students' judgment is typically more predictive than that of important others (Barr-Anderson et al., 2010). Furthermore, the study lacks follow-up, and in order to confirm the stability of the results, future research should incorporate long-term follow-ups [81].

5 Conclusion

The review offers compelling proof of Pakistan's growing obesity and overweight problem among children and adolescents. It highlights a change in nutrition, physical inactivity and screen time that is similar to trends observed globally in other developing nations. The increased frequency of childhood obesity in Pakistan is mostly caused by sedentary lifestyles made feasible by advancing technology, as well as the physical inactivity and more screen time. These findings have important implications and ought to motivate public health and health policy makers at the national and international levels lawmakers, scientists, and scholars to address the rising prevalence of childhood

obesity and overweight. The factors identified highlight the necessity of comprehensive, multi-sectoral interventions at the community, school, and family levels.

The analysis also highlights the pressing need for further research. Although there is a wealth of information suggesting that childhood obesity is becoming more common in Pakistan, there are few nationally representative statistics available. Understanding the underlying cultural, social, and environmental factors including food and behavioural factors requires extensive qualitative research. In addition, there is a substantial knowledge vacuum regarding practical methods for lowering childhood obesity. Therefore, in order to curb the rising rate of obesity and prevent it from turning into a national problem, planners and legislators must take proactive, well-informed actions and develop effective programs at all levels.

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