

Risk Factors of Overweight and Obesity Among School Children Aged 6 to 18 Years: A Scoping Review

Nur Zakiah Mohd Saat¹, Ruzita Abd Talib¹, Sami F Alarsan¹, Nesreen Saadeh², Ghada Shahrour³

¹Centre for Community Health Studies (Reach), Faculty of Health Sciences, Universiti Kebangsaan Malaysia, Kuala Lumpur, 50300, Malaysia;

²Department of Internal Medicine, Faculty of Medicine, Jordan University of Science and Technology, Irbid, Jordan; ³Department of Psychiatric Nursing, Faculty of Nursing, Jordan University of Science and Technology, Irbid, Jordan

Correspondence: Sami F Alarsan, Email P106966@siswa.ukm.edu.my

Aim: Obesity is currently one of the main health problems and represents a challenge for health education programs. Experts point out that obesity is becoming a global epidemic as the number of children suffering from obesity has increased at alarming rates in developing and developed countries. The main objective of this scoping review was identifying the risk factors for overweight and obesity in school children aged 6 to 18 years.

Methods: Included articles were published between January 1993 and June 2022, written in English, and focused on school children aged 6 to 18 years. The search was performed using PubMed, CINAHL, and Embase databases. In total, 153 articles were included in the final qualitative analysis of the study findings.

Results: The findings of this scoping review showed that the risk factors for overweight and obesity are mainly categorized into socioeconomic and household factors, environmental factors, behavioral factors, and biological factors. In addition, the interaction between these factors was found to be a significant risk factor for overweight and obesity among school children aged 6 to 18 years.

Conclusion: The study underscores the need for targeted, school-based interventions to address the risk factors contributing to overweight and obesity among school children aged 6 to 18 years. These interventions should include curriculum-embedded education about healthy eating and physical activity, fostering an environment that promotes healthy food choices and regular exercise, and incorporating behavioral modification strategies.

Keywords: overweight, obesity, risk factors, school children, scoping review

Introduction

Disease patterns are undergoing significant changes worldwide, capturing the interest of different healthcare professionals and policymakers.¹ This is especially noticeable in low- and middle-income nations, which comprise a large portion of the global population.² Within these regions, obesity has become a widespread epidemic, affecting more than 1 billion individuals who are categorized as overweight, and at least 30% of them are classified as obese.³ Excess weight and obesity pose major public health challenges, significantly contributing to a range of long-term illnesses, disabilities, and premature death.⁴

In the last ten years, there has been a significant rise in the occurrence and severity of obesity in children globally, although the extent of the issue varies widely across and within nations.^{5,6} Therefore, the emerging obesity epidemic and its related health problems impose a considerable public health challenge, with significant economic and societal implications.^{7,8}

The global epidemic of obesity has impacted individuals of all age groups. There are approximately 22 million children under the age of five who are overweight or obese worldwide, indicating that around 10% of school children globally are affected.⁹ While overweight and obesity among children initially emerged in developed countries during the late 1980s, it has more recently become a problem in the developing world as well. The prevalence of overweight and obesity in children is

increasing globally, although the rate of change varies significantly among different countries.^{10,11} The International Obesity Task Force (IOTF) recently reported a decade-long increase in obesity rates among children worldwide.¹² According to data from the IOTF, the highest rates of childhood obesity are found in developed regions such as North America and Western Europe, but the rates are rapidly rising in many middle- and low-income countries.¹³ Additionally, a 2013 report by the World Health Organization (WHO) indicated that in 2011, over 40 million children under the age of five were overweight, with approximately 35 million of them residing in developing countries.^{14,15} Consequently, obesity is no longer limited to high-income countries but is also spreading at a much faster pace in low- and middle-income countries.^{13,16}

The World Health Organization (WHO) has drawn significant attention to investigating the global health issues that arise in nations that are undergoing a dramatic shift in their economies and nutritional patterns, especially in developing countries that have seen economic growth and an increase in people's living standards, which has led to a switch from undernutrition to overnutrition issues.¹⁷

Overweight and obesity among school-aged children (6 to 18 years) presents unique challenges and potential repercussions for individual health, academic success, and societal implications. The dynamic environment that school-going children inhabit - encompassing not only the home but also the school and wider community - creates a complex array of factors that contribute to their weight status.^{18,19} The situation is particularly alarming, considering that unhealthy weight gain during this stage is associated with a higher risk of remaining overweight or obese in adulthood, resulting in elevated lifelong risk of non-communicable diseases, such as cardiovascular diseases, type 2 diabetes, and certain types of cancer.^{20,21} Moreover, childhood overweight and obesity can also impact mental health, academic performance, and social relations, further affecting the child's overall quality of life.²²

In addition to the health implications, the rise in childhood overweight and obesity rates presents a burden to health systems and economies globally.²³ The cost implications include both direct costs related to healthcare needs and indirect costs linked to lost productivity in later life. This increasing burden is particularly concerning for low- and middle-income countries, where resources are already scarce, and healthcare systems are often under considerable strain.²⁴ Meanwhile, the rapidly changing food environments, marked by increased availability and promotion of energy-dense and nutrient-poor foods, and shifting activity patterns due to urbanization, technology, and changes in transportation, have been particularly influential on the weight status of school-aged children.^{25,26} Therefore, understanding the risk factors of overweight and obesity specific to this age group is essential for planning effective interventions and public health strategies. These points underscore the need for this scoping review, focused on the risk factors of overweight and obesity among school children aged 6 to 18 years.

To date, there is a paucity of studies exploring the risk factors of overweight and obesity among school children aged 6 to 18 years. Therefore, the overwhelming concern of the present scoping review is to identify the risk factors of overweight and obesity among school children aged 6 to 18 years and to generate a conceptual model illustrating the categories of risk factors of overweight and obesity among school children aged 6 to 18 years.

Methods

Identifying Research Question

This scoping review sought to answer the following research question:

What are the Risk Factors of Overweight and Obesity Among School Children Aged 6 to 18 Years?

Throughout this scoping review, we aimed to identify the risk factors of overweight and obesity among school children aged 6 to 18 years in order to generate a conceptual model illustrating the categories of risk factors of overweight and obesity among school children aged 6 to 18 years.

Search Strategies and Information Sources

Articles published in May 2022 were searched using PubMed, CINAHL, and Embase databases. These databases were comprehensively searched to identify relevant studies. The keywords used in the search process were: “Risk factors”, “Obesity”, “Overweight”, “Dietary behaviors”, “School”, “Children.” There were no limitations to the publication date. However, only articles published in English were included in this search. In addition, the inclusion criteria included all studies addressing the risk factors for dietary behavior change among school children aged 6 to 18 years. The following search equation was used: ((“Risk factors” [Title/Abstract] OR “Obesity” [Title/Abstract] OR “Overweight” [Title/Abstract] OR “Dietary behaviors” [Title/Abstract]) AND (“School” [Title/Abstract] AND “Children” [Title/Abstract])) AND “English” [Language].

Inclusion Criteria

We included studies exploring the risk factors for overweight and/or obesity among school children aged 6 to 18 years, irrespective of the research design. In addition, editorials, commentary articles, online sources, and letters to editors discussing the risk factors of overweight and obesity among school children aged 6 to 18 years were included in this scoping review. Moreover, we considered only articles published in English.

For this scoping review, we employed certain exclusion criteria to maintain focus and quality of research. Studies not pertaining to the specific age group of 6 to 18 years were omitted. Research not directly exploring risk factors for overweight and/or obesity was also excluded. Additionally, articles published in languages other than English were not considered due to potential translation limitations. We disregarded any unpublished material or gray literature, including dissertations, conference proceedings, and reports, due to their less rigorous peer-review processes. Lastly, editorials, commentary articles, online sources, and letters to the editor were included only if they provided significant insight into the risk factors of overweight and obesity among school children aged 6 to 18 years; otherwise, they were excluded. These exclusion criteria ensured the precision and relevance of our review findings.

Study Screening, Study Selection, and Data Extraction

A total of 2,351 articles were retrieved through database searches, and 11 studies were identified through other sources. A total of 2,173 records were retrieved after duplicates were removed using Mendeley software. In total, 318 full-text articles were assessed for eligibility. Of the 318 articles, 165 were excluded (115 records had a population of preschool children, 21 were not risk factors for overweight and/or obesity, 18 were published in languages other than English, and 11 were published in non-peer-reviewed journals). Finally, 153 articles were included in the qualitative analysis (Figure 1).

To ensure a systematic and robust review of the literature, we adhered to the Preferred Reporting Items for Systematic reviews and Meta-Analyses (PRISMA) guidelines for our scoping review. The PRISMA approach provided a detailed 27-item checklist and four-phase flow diagram that guided our selection process, from the initial literature search to the final selection of articles for inclusion. This ensured the transparency, completeness, and reliability of our review process. We commenced with an extensive literature search, followed by the elimination of duplicates, initial screening based on titles and abstracts, and finally, a thorough full-text review for eligibility (Figure 1).

Furthermore, the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) checklist was employed to ensure the quality of the studies included in our review. STROBE provides critical guidelines for reporting observational studies, enhancing the accuracy and comprehensiveness of our data extraction and analysis. Each study selected for our review was evaluated using the STROBE checklist, which covered aspects like study design, setting, participants, variables, data sources, bias, study size, statistical methods, and results. Studies not meeting the criteria were excluded to ensure the high quality and validity of our findings. Through the application of the STROBE checklist, we were able to maintain the rigorous standards necessary for this review.

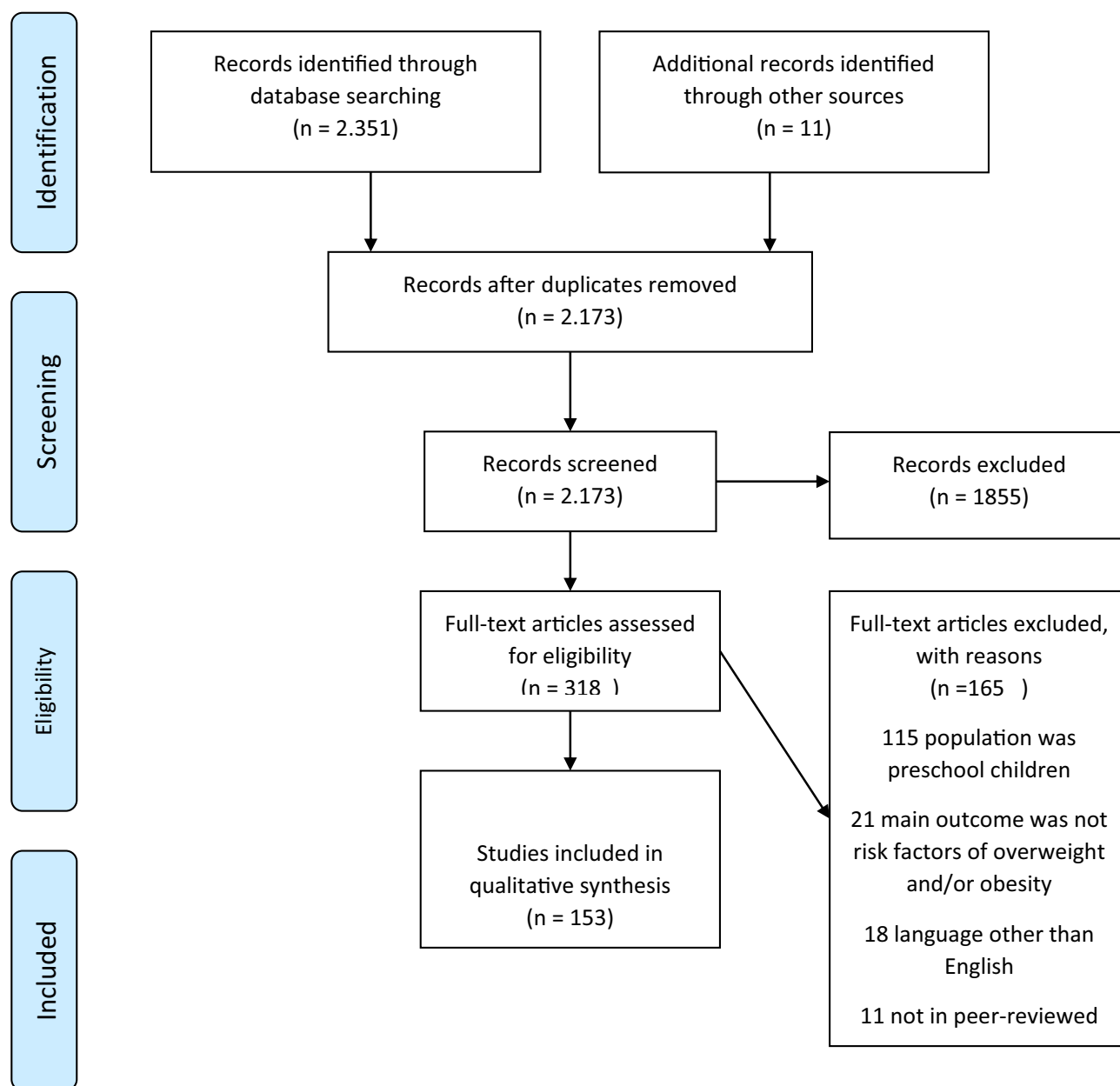


Figure 1 A flow chart of the search process.

Results

Description of the Studies

Among the 153 studies included in the data synthesis process, 52.3% (n=80) were conducted in Asia, 20.9% (n=32) in Europe, 8.5% (n=13) in Africa, 5.9% (n=9) in North America, 4.6% (n=7) in South America, 1.3% (n=2) in Australia, and 6.5% (n=10) remained undetermined.

With regard to the design of the studies, it was found that 117 studies were cross-sectional studies, 9 were case-controlled studies, 9 were narrative reviews, 5 were systematic reviews, 4 were longitudinal studies, three were cohort studies, two were prospective studies, one quasi-experimental study, one descriptive transversal study, one scoping review, and one qualitative study. Exploring the year of publication of the included studies revealed that 54 studies were published before 2011 and 99 studies were published between 2011 and 2021. In addition, the minimum and maximum ages in the included studies were one and 19 years, respectively (Table 1).

Table 1 Description of the Included Studies (n=153)

Parameter	F (%)
Year of publication	
1. Before 2000 ^{18–24}	7 (4.6)
2. 2001 –2010 ^{25–71}	47 (30.7)
3. After 2010 ^{5,11,72–165}	99 (64.7)
Geographical Area	
1. Europe	32 (20.9)
2. Asia	80 (52.3)
3. Africa	13 (8.5)
4. North America	9 (5.9)
5. South America	7 (4.6)
6. Australia	2 (1.3)
7. Undetermined	10 (6.5)
Research Design	
1. Cross-sectional	114
2. Case-control	10
3. Systematic Review	5
4. Narrative Review	8
5. Other	16

Abbreviations: F, Frequency; %, Percentage.

Risk Factors of Overweight and Obesity Among School Children Aged 6 to 18 Years

The emergence of childhood obesity and overweight is caused by several factors. Genetic, behavioral, environmental, cultural, and socioeconomic factors interact to influence weight gain. Age, sex, developmental status, and ethnicity were the other variables that affected the amount of body fat. Although inherited contributing factors to inter-individual variability in BMI, the majority of people experience overweight and obesity as a result of excessive calorie consumption and/or insufficient regular exercise. A review of the included studies revealed a number of risk factors that contribute to overweight and obesity among schoolchildren. In this scoping review, we identified four main themes of risk factors influencing overweight and obesity among schoolchildren as follows:

Socioeconomic and Household Factors

A total of 85 out of 153 extracted studies reported research-based evidence that socioeconomic and household factors are risk factors for overweight and obesity among school children aged 6 to 18 years. For instance, Rachmi et al⁵ reported that the living area, income, and educational level of both parents are risk factors for overweight and obesity among school children with obesity. In addition, Wang et al¹³⁸ explored the risk factors of overweight and obesity in a sample of 1544 Chinese children aged 6–17 years. They reported that sex was a risk factor for overweight and obesity among Chinese school children. In another cross-sectional study carried out by Hadhood et al¹²⁵ in Egypt, a sample of 711 school children aged 6–14 years was recruited. The study found that living in urban regions, a low level of mother's education, formula feeding, and a lack of both vegetables and fruits in diets. Moreover, Paduano et al¹⁵⁶ conducted a cross-sectional study of a sample of 588 school children aged 6 to 7 years and found that the presence of a family history of overweight and obesity, low level of parental education, skipping breakfast meal, and parental beliefs about dietary behaviors are significant risk factors for overweight and obesity among school children. In addition, Karki et al¹⁴⁸ conducted a cross-sectional study on a sample of 575 Nepali school children aged 6 to 13 years. The study found that gender, educational level of both parents, mother's work, and sedentary lifestyle were risk factors for overweight and obesity among school children. Furthermore, Johnson et al¹⁴⁷ provided research-based evidence by conducting a systematic literature review on the risk factors of overweight and obesity among school children and found that

screening of 24 studies, living in a poor region, and limited access to food stores were significant risk factors for overweight and obesity among school children.

Environmental Factors

Among the 153 studies reviewed, 22 studies reported environmental factors as risk factors for overweight and obesity among school children. For example, Jia et al¹²⁴ conducted a secondary data analysis of 1648 school children aged 7 to 18 years in China and identified the school environment and policies as risk factors for overweight and obesity. Similarly, Lafta and Kadhim³⁶ conducted a study in Iraq with 8300 school children aged 7 to 13 years, and their findings indicated that birth rank and certain dietary and lifestyle practices were risk factors for overweight and obesity among Iraqi school children. Another study by Wang et al¹¹ examined 894 school children aged 9 to 12 years in China and found that paternal overweight, maternal overweight, and shorter sleep duration were significant risk factors for overweight and obesity in Chinese school children. Several studies have identified various environmental risk factors for overweight and obesity among school children aged 6 to 18 years. For instance, Jia et al¹²⁴ found that the school environment and policies were risk factors for overweight and obesity among school children in China. Lafta and Kadhim³⁶ reported that birth rank and certain dietary and lifestyle practices contributed to overweight and obesity among Iraqi school children. Wang et al¹¹ discovered that paternal and maternal overweight, as well as shorter sleep duration, were significant risk factors for overweight and obesity among Chinese school children. Murer et al¹¹⁸ revealed that parental activities, including dietary behavior-related activities, parents' nationality, and media consumption, were risk factors for overweight and obesity among school-aged children in Switzerland. Additionally, Shi et al⁹² found that maternal smoking during pregnancy and birth weight were significant risk factors for overweight and obesity among Canadian school-aged children. Furthermore, Bingham et al⁹⁶ identified maternal smoking during pregnancy, TV watching, and playing video games as risk factors for overweight and obesity among Portuguese school-aged children in a cross-sectional study.

Biological and Developmental Factors

A total of 43 of 153 studies reported that biological and developmental factors are risk factors for overweight and obesity among school children aged 6 to 18 years. For instance, Chi et al¹²³ conducted a scoping review study and found that non-modifiable risk factors for obesity among school children included both biological and developmental factors such as genes, developmental conditions, and puberty. In addition, Corica et al¹³⁹ conducted a cross-sectional study of 260 Italian school children aged 2.4–17.2 years and found that a family history of obesity and cardiometabolic diseases was a risk factor for overweight and obesity. Moreover, Teixeira et al¹²⁷ found that metabolic risk factors, such as hypertriglyceridemia and hyperglycemia, are among the biological risk factors of overweight and obesity among school-aged children. Furthermore, Ahrens et al¹²⁸ conducted a population-based cohort study on a sample of 16,228 school students aged 2–9 years and found that bone stiffness, genetic susceptibility, and specific metabolic biomarkers were significant risk factors for overweight and obesity among European school children. In a study by Blair et al, it was found that among school children aged 1 to 7 years, birth weight and rapid weight gain in infancy were risk factors for overweight and obesity. Also, Stettler et al¹²⁵ found that among school children aged 4.5 to 17.4 years in Seychelles, weight gain during the 1st year of life and increased maternal BMI were significant risk factors of overweight and obesity among school children aged 4.5 to 17.4 years.

Interaction Between Socioeconomic and Household, Psychosocial, Biological and Behavioral Factors

A total of 65 out of 153 studies reported that the interaction between two or more socioeconomic factors and household, psychosocial, biological, and behavioral factors are risk factors for overweight and/or obesity among school children. For example, Agustina et al¹⁶⁴ study in Indonesia reported that sedentary lifestyle, male sex, lower educational level, married, younger age, and residence in urban areas were all risk factors that interacted to increase the risk of overweight and obesity among school children. In another study by Aljassim & Jradi,¹⁶² it was reported that the interaction between socioeconomic and household, environmental and behavioral factors, specifically; unemployed father, overweight/obese father, inappropriate father's perceptions, mode of delivery, lack of physical activity, watching TV, and frequent

snacking, were significant risk factors that increase the likelihood of overweight and obesity among school children. Moreover, Danquah et al¹⁵⁸ reported that the interaction between parents' economic status, sex, consumption of highly refined foods, age, parents' educational level, lack of physical activity, type of school, time spent watching TV, size of household, vitamin D deficiency, and having a diabetic parent were all risk factors associated with overweight and obesity among school-aged children.

Discussion

The present scoping review delineated the risk factors contributing to overweight and obesity among school children aged 6 to 18 years, through an analysis of 153 global studies. The risk factors were found to be encompassed in four major themes: socioeconomic, household, environmental, and biological factors. It was observed that these themes often interact, culminating in a heightened risk for obesity among children.

The influence of environmental factors on obesity is substantial, as it relates to the behavioral or lifestyle characteristics that determine energy expenditure. The prevalence of obesity and overweight is not solely a byproduct of hereditary factors; the disparities seen across different demographics and ethnicities are multifaceted.^{53,120,137,166} Despite the fact that genetics and family history contribute significantly to obesity, contemporary advancements in technology have also exacerbated the issue. A noteworthy increase in obesity rates among a genetically consistent population points to the substantial role played by environmental elements. This is further supported by research evidence suggesting that lifestyle modifications are responsible for half of the overweight and obesity cases.^{166,167} As a result, environmental conditions and lifestyle choices are crucial elements influencing the progression and severity of obesity, particularly in genetically predisposed individuals.¹⁶⁸

Children today find themselves in an "obesogenic" environment, where an imbalance between calorie intake and expenditure, spurred by various factors, reigns. This setting promotes overconsumption of energy-dense foods while discouraging regular physical activity.¹⁶⁹ A sedentary lifestyle, coupled with larger food portions and high-fat, sugar-rich diets, poses a significant risk.¹⁷⁰ Evidence from cross-sectional studies highlight how decreased energy expenditure and insufficient physical activity among children are linked to a higher risk of obesity.^{13,106,122,135}

Concurrently, eating habits have also emerged as critical environmental risk factors. Children's diets have shifted significantly over time, with more emphasis on snacking than balanced meals.^{41,55,69,94,129} This tendency towards high-calorie snack foods, especially when consumed outside the home, increases the risk of obesity. Moreover, binge eating episodes further exacerbate this situation by promoting consumption of even more energy-dense meals or overall increased food intake.

Socioeconomic and cultural factors serve as significant influences, especially in industrialized nations. Lower education and socioeconomic status correlate with higher obesity rates, as they limit an individual's ability to navigate an obesity-promoting environment.^{171,172} Children from lower-income families face issues of food security, limited access to healthy food options, and inadequate spaces for physical activity, thus becoming more vulnerable to excessive weight gain.¹⁷³

Household factors, especially sociocultural practices impacting energy expenditure, are influential in the prevalence of obesity. Culturally specific food preferences, family encouragement of physical activity, or the absence thereof, can significantly affect a child's weight.¹⁷⁴

Biological factors also play a crucial role in the development of childhood obesity.¹⁷⁵ Rapid weight gain during the first two years of life or during infancy, periods marked by increased fat cell accumulation and growth rate alterations, are strongly correlated with a subsequent risk of obesity.^{176,177}

Over the last decade, the relationship between breastfeeding and childhood obesity has garnered substantial interest. Research has pointed towards an inverse correlation between breastfeeding and weight gain, further emphasizing the biological aspects of obesity development.^{178,179}

Other significant environmental factors include screen time and sleep duration. Numerous studies highlight a positive correlation between prolonged screen time and body fat, marking media consumption as a marker of sedentary behavior.^{180,181} Inadequate sleep, a variable with substantial influence over neuroendocrine function and glucose metabolism, also contributes to an increased risk of obesity.^{151,152}

Despite the significant findings of this study, there are several limitations. One limitation is that the included studies were not subjected to the assessment of risk of bias, which might have led to the inclusion of misleading findings from studies that included methodological flaws, especially systematic literature reviews. Another limitation is that the present study focused on previous studies published in English, which by default excluded previous studies published in other languages and resulted in region-specific conclusions more than global conclusions.

Conclusion and Recommendations

The scoping review study underscores the intricate network of risk factors – including socioeconomic, household, environmental, and biological elements – that significantly contribute to the growing prevalence of obesity and overweight in school children aged 6 to 18 years. Each of these elements does not operate in isolation but interacts in a complex and dynamic manner, thereby leading to the exacerbation of the obesity epidemic among children in this age group.

However, within these identified factors, a higher-level abstraction unfolds. The increasing technological advancements and subsequent lifestyle changes in today's global society have led to an environment marked by “obesogenic” factors. This milieu has set in motion a vicious cycle of unhealthy dietary habits, sedentary behaviors, and disrupted sleep patterns which, combined with underlying socioeconomic disadvantages and genetic predispositions, form the core of the obesity problem. Ultimately, the interaction of these domains presents a more robust understanding of the risk for obesity, implicating the environment and society we create and the choices we make within them. Acknowledging this multi-dimensional and interconnected framework is the first step towards formulating comprehensive and effective strategies to curb the escalating trend of childhood obesity.

Given our study's findings, we recommend a concentrated focus on school-based health interventions to tackle obesity among children aged 6–18. Schools should integrate educational sessions on balanced nutrition and physical activity into their curriculum, alongside offering healthier food options and regular exercise sessions. Collaboration with healthcare providers for routine health screenings can help identify at-risk students early, allowing for prompt intervention. Future research should evaluate the efficacy of these school-based initiatives, aiding in tailoring interventions to diverse school settings and shaping long-term healthy habits to curb obesity trends among students.

Research Implications

The research implications of this study are substantial and multifaceted. It emphasizes the importance of an integrated, multi-dimensional approach to obesity prevention that takes into account the complex interplay of socioeconomic, household, environmental, behavioral, and biological factors. The findings underscore the need for targeted interventions, particularly within the school setting, to reduce obesity risk among children aged 6–18 years. These interventions need to be supported by policy changes that promote healthy food choices and regular physical activity. Furthermore, the study highlights gaps in our understanding of the specific mechanisms linking these risk factors to childhood obesity, necessitating further research. Lastly, it suggests that prevention strategies should be proactive and start early in life, opening a pathway for researchers to delve into the effects of early-life interventions on long-term obesity outcomes.

Author Contributions

All authors made a significant contribution to the work reported, whether that is in the conception, study design, execution, acquisition of data, analysis and interpretation, or in all these areas; took part in drafting, revising or critically reviewing the article; gave final approval of the version to be published; have agreed on the journal to which the article has been submitted; and agree to be accountable for all aspects of the work.

Disclosure

The authors declare no conflicts of interest.

References

1. Ebbeling CB, Feldman HA, Klein GL, et al. Effects of a low carbohydrate diet on energy expenditure during weight loss maintenance: randomized trial. *BMJ*. 2018;363. doi:10.1136/bmj.k4583
2. Massri C, Sutherland S, Källestål C, Peña S. Impact of the food-labeling and advertising law banning competitive food and beverages in Chilean public schools, 2014–2016. *Am J Public Health*. 2019;109(9):1249–1254. doi:10.2105/ajph.2019.305159
3. Hruby A, Hu FB. The epidemiology of obesity: a big picture. *Pharmacoeconomics*. 2015;33:673–689. doi:10.1007/s40273-014-0243-x
4. Hayes JF, Fitzsimmons-Craft EE, Karam AM, Jakubiak J, Brown ML, Wilfley DE. Disordered eating attitudes and behaviors in youth with overweight and obesity. *Implicat Treat*. 2018;7. doi:10.1007/s13679-018-0316-9
5. Rachmi CN, Li M, Alison Baur L. Overweight and obesity in Indonesia: prevalence and risk factors—a literature review. *Public Health*. 2017;147:20–29. doi:10.1016/j.puhe.2017.02.002
6. Yang L, Colditz GA. Prevalence of overweight and obesity in the United States, 2007–2012. *JAMA Intern Med*. 2015;175(8):1412. doi:10.1001/jamainternmed.2015.2405
7. Mekonnen T, Tariku A, Abebe SM. Overweight/obesity among school aged children in Bahir Dar City: cross sectional study. *Ital J Pediatr*. 2018;44(1). doi:10.1186/s13052-018-0452-6
8. Tomiyama AJ. Stress and Obesity. *Ann Rev Psychol*. 2019;70:703–718. doi:10.1146/annurev-psych-010418-102936
9. Mansoor N, Vinkes KJ, Veierod MB, Retterstol K. Effects of low-carbohydrate diets v. low-fat diets on body weight and cardiovascular risk factors: a meta-analysis of randomised controlled trials. *Br J Nutr*. 2016;115(3):466–479. doi:10.1017/s0007114515004699
10. Doycheva I, Watt KD, Rifai G, et al. Increasing burden of chronic liver disease among adolescents and young adults in the USA: a silent epidemic. *Dig Dis Sci*. 2017;62(5):1373–1380. doi:10.1007/s10620-017-4492-3
11. Wang JJ, Gao Y, Lau PWC. Prevalence of overweight in Hong Kong Chinese children: its associations with family, early-life development and behaviors-related factors. *J Exerc Sci Fit*. 2017;15(2):89–95. doi:10.1016/j.jesf.2017.10.001
12. Gille D, Bütikofer U, Chollet M, et al. Nutrition behavior of the middle-aged and elderly: compliance with dietary recommendations of the food pyramid. *Clin Nutr*. 2016;35(3):638–644. doi:10.1016/j.clnu.2015.04.002
13. Sahoo K, Sahoo B, Choudhury A, Sofi N, Kumar R, Bhadoria A. Childhood obesity: causes and consequences. *J Fam Med Prim Care*. 2015;4(2):1.
14. Monteiro CA, Cannon GJ. The role of the transnational ultra-processed food industry in the pandemic of obesity and its associated diseases: problems and solutions. *World Nutr*. 2019;10(1):89–99. doi:10.26596/wn.201910189-99
15. Liu D, Fang HY, Zhao LY, Yu DM, Long JM, Zhao WH. Study on the relationship between family-related factors and obesity of children and adolescents aged 6–17 years. *Zhonghua Liu Xing Bing Xue Za Zhi*. 2018;39(6). doi:10.3760/cma.jissn.0254-6450.2018.06.005
16. Abd Elmoaty AA, Imam MHR. Effect of low calories diet to decrease weight of obesity. *J Home Econ*. 2015;25(1). doi:10.21608/mkas.2015.171288
17. Pyper E, Harrington D, Manson H. The impact of different types of parental support behaviours on child physical activity, healthy eating, and screen time: a cross-sectional study. *BMC Public Health*. 2016;16(1). doi:10.1186/s12889-016-3245-0
18. Musaiger AO, Matter AM, Alekri SA, Mahdi ARE. Obesity among secondary school students in Bahrain. *Nutr Health*. 1993;9(1):25–32. doi:10.1177/026010609300900103
19. McMurray RG, Harrell JS, Bangdiwala SI, Deng S. Cardiovascular disease risk factors and obesity of rural and urban elementary school children. *J Rural Heal*. 1999;15(4). doi:10.1111/j.1748-0361.1999.tb00760.x
20. Kromeyer-Hauschild K, Zellner K, Jaeger U, Hoyer H. Prevalence of overweight and obesity among school children in Jena (Germany). *Int J Obes*. 1999;23(11):1143–1150. doi:10.1038/sj.ijo.0801044
21. De Vito E, La Torre G, Langiano E, Berardi D, Ricciardi G. Overweight and obesity among secondary school children in Central Italy. *Eur J Epidemiol*. 1999;15(7):649–654. doi:10.1023/a:1007675005395
22. Moussa MAA, Shaltout AA, Nkansa-Dwamena D, et al. Factors associated with obesity in Kuwaiti children. *Eur J Epidemiol*. 1999;15:1. doi:10.1023/a:
23. He Q, Ding ZY, Fong DYT, Karlberg J. Risk factors of obesity in preschool children in China: a population-based case-control study. *Int J Obes*. 2000;24(11):1528–1536. doi:10.1038/sj.ijo.0801394
24. Maffèis C. Aetiology of overweight and obesity in children and adolescents. *Eur J Pediatr*. 2000;159:S35–S44. doi:10.1007/pl00014361
25. Stettler N, Bovet P, Shamlaye H, Zemel BS, Stallings VA, Paccaud F. Prevalence and risk factors for overweight and obesity in children from Seychelles, a country in rapid transition: the importance of early growth. *Int J Obes*. 2002;26:2. doi:10.1038/sj.ijo.0801860
26. Adhianto G, Soetjiningih S. Prevalence and risk factors of overweight and obesity in adolescents. *Paediatr Indones*. 2002;42(9–10):206–211. doi:10.14238/pi42.5.2002.206-11
27. Burrows A, Cooper M. Possible risk factors in the development of eating disorders in overweight pre-adolescent girls. *Int J Obes*. 2002;26(9):1268–1273. doi:10.1038/sj.ijo.0802033
28. Hui LL, Nelson EAS, Yu LM, Li AM, Fok TF. Risk factors for childhood overweight in 6- To 7-y-old Hong Kong children. *Int J Obes*. 2003;27(11):1411–1418. doi:10.1038/sj.ijo.0802423
29. Frye C, Heinrich J. Trends and predictors of overweight and obesity in East German children. *Int J Obes*. 2003;27(8):963–969. doi:10.1038/sj.ijo.0802321
30. Ribeiro J, Guerra S, Pinto A, Oliveira J, Duarte J, Mota J. Overweight and obesity in children and adolescents: relationship with blood pressure, and physical activity. *Ann Hum Biol*. 2003;30(2):203–213. doi:10.1080/0301446021000054587
31. Nuñez-Rivas HP, Monge-Rojas R, León H, Roselló M. Prevalence of overweight and obesity among Costa Rican elementary school children. *Rev Panam Salud Publica Pan Am J Public Heal*. 2003;13(1). doi:10.1590/s1020-49892003000100004
32. Ariza AJ, Chen EH, Binns HJ, Christoffel KK. Risk factors for overweight in five- to six-year-old Hispanic-American children: a pilot study. *J Urban Heal*. 2004;81(1):1.
33. Stewart Agras W, Hammer LD, McNicholas F, Kraemer HC. Risk factors for childhood overweight: a prospective study from birth to 9.5 years. *J Pediatr*. 2004;145(1). doi:10.1016/j.jpeds.2004.03.023

34. Bibiloni MDM, Martinez E, Llull R, Juarez MD, Pons A, Tur JA. Prevalence and risk factors for obesity in Balearic Islands adolescents. *Br J Nutr*. 2010;103(1):99–106. doi:10.1017/s000711450999136x
35. Danielzik S, Czerwinski-Mast M, Langnase K, Dilba B, Müller MJ. Parental overweight, socioeconomic status and high birth weight are the major determinants of overweight and obesity in 5–7 y-old children: baseline data of the Kiel Obesity Prevention Study (KOPS). *Int J Obes*. 2004;28(11):1494–1502. doi:10.1038/sj.ijo.0802756
36. Lafta RK, Kadhim MJ. Childhood obesity in Iraq: prevalence and possible risk factors. *Ann Saudi Med*. 2005;25(5):389–393. doi:10.5144/0256-4947.2005.389
37. Padez C, Mourão I, Moreira P, Rosado V. Prevalence and risk factors for overweight and obesity in Portuguese children. *Acta Paediatr Int J Paediatr*. 2005;94(11):1550–1557. doi:10.1080/08035250510042924
38. Veugelers PJ, Fitzgerald AL. Prevalence of and risk factors for childhood overweight and obesity. *C Can Med Assoc J*. 2005;173(6):1.
39. Andersen LF, Lillegaard ITL, Øverby N, Klepp KI, Lytle L, Johansson L. Overweight and obesity among Norwegian schoolchildren: changes from 1993 to 2000. *Scand J Public Health*. 2005;33(2):99–106. doi:10.1080/140349404100410019172
40. Tokmakidis SP, Kasambalis A, Christodoulos AD. Fitness levels of Greek primary schoolchildren in relationship to overweight and obesity. *Eur J Pediatr*. 2006;165(12):867–874. doi:10.1007/s00431-006-0176-2
41. Mutunga M, Gallagher AM, Boreham C, et al. Socioeconomic differences in risk factors for obesity in adolescents in Northern Ireland. *Int J Pediatr Obes*. 2006;1(2):114–119. doi:10.1080/17477160600569560
42. Salmon J, Campbell KJ, Crawford DA. Television viewing habits associated with obesity risk factors: a survey of Melbourne schoolchildren. *Med J Aust*. 2006;184(2):64–67. doi:10.5694/j.1326-5377.2006.tb00117.x
43. Chakar H, Salameh PR. Adolescent obesity in Lebanese private schools. *Eur J Public Health*. 2006;16(6):648–651. doi:10.1093/eurpub/ckl057
44. Moreno LA, Rodríguez G. Dietary risk factors for development of childhood obesity. *Curr Opin Clin Nutr Metab Care*. 2007;10:336–341. doi:10.1097/MCO.0b013e3280a94f59
45. Blair NJ, Thompson JMD, Black PN, et al. Risk factors for obesity in 7-year-old European children: the Auckland Birthweight Collaborative Study. *Arch Dis Child*. 2007;92(10):866–871. doi:10.1136/adc.2007.116855
46. Suñé FR, Dias-Da-Costa JS, Olinto MTA, Pattussi MP. Prevalence of overweight and obesity and associated factors among schoolchildren in a southern Brazilian city. *Cad Saude Publica*. 2007;23(6):1361–1371. doi:10.1590/s0102-311x2007000600011
47. Al-Saeed WY, Al-Dawood KM, Bukhari IA, Bahnassy A. Prevalence and socioeconomic risk factors of obesity among urban female students in Al-Khobar city, Eastern Saudi Arabia 2003. *Obes Rev*. 2007;8(2):93–99. doi:10.1111/j.1467-789x.2006.00287.x
48. Lutfiyya MN, Lipsky MS, Wisdom-Behounek J, Inpanbutr-Martinkus M. & Inpanbutr-Martinkus M. Is rural residency a risk factor for overweight and obesity for US children? *Obesity*. 2007;15(9):2348–2356. doi:10.1038/oby.2007.278
49. Fuiano N, Rapa A, Monzani A, et al. Prevalence and risk factors for overweight and obesity in a population of Italian schoolchildren: a longitudinal study. *J Endocrinol Invest*. 2008;31(11):979–984. doi:10.1007/bf03345635
50. Bharati DR, Deshmukh PR, Garg BS. Correlates of overweight & obesity among school going children of Wardha city, central India. *Indian J Med Res*. 2008;127(6):539–543.
51. Farias de Novaes J, Castro Franceschini SDC, Eloiza Priore S. Mothers overweight, parents constant limitation on the foods and frequent snack as risk factors for obesity among children in Brazil. *Arch Latinoam Nutr*. 2008;58(3):256–264.
52. Hirschler V, Bugna J, Roque M, Gilligan T, Gonzalez C. Does low birth weight predict obesity/overweight and metabolic syndrome in elementary school children? *Arch Med Res*. 2008;39(8):796–802. doi:10.1016/j.arcmed.2008.08.003
53. Sen Y, Kandemir N, Alikasifoglu A, Gonc N, Ozon A. Prevalence and risk factors of metabolic syndrome in obese children and adolescents: the role of the severity of obesity. *Eur J Pediatr*. 2008;167(10):1183–1189. doi:10.1007/s00431-007-0658-x
54. Khalid MEH. Is high-altitude environment a risk factor for childhood overweight and obesity in Saudi Arabia? *Wilderness Environ Med*. 2008;19(3):157. doi:10.1580/07-weme-or-095.1
55. Amin TT, Al-Sultan AI, Ali A. Overweight and obesity and their relation to dietary habits and socio-demographic characteristics among male primary school children in Al-Hassa, Kingdom of Saudi Arabia. *Eur J Nutr*. 2008;47(6):310–318. doi:10.1007/s00394-008-0727-6
56. Mahfouz AA, Abdelmoneim I, Khan MY, et al. Obesity and related behaviors among adolescent school boys in Abha City, Southwestern Saudi Arabia. *J Trop Pediatr*. 2008;54(2):120–124. doi:10.1093/tropej/fmm089
57. Vanhala M, Korpelainen R, Tapanainen P, et al. Lifestyle risk factors for obesity in 7-year-old children. *Obes Res Clin Pract*. 2009;3(2):99–107. doi:10.1016/j.orcp.2009.01.003
58. Akhavan-Karbasi S, Fallah R, Golestan M, Sadr-Bafghi M. Prevalence and risk factors of obesity and overweight among primary school children in Yazd. *SSU Journals*. 2009;16(5):8–13.
59. Menezes IHCF, Borges Neutzling M, De Aguiar Carrazedo Taddei JA. Risk factors for overweight and obesity in adolescents of a Brazilian university: a case-control study. *Nutr Hosp*. 2009;24(1):5.
60. Tharkar S, Viswanathan V. Impact of socioeconomic status on prevalence of overweight and obesity among children and adolescents in urban India. *Open Obes J*. 2009;1:1. doi:10.2174/1876823700901010009
61. Khader Y, Irshaidat O, Khasawneh M, Amarin Z, Alomari M, Batieha A. Overweight and obesity among school children in Jordan: prevalence and associated factors. *Matern Child Health J*. 2009;13(3):424–431. doi:10.1007/s10995-008-0362-0
62. Mohammed AH, Al-Dabbagh SA. Prevalence and risk factors of obesity and overweight among children In Duhok, Kurdistan Region, Iraq. *Duhok Med J*. 2009;3(2):1–9.
63. El-Bayoumy I, Shady I, Lotfy H. Prevalence of obesity among adolescents (10 to 14 Years) in Kuwait. *Asia-Pacific J Public Heal*. 2009;21(2). doi:10.1177/1010539509331786
64. Abu Baker NN, Daradkeh SM. Prevalence of overweight and obesity among adolescents in Irbid Governorate, Jordan. *East Mediterr Heal J*. 2010;16(6):1.
65. Júlíusson PB, Eide GE, Roelants M, Waaler PE, Hauspie R, Bjerknes R. Overweight and obesity in Norwegian children: prevalence and socio-demographic risk factors. *Acta Paediatr Int J Paediatr*. 2010;99(6):900–905. doi:10.1111/j.1651-2227.2010.01730.x
66. Shan XY, Xi B, Cheng H, Hou DQ, Wang Y, Mi J. Prevalence and behavioral risk factors of overweight and obesity among children aged 218 in Beijing, China. *Int J Pediatr Obes*. 2010;5(5):383–389. doi:10.3109/17477160903572001

67. Pirinççi E, Durmuş B, Gündoğdu C, Açık Y. Prevalence and risk factors of overweight and obesity among urban school children in Elazığ city, Eastern Turkey, 2007. *Ann Hum Biol.* 2010;37(1):44–56. doi:10.3109/03014460903218984
68. Thibault H, Contrand B, Saubusse E, Baine M, Maurice-Tison S. Risk factors for overweight and obesity in French adolescents: physical activity, sedentary behavior and parental characteristics. *Nutrition.* 2010;26(2):192–200. doi:10.1016/j.nut.2009.03.015
69. Goyal RK, Shah VN, Saboo BD, et al. Prevalence of overweight and obesity in Indian adolescent school going children: its relationship with socioeconomic status and associated lifestyle factors. *J Assoc Physicians India.* 2010;58(3):151–158.
70. Papandreou D, Malindretos P, Rouso I. Risk factors for childhood obesity in a Greek paediatric population. *Public Health Nutr.* 2010;13(10):1535–1539. doi:10.1017/s1368980009993156
71. Al-Isa AN, Campbell J, Desapriya E. Factors associated with overweight and obesity among Kuwaiti elementary male school children aged 6–10 years. *Int J Pediatr.* 2010;2010:1–6. doi:10.1155/2010/459261
72. Hajian-Tilaki KO, Sajjadi P, Razavi A. Prevalence of overweight and obesity and associated risk factors in urban primary-school children in Babol, Islamic Republic of Iran. *East Mediterr Heal J.* 2011;17(2):4.
73. Beyerlein A, Toschke AM, Rosario AS, von Kries R. Risk factors for obesity: further evidence for stronger effects on overweight children and adolescents compared to normal-weight subjects. *PLoS One.* 2011;6(1). doi:10.1371/journal.pone.0015739
74. Duncan S, Duncan EK, Fernandes RA, et al. Modifiable risk factors for overweight and obesity in children and adolescents from São Paulo, Brazil. *BMC Public Health.* 2011;11:11. doi:10.1186/1471-2458-11-585
75. Boukthir S, Essaddam L, Mrad SM, et al. Prevalence and risk factors of overweight and obesity in elementary schoolchildren in the metropolitan region of Tunis, Tunisia. *Tunis Med.* 2011;89(1):1.
76. Goyal JP, Kumar N, Parmar I, Shah VB, Patel B. Determinants of overweight and obesity in affluent adolescent in Surat city, South Gujarat region, India. *Indian J Community Med.* 2011;36(4):296. doi:10.4103/0970-0218.91418
77. Mushtaq MU, Gull S, Shahid U, et al. Family-based factors associated with overweight and obesity among Pakistani primary school children. *BMC Pediatr.* 2011;11:11. doi:10.1186/1471-2431-11-114
78. Vohra R, Bhardwaj P, Srivastava J, Srivastava S, Vohra A. Overweight and obesity among school-going children of Lucknow city. *J Fam Community Med.* 2011;18(2):59. doi:10.4103/2230-8229.83369
79. Mahfouz A, Shatour A, Khan M, Daffalla O, Mostafa O, Hassanein M. Nutrition, physical activity, and gender risks for adolescent obesity in Southwestern Saudi Arabia. *Saudi J Gastroenterol.* 2011;17(5):318. doi:10.4103/1319-3767.84486
80. Yi X, Yin C, Chang M, Xiao Y. Prevalence and risk factors of obesity among school-aged children in Xi'an, China. *Eur J Pediatr.* 2012;171(2):389–394. doi:10.1007/s00431-011-1566-7
81. Li P, Yang F, Xiong F, et al. Nutritional status and risk factors of overweight and obesity for children aged 9–15 years in Chengdu, Southwest China. *BMC Public Health.* 2012;12(1):1–7. doi:10.1186/1471-2458-12-636
82. Song Y, Zhang X, Ma J, Zhang B, Hu PJ, Dong B. 2010年中国中小学生学习超重与肥胖的行为影响因素 [Behavioral risk factors for overweight and obesity among Chinese primary and middle school students in 2010]. *Zhonghua Yu Fang Yi Xue Za Zhi.* 2012;46(9):1. Chinese.
83. Yang Y, Chen PJ, Wu YQ, Peng NN, Zhou GY. Study on risk factors of overweight and obesity school-age children and adolescents in Shanghai. *Chinese J Sch Heal.* 2012;33(11):1350–1352.
84. Andegiorghis AK, Wang J, Zhang X, Liu X, Zhu H. Prevalence of overweight, obesity, and associated risk factors among school children and adolescents in Tianjin, China. *Eur J Pediatr.* 2012;171(4):697–703. doi:10.1007/s00431-011-1636-x
85. Ercan S, Dallar YB, Önen S, Engiz Ö. Prevalence of obesity and associated risk factors among adolescents in Ankara, Turkey. *JCRPE J Clin Res Pediatr Endocrinol.* 2012;4(4):204–207. doi:10.4274/jcrpe.714
86. Kurtoglu S, Hatipoglu N, Mazicioglu MM, Kondolot M. Neck circumference as a novel parameter to determine metabolic risk factors in obese children. *Eur J Clin Invest.* 2012;42(6):623–630. doi:10.1111/j.1365-2362.2011.02627.x
87. Rezali FW, Chin YS, Yusof BNM. Obesity-related behaviors of Malaysian adolescents: a sample from Kajang district of Selangor state. *Nutr Res Pract.* 2012;6(5):458. doi:10.4162/nrp.2012.6.5.458
88. Nasreddine L, Naja F, Tabet M, et al. Obesity is associated with insulin resistance and components of the metabolic syndrome in Lebanese adolescents. *Ann Hum Biol.* 2012;39(2):122–128. doi:10.3109/03014460.2012.655776
89. Al-Ghamdi S. The association between watching television and obesity in children of school-Age in Saudi Arabia. *J Fam Community Med.* 2013;20(2):83. doi:10.4103/2230-8229.114767
90. AlQahtani A, AlAlGhamdi R, AlGhamdi K. Childhood obesity: prevalence, risk factors and life style behaviour among primary school male children in Al-Madinah-Al-Munawarah, Saudi Arabia. *Int J Med Sci Public Heal.* 2017;1. doi:10.5455/ijmsph.2013.010920131
91. Bhuiyan MU, Zaman S, Ahmed T. Risk factors associated with overweight and obesity among urban school children and adolescents in Bangladesh: a case-control study. *BMC Pediatr.* 2013;13(1). doi:10.1186/1471-2431-13-72
92. Shi Y, de Groh M, Morrison H. Perinatal and early childhood factors for overweight and obesity in young Canadian children. *Can J Public Heal.* 2013;104(1). doi:10.1007/bf03405658
93. Teshome T, Singh P, Moges D. Prevalence and associated factors of overweight and obesity among high school adolescents in urban communities of hawassa, southern Ethiopia. *Curr Res Nutr Food Sci.* 2013;1(1):23–36. doi:10.12944/CRNFSJ.1.1.03
94. Badawi NES, Barakat AA, El Sherbini SA, Fawzy HM. Prevalence of overweight and obesity in primary school children in Port Said city. *Egypt Pediatr Assoc Gaz.* 2013;61(1). doi:10.1016/j.epag.2013.04.007
95. Kyallo F, Makokha A, Mwangi AM. Overweight and obesity among public and private primary school children in Nairobi, Kenya. *Health.* 2013;05(08). doi:10.4236/health.2013.58A3012
96. Bingham DD, Varela-Silva MI, Ferrão MM, et al. Socio-demographic and behavioral risk factors associated with the high prevalence of overweight and obesity in Portuguese children. *Am J Hum Biol.* 2013;25(6):733–742. doi:10.1002/ajhb.22440
97. Birbilis M, Moschonis G, Mougios V, Manios Y. Obesity in adolescence is associated with perinatal risk factors, parental BMI and socio-demographic characteristics. *Eur J Clin Nutr.* 2013;67(1):115–121. doi:10.1038/ejcn.2012.176
98. Naidu BM, Mahmud SZ, Ambak R, et al. Overweight among primary school-age children in Malaysia. *Asia Pac J Clin Nutr.* 2013;22(3):408–415. doi:10.6133/apjcn.2013.22.3.18
99. He L, Ren X, Chen Y, et al. Prevalence of overweight and obesity among primary school children aged 5 to 14 years in Wannan area, China. *Nutr Hosp.* 2014;30(4). doi:10.3305/nh.2014.30.4.7693

100. Wandia FB, Ettayang GK, Mbagaya G. Prevalence of and factors associated with overweight and obesity among nursery school children aged 3–6 years in Eldoret Municipality. *African J Food, Agric Nutr Dev*. 2014;14(5):2057–2071.
101. Kjeldsen JS, Hjorth MF, Andersen R, et al. Short sleep duration and large variability in sleep duration are independently associated with dietary risk factors for obesity in Danish school children. *Int J Obes*. 2014;38(1):32–39. doi:10.1038/ijo.2013.147
102. Kim HS, Ham OK, Jang MN, Yun HJ, Park J. Economic differences in risk factors for obesity among overweight and obese children. *J Sch Nurs*. 2014;30(4):281–291. doi:10.1177/1059840513509839
103. Januszek-Trzciakowska A, Malecka-Tendera E, Klimek K, Matusik P. Obesity risk factors in a representative group of Polish prepubertal children. *Arch Med Sci*. 2014;10(5):880–885. doi:10.5114/aoms.2013.33328
104. Hjorth MF, Quist JS, Andersen R, et al. Change in sleep duration and proposed dietary risk factors for obesity in Danish school children. *Pediatr Obes*. 2014;9(6):e156–e159. doi:10.1111/ijpo.264
105. Al Dahi S, Al Hariri I, Al-Enazy W. Prevalence of overweight and obesity among Saudi primary school students in Tabuk, Saudi Arabia. *Saudi J Obes*. 2014;2(1).
106. Firouzi S, Poh BK, Ismail MN, Sadeghilar A. Sleep habits, food intake, and physical activity levels in normal and overweight and obese Malaysian children. *Obes Res Clin Pract*. 2014;8(1):e70–e78. doi:10.1016/j.orcp.2012.12.001
107. Musaiger AO, Al-Roomi K, Bader Z. Social, dietary and lifestyle factors associated with obesity among Bahraini adolescents. *Appetite*. 2014;73. doi:10.1016/j.appet.2013.11.002
108. Anteneh ZA, Gedefaw M, Tekletsadek KN, Tsegaye M, Alemu D. Risk factors of overweight and obesity among high school students in Bahir Dar city, north west Ethiopia: school based cross-sectional study. *Adv Prev Med*. 2015;2015:1–9. doi:10.1155/2015/294902
109. Mistry SK, Puthussery S. Risk factors of overweight and obesity in childhood and adolescence in South Asian countries: a systematic review of the evidence. *Public Health*. 2015;129(3):200–209. doi:10.1016/j.puhe.2014.12.004
110. Martinovic M, Belojevic G, Evans GW, et al. Prevalence of and contributing factors for overweight and obesity among Montenegrin schoolchildren. *Eur J Public Health*. 2015;25(5). doi:10.1093/eurpub/ckv071
111. Watharkar A, Nigam S, Martolia DS, Varma P, Barman SK, Sharma RP. Assessment of risk factors for overweight and obesity among school going children in Kanpur, Uttar Pradesh. *Indian J Community Heal*. 2015;27(2):2.
112. Hala AAT, Marawan M. Socio-behavioral determinants of overweight and obesity in Egyptian primary school children. *J Child Adolesc Behav*. 2015;03(05). doi:10.4172/2375-4494.1000236
113. Karimi B, Ghorbani R. Overweight and obesity in the Iranian schoolchildren. *Middle East J Rehabil Heal*. 2015;2(1). doi:10.17795/mejr-24433
114. Al-Muhaimeed AA, Dandash K, Ismail MS, Saquib N. Prevalence and correlates of overweight status among Saudi school children. *Ann Saudi Med*. 2015;35(4):275–281. doi:10.5144/0256-4947.2015.275
115. Naja F, Hwalla N, Itani L, Karam S, Mehio Sibai A, Nasreddine L. A Western dietary pattern is associated with overweight and obesity in a national sample of Lebanese adolescents (13–19 years): a cross-sectional study. *Br J Nutr*. 2015;114(11):1909–1919. doi:10.1017/s0007114515003657
116. Alrashidi MA, ShahwanAKL L, James Jones LK. Contributing factors to childhood overweight and obesity in Kuwait. *Int J Heal Sci*. 2015;3(1). doi:10.15640/ijhs.v3n1a8
117. Campbell MK. Biological, environmental, and social influences on childhood obesity. *Pediatr Res*. 2016;79:205–211. doi:10.1038/pr.2015.208
118. Murer SB, Saarsalu S, Zimmermann J, Herter-Aeberli I. Risk factors for overweight and obesity in Swiss primary school children: results from a representative national survey. *Eur J Nutr*. 2016;55(2):621–629. doi:10.1007/s00394-015-0882-5
119. Patsopoulou A, Tsimtsiou Z, Katsioulis A, Rachiotis G, Malissiova E, Hadjichristodoulou C. Prevalence and risk factors of overweight and obesity among adolescents and their parents in central Greece (FETA project). *Int J Environ Res Public Health*. 2015;13(1):83. doi:10.3390/ijerph13010083
120. Tuñón-Pablos E, Dreby J. Risk factors for overweight and obesity among Mexican children in New York. *Int J Popul Res*. 2016;2016. doi:10.1155/2016/2420167
121. Goisis A, Sacker A, Kelly Y. Why are poorer children at higher risk of obesity and overweight? A UK cohort study. *Eur J Public Health*. 2016;26(1):7–13. doi:10.1093/eurpub/ckv219
122. Thasanasuwan W, Srichan W, Kijboonchoo K, et al. Low sleeping time, high TV viewing time, and physical inactivity in school are risk factors for obesity in pre-adolescent Thai children. *J Med Assoc Thai*. 2016;99(3):4.
123. Chi DL, Luu M, Chu F. A scoping review of epidemiologic risk factors for pediatric obesity: implications for future childhood obesity and dental caries prevention research. *J Public Health Dent*. 2017;77. doi:10.1111/jphd.12221
124. Jia P, Li M, Xue H, Lu L, Xu F, Wang Y. School environment and policies, child eating behavior and overweight/obesity in urban China: the childhood obesity study in China megacities. *Int J Obes*. 2017;41(5). doi:10.1038/ijo.2017.2
125. Hadhood SESA, Ali RAE, Mohamed MM, Mohammed ES. Prevalence and correlates of overweight and obesity among school children in Sohag, Egypt. *Open J Gastroenterol*. 2017;07(02). doi:10.4236/ojgas.2017.72009
126. Felső R, Lohner S, Hollódy K, Molnár D, Molnár D. Relationship between sleep duration and childhood obesity: systematic review including the potential underlying mechanisms. *Nutr Metab Cardiovasc Dis*. 2017;27:751–761. doi:10.1016/j.numecd.2017.07.008
127. Teixeira FC, Pereira FEF, Pereira AF, Ribeiro BG. Metabolic syndrome's risk factors and its association with nutritional status in school-children. *Prev Med Reports*. 2017;6. doi:10.1016/j.pmedr.2017.02.002
128. Ahrens W, Pigeot I. Risk factors of childhood obesity: lessons from The European IDEFICS Study. The ECOG Free Obesity eBook; 2017. Available from: <https://ebook.ecog-obesity.eu/wp-content/uploads/2015/02/ECOG-Obesity-eBook-Risk-factors-of-childhood-obesity-Lessons-from-The-European-IDEFICS-study.pdf>. Accessed June 28, 2023.
129. Lu J, Yin X, Deng Y, Ji L. High socioeconomic status and key risk factors of overweight and obesity among rural-to-urban migrant 7–10y-old children in Shanghai, China. *Iran J Public Health*. 2017;46:6.
130. Kowal M, Matusik S, Pilecki MW, Kryst Ł, Sobiecki J, Woronkowicz A. Overweight and obesity risk factors in children aged 3–7 years: a prospective study in the city of Kraków. *Ann Hum Biol*. 2017;44(8):693–703. doi:10.1080/03014460.2017.1380226
131. Geckil E, Aslan S, Ister ED, Simsek DK, Sahin T. Prevalence and risk factors of obesity and overweight in elementary School-Age (5 to 15 years old) children in South-eastern Turkey. *Iran J Pediatr*. 2017;27(2). doi:10.5812/ijp.7218

132. Al-Dalaeen AM, Al-Domi HA. Factors associated with obesity among school children in Amman, Jordan. *Malays J Nutr.* 2017;23(2):1.
133. El-Kassas G, Ziade F. Exploration of the risk factors of generalized and central obesity among adolescents in North Lebanon. *J Environ Public Health.* 2017;2017:1–13. doi:10.1155/2017/2879075
134. Wehrauch-Blüher S, Wiegand S. Risk factors and implications of childhood obesity. *Curr Obes Rep.* 2018;7(4):254–259. doi:10.1007/s13679-018-0320-0
135. Mhrshahi S, Baur LA. What exposures in early life are risk factors for childhood obesity? *J Paediatr Child Health.* 2018;54:1294–1298. doi:10.1111/jpc.14195
136. Hemmingsson E. Early childhood obesity risk factors: socioeconomic adversity, family dysfunction, offspring distress, and junk food self-medication. *Curr Obes Rep.* 2018;7:204–209. doi:10.1007/s13679-018-0310-2
137. Lee EY, Yoon KH. Epidemic obesity in children and adolescents: risk factors and prevention. *Front Med.* 2018;12:658–666. doi:10.1007/s11684-018-0640-1
138. Wang VH, Min J, Xue H, et al. What factors may contribute to sex differences in childhood obesity prevalence in China? *Cambridge Q Healthc Ethics.* 2018;21(11):1.
139. Corica D, Aversa T, Valenzise M, et al. Does family history of obesity, cardiovascular, and metabolic diseases influence onset and severity of childhood obesity? *Front Endocrinol.* 2018;9(MAY). doi:10.3389/fendo.2018.00187
140. Kambondo G, Sartorius B. Risk factors for obesity and overfat among primary school children in Mashonaland west province, Zimbabwe. *Int J Environ Res Public Health.* 2018;15(2):249. doi:10.3390/ijerph15020249
141. Dasappa H, Fathima FN, Ganesh K, Prasad S. Prevalence, risk factors and attitude of parents towards childhood obesity among school children in Bangalore city. *Int J Community Med Public Heal.* 2018;5(2). doi:10.18203/2394-6040.ijcmph20180262
142. Ofakunrin AOD, Obayomi JJ, Toma BO, Diala UM, Abok II, Okolo SN. Risk factors for overweight and obesity among school-age children in Jos, Nigeria. *Int J Heal Sci Res.* 2018;8(7):5.
143. Ardiç C, Omar E. Obesity frequency and related risk factors in primary school children. *Eur Res J.* 2018;2018:1.
144. El Kabbaoui M, Chda A, Bousfiha A, Aarab L, Bencheikh R, Tazi A. Prevalence of and risk factors for overweight and obesity among adolescents in Morocco. *East Mediterr Heal J.* 2018;24(6). doi:10.26719/2018.24.6.512
145. Chew WF, Yap SF, Yasmin AM, Choo KB, Low GKK, Boo NY. Risk factors associated with abdominal obesity in suburban adolescents from a Malaysian district. *Singapore Med J.* 2018;59(2):104–111. doi:10.11622/smedj.2017013
146. Ahmad A, Zulaili N, Shahril MR, Syed Abdullah EFH, Ahmed A. Association between socioeconomic status and obesity among 12-year-old Malaysian adolescents. *PLoS One.* 2018;13(7):e0200577. doi:10.1371/journal.pone.0200577
147. Johnson KA, Showell NN, Flessa S, et al. Do neighborhoods matter? A systematic review of modifiable risk factors for obesity among low socio-economic status Black and Hispanic children. *Childhood Obesity.* 2019;15:71–86. doi:10.1089/chi.2018.0044
148. Karki A, Shrestha A, Subedi N. Prevalence and associated factors of childhood overweight/obesity among primary school children in urban Nepal. *BMC Public Health.* 2019;19(1). doi:10.1186/s12889-019-7406-9
149. Top FU, Kaya B, Tepe B, Cam HH. Prevalence of obesity and related risk factors among secondary school adolescents. *Int J Caring Sci.* 2019;12(2):5.
150. Santos C, Bustamante A, Hedeker D, et al. Correlates of overweight in children and adolescents living at different altitudes: the Peruvian health and optimism growth study. *J Obes.* 2019;2019:1–11. doi:10.1155/2019/2631713
151. Pham TTP, Matsushita Y, Dinh LTK, et al. Prevalence and associated factors of overweight and obesity among schoolchildren in Hanoi, Vietnam. *BMC Public Health.* 2019;19(1). doi:10.1186/s12889-019-7823-9
152. Oyewande A, Ademola A, Okunye T, Sanni F, Hassan A, Olaiya P. Knowledge, attitude and perception regarding risk factors of overweight and obesity among secondary school students in Ikeja local government area, Nigeria. *J Fam Med Prim Care.* 2019;8(4):1.
153. Al-Domi HA, Faqih A, Jaradat Z, Al-Dalaeen A, Jaradat S, Amarnah B. Physical activity, sedentary behaviors and dietary patterns as risk factors of obesity among Jordanian schoolchildren. *Diabetes Metab Syndr Clin Res Rev.* 2019;13(1):189–194. doi:10.1016/j.dsx.2018.08.033
154. Al-Lahham S, Jaradat N, Altamimi M, et al. Prevalence of underweight, overweight and obesity among Palestinian school-age children and the associated risk factors: a cross sectional study. *BMC Pediatr.* 2019;19(1). doi:10.1186/s12887-019-1842-7
155. Badrasawi M, Abu Snouber L, Al-Tamimi M, Badrasawi K. Prevalence, risk factors and psychosocial status of obese and overweight adolescents in Hebron City, Palestine. *Int J Nutr Pharmacol Neurol Dis.* 2019;9:2. doi:10.4103/ijnpnd.ijnpnd_2_19
156. Paduano S, Borsari L, Salvia C, et al. Risk factors for overweight and obesity in children attending the first year of primary schools in Modena, Italy. *J Community Health.* 2020;45(2):301–309. doi:10.1007/s10900-019-00741-7
157. Liberali R, Kupek E, Assis MAA. Dietary patterns and childhood obesity risk: a systematic review. *Child Obes.* 2020;16(2):70–85. doi:10.1089/chi.2019.0059
158. Danquah FI, Ansu-Mensah M, Bawontuo V, et al. Risk factors and morbidities associated with childhood obesity in sub-Saharan Africa: a systematic scoping review. *BMC Nutrition.* 2020;6. doi:10.1186/s40795-020-00364-5
159. Abdulkareem AR, Sharif SI, Bankessli FG, Kamal SA, Kulhasan NM, Hamrouni AM. Obesity and its associated risk factors among school-aged children in Sharjah, UAE. *PLoS One.* 2020;15(6):e0234244. doi:10.1371/journal.pone.0234244
160. Al-Delaimy AK, Al-Taha MA, Al-Samarraie MAM. Prevalence and predicting risk factors of overweight and obesity among primary school pupils in Ramadi, Iraq. *Malaysian J Public Heal Med.* 2020;20(3). doi:10.37268/mjphm/vol.20/no.3/art.544
161. Al-Ani RK, Al-Hadeethi RQ, Al-Ani SK. The prevalence of overweight and obesity among primary school children in Ramadi City, West of Iraq. *Int Med J.* 2020;27(4). doi:10.37268/mjphm/vol.20/no.3/art.544
162. Aljassim H, Jradi H. Childhood overweight and obesity among the Saudi population: a case-control study among school children. *J Heal Popul Nutr.* 2021;40(1). doi:10.1186/s41043-021-00242-1
163. Alam MM, Hawlader MDH, Wahab A, et al. Determinants of overweight and obesity among urban school-going children and adolescents: a case-control study in Bangladesh. *Int J Adolesc Med Health.* 2021;33(1). doi:10.1515/ijamh-2018-0034
164. Agustina R, Meilianawati F, Atmarita S, et al. Psychosocial, eating behavior, and lifestyle factors influencing overweight and obesity in adolescents. *Food Nutr Bull.* 2021;42(1_suppl):S72–S91. doi:10.1177/0379572121992750
165. Hussein HM, Ali AA, Alrawaili SM, Ahmed AA, Kamel EM. Prevalence and risk factors of obesity among school-age female children in Ha'il, Saudi Arabia. *Med Sci.* 2021;25(107):7–15.

166. Nasreddine L, Naja F, Akl C, et al. Dietary, lifestyle and socio-economic correlates of overweight, obesity and central adiposity in Lebanese children and adolescents. *Nutrients*. 2014;6(3):1038–1062. doi:10.3390/nu6031038
167. Canhada SL, Luft VC, Giatti L, et al. Ultra-processed foods, incident overweight and obesity, and longitudinal changes in weight and waist circumference: the Brazilian longitudinal study of adult health (ELSA-Brasil). *Public Health Nutr*. 2020;23(6):1076–1086. doi:10.1017/s1368980019002854
168. Blüher M. Obesity: global epidemiology and pathogenesis. *Nat Rev Endocrinol*. 2019;15:288–298. doi:10.1038/s41574-019-0176-8
169. Kitching K, Fernández E, Horgan D. Sweets are ‘my best friend’: belonging, bargains and body-shaming in working class girls’ food and health relationships. *Child Geogr*. 2021. doi:10.1080/14733285.2021.1937522
170. Berenbaum F, Wallace IJ, Lieberman DE, Felson DT. Modern-day environmental factors in the pathogenesis of osteoarthritis. *Nat Rev Rheumatol*. 2018;14:674–681. doi:10.1038/s41584-018-0073-x
171. Šarkauskienė A, Dromantienė L, Paškauskė Ž. The correlation between the physical activity and health of older adults: case of Lithuania. In: Liječnički vjesnik: glasilo Hrvatskog liječničkog zbora: Better future of healthy ageing 2020: conference proceedings; 2020:94–95.
172. Juma K, Juma A, Shumba P, Otieno P, Asiki G. Non-communicable diseases and urbanization in African cities: a narrative review. *Public Health Dev Count*. 2020. doi:10.5772/intechopen.89507
173. Taylor EA, Foster JS, Mobley AR. A qualitative investigation of body weight and weight loss-related attitudes of mothers and fathers in the context of food insecurity. *Eat Weight Disord*. 2020;25(6):1663–1669. doi:10.1007/s40519-019-00804-7
174. Caso G, Vecchio R. Factors influencing independent older adults (un) healthy food choices: a systematic review and research agenda. *Food Res Int*. 2022;158:111476. doi:10.1016/j.foodres.2022.111476
175. Orsso CE, Colin-Ramirez E, Field CJ, Madsen KL, Prado CM, Haqq AM. Adipose tissue development and expansion from the womb to adolescence: an overview. *Nutrients*. 2020;12:2735. doi:10.3390/nu12092735
176. Larqué E, Labayen I, Flodmark CE, et al. From conception to infancy — early risk factors for childhood obesity. *Nat Rev Endocrinol*. 2019;15:456–478. doi:10.1038/s41574-019-0219-1
177. Ong K, Loos R. Rapid infancy weight gain and subsequent obesity: systematic reviews and hopeful suggestions. *Acta Paediatr*. 2006;95:904–908. doi:10.1080/08035250600719754
178. Marseglia L, Manti S, D’Angelo G, et al. Obesity and breastfeeding: the strength of association. *Women Birth*. 2015;28:81–86. doi:10.1016/j.wombi.2014.12.007
179. Rito AI, Buoncristiano M, Spinelli A, et al. Association between characteristics at birth, breastfeeding and obesity in 22 countries: the WHO European childhood obesity surveillance initiative - COSI 2015/2017. *Obes Facts*. 2019;12(2):226–243. doi:10.1159/000500425
180. Wilkie HJ, Standage M, Gillison FB, Cumming SP, Katzmarzyk PT. Multiple lifestyle behaviours and overweight and obesity among children aged 9–11 years: results from the UK site of the international study of childhood obesity, lifestyle and the environment. *BMJ Open*. 2016;6(2):e010677. doi:10.1136/bmjopen-2015-010677
181. Pineros-Leano M, Grafft N, Aguayo L. Childhood obesity risk factors by race and ethnicity. *Obesity*. 2022;30(8):1670–1680. doi:10.1002/oby.23500

Nutrition and Dietary Supplements

Dovepress

Publish your work in this journal

Nutrition and Dietary Supplements is an international, peer-reviewed, open access journal focusing on research into nutritional requirements in health and disease, impact on metabolism and the identification and optimal use of dietary strategies and supplements necessary for normal growth and development. The journal welcomes submitted papers covering original research, basic science, clinical & epidemiological studies, reviews and evaluations, guidelines, expert opinion and commentary, case reports and extended reports. The manuscript management system is completely online and includes a very quick and fair peer-review system, which is all easy to use. Visit <http://www.dovepress.com/testimonials.php> to read real quotes from published authors.

Submit your manuscript here: <https://www.dovepress.com/nutrition-and-dietary-supplements-journal>