

Incidence of Obesity and Overweight in Adolescents

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1. Abstract

1.1. Introduction: The adverse effects of obesity and overweight in adolescence are vast and cover a wide range of physical and mental health problems. Overweight adolescents are at increased risk of developing chronic conditions such as type 2 diabetes, hypertension, cardiovascular disease and musculoskeletal disorders, as well as facing psychosocial challenges such as stigma, low self-esteem and depression.

1.2. Objective: to contribute to a better understanding of the complexity of obesity and overweight in adolescence, as well as to help in the development of effective and comprehensive approaches to preventing and controlling these conditions, aiming to promote the health and well-being of adolescents.

1.3. Methods: This study constitutes a systematic review, classified as exploratory and descriptive. The preparation of the research was a bibliographical search in electronic databases on methods associated with RSL (Systematic Literature Review) and the applications of SMARTER (Simple Multi-Attribute Rating Technique using Exploiting Rankings).

1.4. Results: A comprehensive systematic search of the literature yielded 4125 articles referring to the incidence of obesity and overweight in adolescents, of which 22 articles were eligible to be included in this systematic review.

1.5. Conclusion: By prioritizing nutrition education, promoting regular physical activity and access to healthy foods, we can not only reduce the incidence of obesity and overweight among adolescents, but also improve their quality of life and overall well-being.

2. Introduction

The incidence of obesity and overweight among adolescents is an increasingly prevalent and worrying public health problem worldwide [6]. During recent decades, an alarming increase in the proportion of young people experiencing these conditions has been observed, raising serious concerns about the consequences for the health and well-being of this growing population [21]. This complex phenomenon is the result of a varied interaction between genetic, behavioral, social, economic and environmental factors, which converge to influence eating patterns, physical activity levels and lifestyles of adolescents [19].

Adolescence is a critical period of development characterized by significant biological, psychological and social changes that can have a lasting impact on health and body weight throughout life [7, 13]. During this phase, teens face unique challenges, such as the transition to independence in food choices and social pressure to fit into idealized beauty standards, which can contribute to unhealthy eating behaviors and a decrease in physical activity [17].

During adolescence, young people experience rapid physical and hormonal growth, which can directly influence body weight. Some hormonal changes can affect metabolism, appetite and fat distribution in the body, contributing to weight gain [14,16]. Furthermore, genetic factors play an important role in susceptibility to overweight and obesity, and these factors often manifest during adolescence [22].

The environment in which adolescents live plays a crucial role in their health and weight [15]. Socioeconomic factors, such as access to healthy foods and food security, can influence adolescents'

food choices [4]. Furthermore, the availability of high-calorie foods rich in fat and sugar, combined with adverse advertising of unhealthy food products, can lead to harmful food choices during adolescence [1].

A sedentary lifestyle is another significant contributing factor to overweight and obesity in adolescence [3, 9]. With the increase in time dedicated to sedentary activities, such as watching television, using computers and playing video games, many adolescents are unable to meet physical activity recommendations, which can lead to the accumulation of body fat [11].

The adverse effects of obesity and overweight in adolescence are vast and cover a wide range of physical, mental and social health problems [2, 5]. They often face stigmatization and discrimination, which can lead to problems with self-esteem, social isolation and even depression [8, 18].

Obesity in adolescence is also associated with a greater risk of persistence into adulthood, increasing the likelihood of developing obesity and its complications throughout life. They have an increased risk of developing chronic conditions such as type 2 diabetes, hypertension, cardiovascular diseases and musculoskeletal disorders [10, 12].

Therefore, effective prevention and management of obesity and overweight during adolescence are crucial to reduce the negative impact on individual and collective health, as well as to reduce the social and economic costs associated with these conditions [20].

Faced with this challenging scenario, it is essential that integrated and comprehensive approaches are adopted, involving interventions at multiple levels, including public policies, school programs, community initiatives and family support. By directing efforts to promote healthy eating habits, encourage regular physical activity and create environments conducive to the well-being of adolescents, we can work towards a future where obesity and overweight in adolescence are less prevalent and their adverse consequences are mitigated.

Considering the above, the objective of this review is to improve understanding of the complexity of obesity and overweight in adolescence, in addition to contributing to the development of comprehensive and effective approaches to prevent and control these conditions, aiming to promote the health and well-being of adolescents.

3. Methods

This study constitutes a systematic review, classified as exploratory and descriptive. The preparation of the research was a bibliographical search in electronic databases on methods associated with RSL (Systematic Literature Review) and the applications of

SMARTER (Simple Multi-Attribute Rating Technique using Exploiting Rankings). The work carried out is of a qualitative and quantitative nature. Qualitative data analysis was carried out intuitively and inductively during the survey of the theoretical framework. It is also quantitative through the use of the multi-criteria method. In addition, there is also a numerical experimental study in order to simulate an article selection situation based on the observed criteria.

The bibliographical research was carried out in the following databases: Web of Science; Science Direct; Wiley; Springer Link; Taylor and Francis; PubMed and EBSCO. In addition, searches were carried out using bibliographical references of studies that relevantly addressed the topic on the Google Scholar search platform.

The search in the databases was carried out using the terminologies registered in the Health Sciences Descriptors created by the Virtual Health Library developed from the Medical Subject Headings of the US National Library of Medicine, which allows the use of common terminology in Portuguese, English and Spanish. The present study sought to investigate the literature on the incidence of obesity and overweight in adolescents. To this end, the descriptors “incidence”, “obesity”, “overweight” and “adolescents” were used, initially in English, and in a complementary way in Spanish and Portuguese.

As a tool to support decision-making in the selection and prioritization of articles, a set of criteria were considered essential to represent the state of the art of the topic under study. This method has the following characteristics: (i) rigorous logic allows the method to be accepted as a decision support tool; (ii) simple to understand and apply with easy-to-interpret results.

References from selected works were also searched for other documents of potential interest. Once qualified for full text in the evaluation, articles were included in the qualitative review if they met the following inclusion criteria: a) they contained data on the incidence of overweight in adolescents; b) contained data on the incidence of obesity in adolescents. Articles were excluded if they were reports, banners or conference abstracts. There was no review of confidential health information and the study was non-interventional. Therefore, ethics committee approval was not necessary. In the end, the result obtained totaled 22 articles that covered the desired characteristics for the study.

Three independent researchers extracted data from articles that met the inclusion criteria and recorded them in a “Data Extraction Form” generated in Microsoft Excel on the incidence of overweight and obesity in adolescents. From this form, the authors and year of publication, objective, type of study (design), study title, sample size (n) and conclusion of the studies were included, which will be demonstrated in the results through Table 1.

Table 1: Selected studies and their main findings

| AUTHORS/YEAR | OBJECTIVE | TITLE OF THE STUDY | CONCLUSION |
|----------------------------------|---|--|---|
| BERNARD (2022) | Investigate the implications for school life, eating habits and human health of basic education students caused by the consumption of food and/or psychoactive substances, considering their sociocultural environment | Substances that interfere with eating habits and human health: sociocultural senses and meanings in the school context | The authors defend the inclusion of emancipatory actions in the school curriculum, considering the complexity of eating behaviors. We propose an integration between health and education, addressing social, socio-anthropological and socio-cultural aspects of food and nutrition. |
| CARPENA LUCAS et al. (2022) | Identify potentially modifiable risk factors for developing excess weight and determine the importance of developing certain habits to prevent childhood overweight and obesity | Influence of Lifestyle Habits in the Development of Obesity during Adolescence | The responsible and controlled adoption of electronic devices, together with participation in physical activities outside school hours, emerge as economically viable and effective strategies for obesity prevention programs |
| DALY; O'SULLIVAN; KEARNEY (2022) | Summarize common barriers and motivations for choosing healthy foods among adolescents, with a specific focus on the Irish context where available | Considerations for health and food choices in adolescents | When designing interventions for adolescents, it is crucial to consider their nutritional needs, health and body image concerns, as well as barriers and motivations for healthy eating habits. |
| FÖRSTER et al. (2023) | To examine the relationship between body mass index (BMI) and health-related quality of life (HRQoL), somatoform complaints, and behavioral problems in children and adolescents | Mental health in children and adolescents with overweight or obesity | The results highlight the importance of mental difficulties in children and adolescents with high BMI, highlighting the need for psychological interventions in the treatment of obesity. |
| JEBEILE et al. (2022) | Describes current knowledge about the epidemiology and causes of childhood and adolescent obesity, considerations for assessment, and current management approaches | Obesity in children and adolescents: epidemiology, causes, assessment, and management | Additional research is needed to guide the personalization of obesity treatment approaches in children and adolescents and their implementation into clinical practice. |
| JOSHI et al. (2023) | Explore its profound impact on health | Variability in Health Impact: Examining Lifestyle and Dietary Habits Across Different Stages of Adolescence: A Comprehensive Literature Review | Understanding the challenges faced during adolescence is essential for long-term well-being. Effective educational interventions can help adolescents make healthier choices, reducing the negative impacts of suboptimal habits on immediate and future health. |
| LANGFORD et al. (2022) | Addresses evidence gaps | Links between obesity, weight stigma and learning in adolescence: a qualitative study | It is urgent to implement measures to reduce weight-related stigma, both in schools and in society in general. This can help address educational disparities, which in turn can affect health across the lifespan. |
| LIU et al. (2022) | Analyze the eating behavior and physical activity of children and adolescents with different nutritional status and the relationship between them | Compared with dietary behavior and physical activity risk, sedentary behavior risk is an important factor in overweight and obesity: evidence from a study of children and adolescents aged 13–18 years in Xinjiang, China | In Xinjiang, China, detection of underweight is more common among children and adolescents aged 13 to 18, while detection of overweight and obesity is lower compared to the rest of the country |
| LOPEZ-JIMENEZ et al. (2022) | Improve understanding of the direct and indirect links between overweight/obesity and CVD, the main controversies in this area and the evidence related to cardiometabolic outcomes with available weight control options | Obesity and cardiovascular disease: mechanistic insights and management strategies. A joint position paper by the World Heart Federation and World Obesity Federation | An action plan for doctors offers guidelines for identifying and dealing with the risks of cardiovascular diseases associated with obesity, taking into account the different realities and resources available in each country |

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| MATEO-ORCAJADA; VAQUERO-CRISTÓBAL; ABENZA-CANO (2024) | Determine changes in physical activity (PA) level, kin anthropometric and derived variables, and physical fitness in adolescents as a result of an after-school intervention with step tracker mobile applications promoted in the field | Importance of training volume through the use of step trackers apps promoted from the subject of physical education to change body composition, physical fitness and physical activity in adolescents and the influence of gender | An increase in training using mobile apps appears to be effective in increasing physical activity, muscle strength and reducing body fat. Gender does not affect changes within groups, but it influences differences between them. |
| MOHAJAN; MOHAJAN (2023) | Discuss aspects of obesity, such as causes and prevention of obesity | Obesity and Its Related Diseases: A New Escalating Alarming in Global Health | Obesity can be prevented, avoided and treated. Prevention is the most effective strategy, but appropriate treatment is necessary for those already affected by the condition. |
| MOORE HESLIN; MCNULTY (2023) | To summarize the main nutritional and dietary characteristics of adolescents, provide an overview of the causes and consequences of poor nutrition in adolescence and highlight potential intervention opportunities to protect the health of this age group, with a particular focus on evidence from an Irish context | Adolescent nutrition and health: characteristics, risk factors and opportunities of an overlooked life stage | Teenagers are susceptible to the influence of the environment and society, which can impact their behavior toward healthier habits |
| MOUSIKOU; KYRIAKOU; SKORDIS (2023) | Describe the neuroendocrinology of the stress response, the factors that influence growth, and the impact of chronic stress on growth during critical periods of infancy, childhood, and puberty, with particular reference to growth, the thyroid, and the gonadal axis. | Stress and Growth in Children and Adolescents | Current models of chronic stress indicate that childhood adversity can influence growth and have lasting effects on well-being throughout life. |
| NEUFELD et al. (2022) | Elevate the importance given to adolescents' dietary intake and food choices, bringing a developmental perspective to inform policies and programmatic actions to improve diets | Food choice in transition: adolescent autonomy, agency, and the food environment | It is important to consider adolescents' shared values when trying to improve food environments and promote healthy food choices. These efforts must go beyond nutrition and health concerns to incorporate broader aspects of adolescents' social and cultural context. |
| WHO (2022) | Highlight the importance of including obesity prevention and control in measures to build back better after the COVID-19 pandemic | WHO European regional obesity report 2022 | Tackling obesity is essential to achieving the Sustainable Development Goals and is a priority highlighted in the European Program of Work 2020–2025: <u>United Action for Better Health.</u> |
| SHALITIN; GAT-YABLONSKI (2022) | Focus on the interactions of obesity with linear growth and pubertal processes, based on basic research and clinical data in humans. | Associations of Obesity with Linear Growth and Puberty | Nutritional factors, epigenetics, and endocrine-disrupting chemicals are potential mediators connecting the onset of <u>puberty with obesity.</u> |
| SHAMS; SHAFIEI; SADREMOMTAZ (2024) | Explore the social and environmental factors that impact adolescents' motivation for weight control in Gilan Province, Iran | The social and environmental factors impacting the motivation of adolescents for weight control, why and how? A qualitative study | It appears necessary to adopt integrated multisectoral approaches to address obesity among adolescents. We recommend that health policymakers develop practical policies by focusing on the factors mentioned in this study |
| CABRAL; SOARES; WOULD MAKE (2023) | Report what is already known about obesity in childhood and adolescence, specifically what has been investigated in the age group of 5 to 18 years | Obesity in Childhood and Adolescence: A Review | It is extremely important to expand research on obesity in childhood and adolescence, allowing early monitoring of this problem and reducing its impact <u>on medium and long-term consequences.</u> |
| TANAS et al. (2022) | Raise awareness about weight stigma and its negative effects on children and adolescents and emphasize the importance for pediatricians to be adequately trained to address this challenge in their practice | Addressing Weight Stigma and Weight-Based Discrimination in Children: Preparing Pediatricians to Meet the Challenge | Pediatric healthcare professionals play a vital role in combating weight stigma in children and adolescents by promoting awareness of its discriminatory nature and the limits of its stereotypes in promoting healthy behaviors and reducing obesity. |

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|----------------------|---|--|--|
| TONG et al. (2022) | Investigate the spatial patterns of factors that influence low physical fitness among adolescents | Multiscale Impact of Environmental and Socio-Economic Factors on Low Physical Fitness among Chinese Adolescents and Regionalized Coping Strategies | The study suggests that each region develop personalized strategies to address adolescents' low physical fitness, including promoting physical activity in natural environments and modernizing industrial structures in specific areas, while closely monitoring rapid urbanization in other regions. |
| TULLY et al. (2022) | Narratively review clinical practice guidelines published in English for the treatment of childhood and adolescent obesity to identify the highest quality guidelines and assess similarities, conflicts, and gaps in recommendations | Guidelines for treating child and adolescent obesity: A systematic review | There is currently a paucity of evidence to evaluate the use of pharmaceutical and surgical interventions in children, resulting in a lack of recommendations for these types of treatment. |
| WÓJCIK et al. (2023) | Provide an up-to-date review of research on external factors – related to the patient's environment | Psychosocial and environmental risk factors of obesity and hypertension in children and adolescents a literature overview | Obesity is a multifactorial condition, influenced by the interaction between genetic, physiological, behavioral, psychosocial and environmental factors over time, since conception. These factors contribute to impaired energy regulation throughout life |

Source: Authors (2024)

4. Results

A comprehensive systematic search of the literature yielded 4125 articles referring to the incidence of overweight and obesity in adolescents. Of these, 783 studies were excluded due to data overlap. From this, the SMARTER method (Simple Multi-Attribute Rating Technique using Exploiting Rankings) was chosen and 449

articles were selected that were suitable for full-text screening, of which 135 articles were included for data extraction, of which 113 were excluded by the exclusion criteria, making 22 articles eligible and included for systematic review. In Figure 1, we describe the strategy for selecting articles on the topic in question.

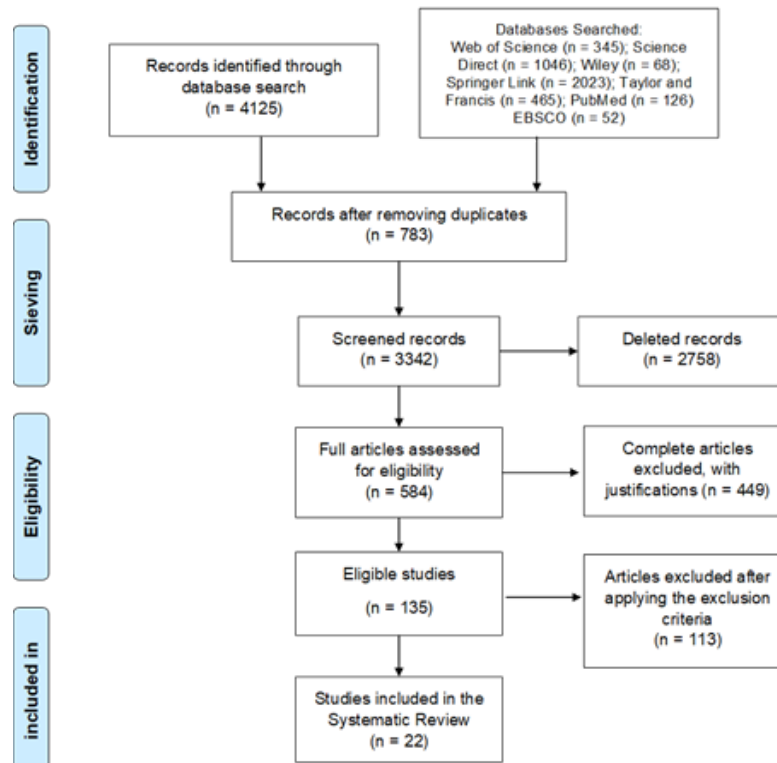


Figure 1: Article search strategy

Source: Authors (2024)

5. Discussion

Obesity is a multifactorial condition, influenced by a complex interaction of several factors throughout life, from conception to adulthood. These factors include genetic predisposition, eating habits, physical activity levels, psychosocial and environmental factors. Understanding the factors that influence health-related behaviors, such as diet and physical activity, is critical due to their significant impact on global morbidity and mortality. Changes in these behaviors can have substantial effects on health [17].

Early childhood adversity, whether emotional or physical, is linked to long-term negative effects on physical and mental health. Chronic stress resulting from these adversities can affect growth and well-being throughout life. There is a global increase in the prevalence of obesity in children and adolescents, which can lead to several comorbidities and impact physical and psychological development, including accelerated linear growth and the risk of precocious puberty [14, 16].

Obesity is now recognized as a chronic, multifactorial, and treatable neurobehavioral disease characterized by adipose tissue dysfunction and adverse consequences for metabolic, biomechanical, and psychosocial health. It is one of the main causes of increased cardiovascular risk in young adults. Obesity-related hypertension is prevalent among adolescents, highlighting the significant impacts of obesity on cardiovascular health [22].

The study “Substances that interfere with eating habits and human health: sociocultural senses and meanings in the school context” highlights the influence of the school environment on the formation of adolescents’ eating habits, highlighting the importance of considering sociocultural aspects in health promotion [1].

The need for comprehensive educational programs on nutrition, involving schools, parents and health professionals, is highlighted in light of inadequate eating habits and decreased physical activity among adolescents. Such programs, by emphasizing critical thinking and emotional intelligence, empower teens to make informed choices about lifestyle and diet. The deterioration in diet quality during adolescence is influenced by several individual, social and environmental factors, whose influences increase as adolescents become more independent. This poor nutrition can have immediate and long-term health consequences, such as micronutrient deficiencies and increased risk of overweight, obesity and cardiometabolic risk factors, problems that persist among adolescents, both in Ireland and internationally [7, 13].

Diet during adolescence is fundamental to a healthy life, although eating patterns and influencing factors vary among adolescents. More evidence is needed to better understand adolescents’ dietary issues and their food choices in order to promote more effective actions. Although concerned about their health, teenagers often relate this to their body image, which can influence their food choices. Factors such as taste, price, and convenience play a significant

role in adolescents’ food choices, while social influence and social norms become more prominent as they gain independence and interact more with their peers [4,15].

Controlling modifiable risk factors is crucial in the prevention and treatment of excess weight, with genetics being responsible for a small portion of childhood obesity. Environmental and behavioral factors play a significant role in weight. Recent social and cultural changes have amplified the factors involved in obesity, including the increased consumption of ultra-processed foods and the decreased intake of healthy foods. The increasing use of information and communication technologies is associated with a reduction in physical activity among adolescents, contributing to a positive energy balance and associated health problems, such as increased body fat percentage and worse cardiorespiratory performance [3, 11].

Adolescent physical fitness is declining globally, with a decrease in aerobic capacity and an increase in body mass index. Studies reveal high rates of below-normal muscular fitness in Czech children and less than half of North American teenagers have healthy levels of physical fitness [19].

Before the COVID-19 pandemic, obesity in children and adolescents had stabilized in many rich countries, although severe obesity continued to rise. On the other hand, in low- and middle-income countries, the prevalence of obesity was on the rise. With the advent of the pandemic, there was an increase in weight gain among children and adolescents in several regions [6].

Obesity is the main risk factor for disability, contributing to 7% of years lived with disability, and is associated with greater morbidity and mortality from COVID-19. Initial studies from several countries in the Region show an increase in the prevalence of overweight and obesity, as well as in the average body mass index in children and adolescents during the COVID-19 pandemic [21].

In short, obesity during adolescence requires a multidisciplinary approach that takes into account sociocultural, behavioral, nutritional and mental health factors. Effective interventions must be aimed not only at modifying eating and lifestyle habits, but also at promoting a school and social environment that supports healthy choices and the well-being of adolescents.

6. Final Considerations

The incidence of obesity and overweight in adolescents represents a significant public health challenge that requires urgent attention and coordinated action at multiple levels. Analysis of the determining factors and consequences of these conditions reveals the complexity of the problem, highlighting the need for integrated and comprehensive approaches to prevention and intervention.

It is essential to recognize that adolescence is a crucial period of development in which eating behavior and physical activity patterns can be established and have lasting impacts on health throughout life. Therefore, investing in strategies that promote healthy habits

from a young age is essential to reduce the risks associated with obesity and overweight.

Furthermore, the implementation of effective public policies, the creation of environments favorable to well-being and the strengthening of family and community support are essential elements to face this challenge in a broad and sustainable way.

By prioritizing nutrition education, promoting regular physical activity and access to healthy foods, we can not only reduce the incidence of obesity and overweight among adolescents, but also improve their quality of life and overall well-being.

By working together to tackle this public health issue, we can build a future where teens grow up healthy, happy and empowered to reach their full potential.

References

- Bernard A. Substances that interfere with eating habits and human health: sociocultural senses and meanings in the school context. [sl] Federal University of Rio Grande do Sul. 2022.
- Cabral S, Soares L, Faria AL. Obesity in Childhood and Adolescence: A Review. *Biomedical Journal of Scientific & Technical Research*. 2023; 51(3): 7.
- Lucas PJC, Sánchez-Cubo F, Vargas MV, Jiménez JM. Influence of Lifestyle Habits in the Development of Obesity during Adolescence. *International Journal of Environmental Research and Public Health*. 2022; 19(7): 4124.
- Daly AN, O'sullivan EJ, Kearney JM. Considerations for health and food choices in adolescents. *Proceedings of the Nutrition Society*. 2022; 81: 75-86.
- Förster LJ, Vogel M, Stein R, Hilbert A, Breinker JL, Böttcher M, et al. Mental health in children and adolescents with overweight or obesity. *BMC Public Health*. 2023; 23: 135.
- Jebeile H, Kelly AS, O'malley G, Baur LA. Obesity in children and adolescents: epidemiology, causes, assessment, and management. *The Lancet Diabetes & Endocrinology*. 2022; 10: 351-65.
- Joshi S, Mardik S, Verma P, Rajagopalan H, Siddiqui MH, Lachyan A. Variability in Health Impact: Examining Lifestyle and Dietary Habits Across Different Stages of Adolescence: A Comprehensive Literature Review. *European Journal of Nutrition & Food Safety*. 2023; 15(11): 41-7.
- Langford R, Davies A, Howe L, Cabral C. Links between obesity, weight stigma and learning in adolescence: a qualitative study. *BMC Public Health*. 2022; 22: 109.
- Liu H, Bi C, Lin H, Ma W, Zhang J, Hu YY, et al. Compared with dietary behavior and physical activity risk, sedentary behavior risk is an important factor in overweight and obesity: evidence from a study of children and adolescents aged 13–18 years in Xinjiang, China. *BMC Pediatrics*. 2022; 22: 582.
- Lopez-Jimenez F, Almahmeed W, Bays H, Cuevas A, Di Angelantonio E, Le Roux CW, et al. Obesity and cardiovascular disease: mechanistic insights and management strategies. A joint position paper by the World Heart Federation and World Obesity Federation. *European Journal of Preventive Cardiology*. 2022; 29(17): 2218-37.
- Mateo-Orcajada A, Vaquero-Cristóbal R, Abenza-Cano L. Importance of training volume through the use of step trackers apps promoted from the subject of physical education to change body composition, physical fitness and physical activity in adolescents and the influence of gender. *Physiology & Behavior*. 2024; 273: 114402.
- Mohajan D, Mohajan HK. Obesity and Its Related Diseases: A New Escalating Alarming in Global Health. *Journal of Innovations in Medical Research*. 2023; 2(3): 12-23.
- Moore Heslin A, McNulty B. Adolescent nutrition and health: characteristics, risk factors and opportunities of an overlooked life stage. *Proceedings of the Nutrition Society*. 2023; 82(2): 142-56.
- Mousikou M, Kyriakou A, Skordis N. Stress and Growth in Children and Adolescents. *Hormone Research in Pediatrics*. 2023; 96: 25-33.
- Neufeld LM, Andrade EB, Suleiman AB, Barker M, Beal T, Blum LS, et al. Food choice in transition: adolescent autonomy, agency, and the food environment. *The Lancet*. 2022; 399: 10320: 185-97.
- Shalitin S, Gat-Yablonski G. Associations of Obesity with Linear Growth and Puberty. *Hormone Research in Pediatrics*. 2022; 95: 120-36.
- Shams L, Shafiei F, Sadremomtaz Z. The social and environmental factors impacting the motivation of adolescents for weight control, why and how? A qualitative study. *BMC Nutrition*. 2024; 10: 19.
- Tanas R, Gil B, Marsella M, Nowicka P, Pezzoli V, Phelan SM, et al. Addressing Weight Stigma and Weight-Based Discrimination in Children: Preparing Pediatricians to Meet the Challenge. *The Journal of Pediatrics*. 2022; 248: 135-6.
- Tong Z, Kong Z, Jia X, Zhang H, Zhang Y. Multiscale Impact of Environmental and Socio-Economic Factors on Low Physical Fitness among Chinese Adolescents and Regionalized Coping Strategies. *International Journal of Environmental Research and Public Health*. 2022; 19(20): 13504.
- Tully L, Arthurs N, Wyse C, Browne S, Case L, Mccrea L, et al. Guidelines for treating child and adolescent obesity: A systematic review. *Frontiers in Nutrition*. 2022; 9: 12.
- WHO. WHO European regional obesity report 2022. Copenhagen: World Health Organization. Regional Office for Europe. 2022.
- Wójcik M, Alvarez-Pitti J, Koziol-Kozakowska A, Brzeziński M, Gabbianelli R, Herceg-Čavrak V, et al. Psychosocial and environmental risk factors of obesity and hypertension in children and adolescents—a literature overview. *Frontiers in Cardiovascular Medicine*. 2023; 10: 20.