

A Bibliometric Analysis of Global Research Trends on Adolescent Obesity Interventions (2005-2025)

Andy Muharry^{1,4}, Haryono², Eko Farida³, Meita Tyas Nugrahaeni⁴

¹Public Health, Faculty of Medicine, Universitas Negeri Semarang, Central Java, Indonesia

²Faculty of Educational Sciences and Psychology, Universitas Negeri Semarang, Central Java, Indonesia

³Public Health, Faculty of Medicine, Universitas Negeri Semarang, Central Java, Indonesia

⁴Public Health, Health and Science Faculty, Universitas Siliwangi, Tasikmalaya, West Java, Indonesia

Abstract. The global rise in adolescent obesity presents a pressing public health concern, with long-term implications including metabolic disorders and psychosocial challenges. Despite the growing urgency for practical and evidence-based interventions, existing literature remains fragmented and lacks systematic synthesis. This study aims to provide a comprehensive bibliometric overview of research trends, thematic dynamics, and emerging hotspots in adolescent obesity interventions over the past two decades (2005-2025). Data were retrieved from the Scopus database and analyzed using Microsoft Excel, VOSviewer, and Harzing's Publish or Perish. A total of 661 publications met the inclusion criteria. The findings reveal a significant increase in research productivity, peaking between 2012 and 2019. The United States emerged as the most prolific contributor, with the highest volume of international collaborations. Eaton et al. were the most cited authors in 2012, while Kelishadi, R. was the most productive, contributing 14 publications. Keyword evolution analysis indicates a shift in focus: between 2015 and 2020, dominant themes included sugar-sweetened beverages, fruit and vegetable intake, and unhealthy diets, particularly in high-income countries. From 2020 to 2025, attention shifted toward social media, sedentary behavior, sex-based factors, and healthy lifestyle promotion. These findings underscore the evolving landscape of adolescent obesity research and the need for targeted, context-sensitive interventions.

Keywords. bibliometric analysis, adolescent obesity, Harzing's Publish or Perish, Scopus, Vosviewer

1 Introduction

The prevalence of adolescent obesity has risen to near-epidemic proportions in developed countries, emerging as a public health crisis in developing nations. [1] and is rapidly increasing worldwide, signaling a shift in the global health burden [2]. This phenomenon aligns with the epidemiological transition from the 19th to the 21st century, during which the public health burden shifted from infectious diseases to non-communicable diseases [3]. Obesity substantially contributes to the prevalence of the leading causes of global morbidity and mortality [4], and serves as a predisposing factor for various non-communicable diseases in adulthood, including cardiovascular disease, hypertension, and insulin resistance [1], type 2 diabetes mellitus, psychological disorders such as depression, and eating disorders [5], and even cancer [4]. Non-communicable diseases have become the dominant contributors to the global disease burden, accounting for 83% in 2020, primarily driven by modern lifestyles, particularly unhealthy dietary patterns [3].

Obesity is a pathological condition characterized by excessive accumulation of body fat that disrupts health and normal physiological functions [6]. Obesity is commonly assessed using Body Mass Index (BMI) as a simple indicator of excess body fat; however, this measure fails to capture fat distribution, despite abdominal fat accumulation being more strongly associated with health risks [7]. Behaviors such as dietary patterns, physical activity levels, and sedentary lifestyles contribute to an imbalance between energy intake and expenditure, making them key drivers of obesity [5]. In developing countries, the rising prevalence of obesity is influenced by socioeconomic development, lifestyle changes marked by reduced physical activity, unhealthy food consumption, and rapid epidemiological and demographic transitions [1], and social factors such as low parental or caregiver nutrition education, family environment, and school setting [8]. Adolescence, characterized by puberty and hormonal fluctuations, accelerates physical growth. When this phase is accompanied

by non-adherence to healthy lifestyle behaviors, the risk of overweight conditions emerging during adolescence significantly increases [2].

The rising prevalence of adolescent obesity in both developed and developing countries underscores the critical need for research into risk factors specific to this age group, which can be integrated into intervention strategies [2], programs, and policies aimed at health promotion and obesity prevention, both at the national level and through international collaboration [9]. Despite the growing volume of research, a comprehensive understanding of the research dynamics is still required, encompassing publication trends, patterns of global collaboration, citation rates, and the thematic focus and novelty of emerging studies. Such understanding is essential for mapping the evolution of knowledge and identifying research gaps that may inform more effective intervention innovations. Accordingly, this study aims to address four key questions: (1) What are the publication trends in adolescent obesity interventions? (2) Who are the leading contributors, and how do international collaborations unfold? (3) What are the patterns of scientific citation? Moreover, (4) What are the thematic focus and novelty of research related to adolescent obesity interventions?

2 Method and analysis

This study employs a bibliometric approach to quantitatively assess the literature, aiming to understand trends, patterns, and key contributors within a specific scientific domain. [10,11]. The PRISMA framework is applied to ensure a comprehensive and replicable article review process, thereby providing a clear and transparent overview of the research topic [12].

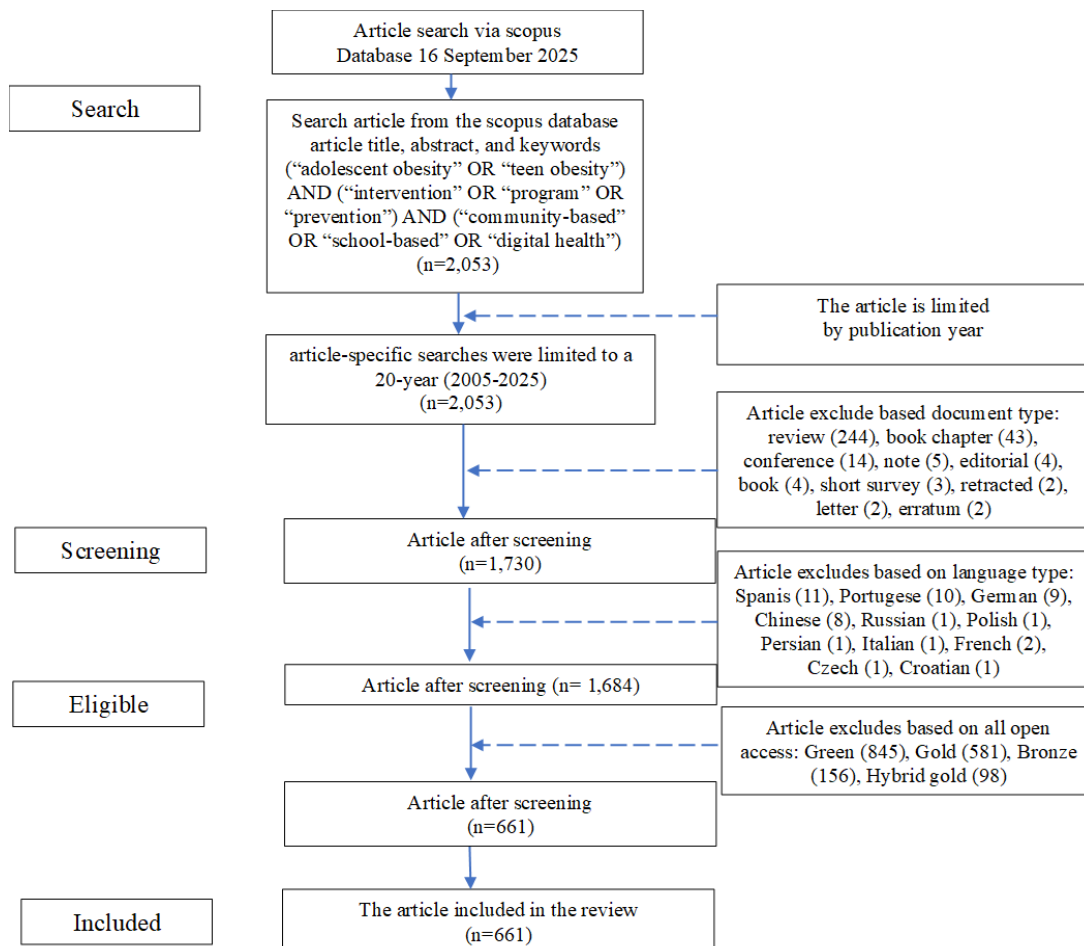


Figure 1. PRISMA Framework

The inclusion criteria for this study comprise articles published up to September 16, 2025, publications in English, and a thematic focus on adolescent obesity. Data were retrieved from the Scopus database based on a search conducted on September 16, 2025, using a combination of keywords “adolescent obesity” OR “teen obesity” AND “intervention” OR “program” OR “prevention” AND “community-based” OR “school-based” OR “digital health” applied to article titles, abstracts, and keyword lists across multiple disciplines, covering a 20-year publication period (2005–2025).

A total of 2,053 documents were initially identified. A screening process was conducted to eliminate irrelevant document types, including: reviews (244), book chapters (43), conference papers (14), notes (5), editorials (4), books (4), short surveys (3), retracted articles (2), letters (2), and errata (2). After this screening, 1,730 articles remained. Further filtering was applied based on the language of publication, excluding articles in Spanish (11), Portuguese (10), German (9), Chinese (8), Russian (1), Polish (1), Persian (1), Italian (1), French (2), Czech (1), and Croatian (1), resulting in a final total of 1,684 articles. The next screening step involved limiting the selection to open access types, including Green (845), Gold (581), Bronze (156), and Hybrid Gold (98). Analysis was performed using the “Analyze Search Results” feature on the Scopus website, focusing on metrics such as the number of documents by year, author, and country/territory. Subsequently, 661 search results were exported in RIS and CSV formats for further analysis. VOSviewer was employed to generate visualizations based on text and keywords, including international collaboration networks and keyword co-occurrence analysis to visualize research focus and novelty. Microsoft Excel and Harzing’s Publish or Perish were used to analyze citation trends.

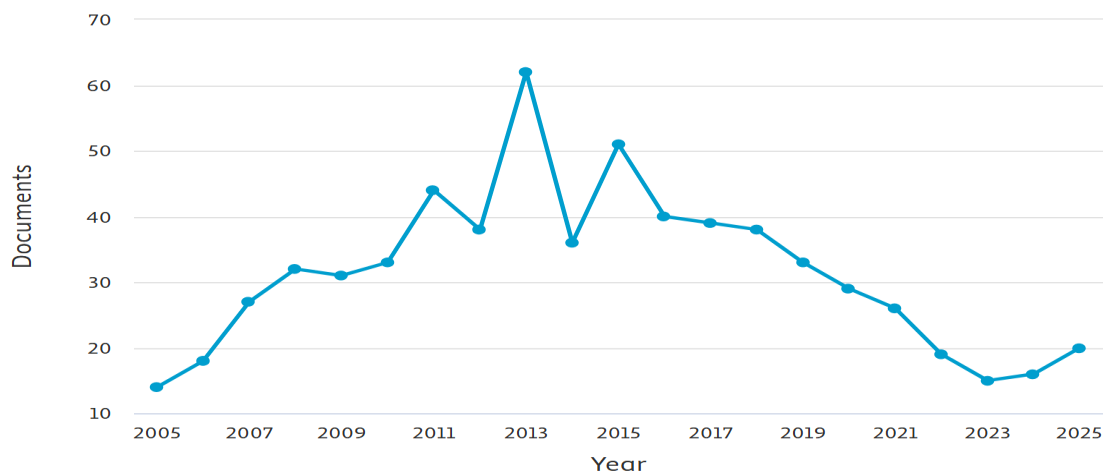
3 Results and Discussion

At this stage, a total of 661 articles were identified as relevant scientific publications that met the inclusion criteria for further analysis in addressing the three main research questions:

3.1 Publication Productivity Trends Over the Past 20 Years

Based on data retrieved from the Scopus database covering the period 2005–2025, a total of 661 articles related to adolescent obesity interventions were identified. Figure 1 illustrates that the publication trend is not evenly distributed but exhibits a distinct growth pattern that can be categorized into three main phases: the initial phase (2005–2011), the growth phase (2012–2019), and the stabilization phase (2020–2025). During the initial phase, research productivity was relatively low, with annual publication counts ranging between 14 and 44 documents. This phase marks the growing recognition of adolescent obesity as a key topic of interest within the global health research agenda. The second phase (2012–2019) represents a period of rapid and consistent growth in publication volume. The inflection point occurred around 2012, marking the beginning of a steep upward trajectory, which peaked in 2019—a year that signifies heightened research interest and increased resource allocation toward addressing adolescent obesity. This surge may have been driven by growing global concern over the prevalence of obesity and an improved understanding of its long-term consequences. The third phase, stabilization (2020–2025), follows the peak with slight fluctuations in publication output. A decline was observed in 2023, followed by a subsequent rebound in publication activity.

Documents by year



Source: Scopus database

Figure 1. Number of Publications on Adolescent Obesity Interventions

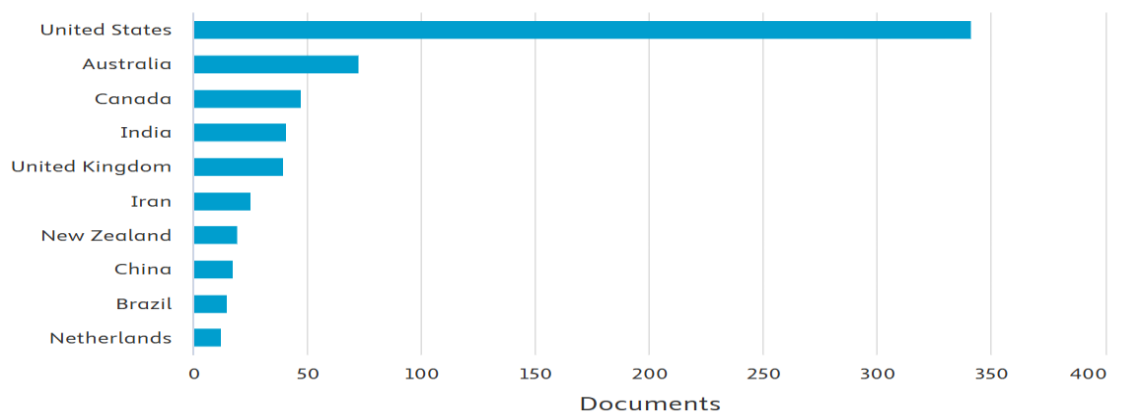
Overall, these findings address the research question by demonstrating that scholarly productivity in adolescent obesity interventions has experienced rapid and significant growth over the past two decades. This indicates that the field has evolved into a dynamic and continuously expanding area of research within global public health. In other words, the findings suggest that adolescent obesity interventions remain a vibrant research domain that continues to attract increasing scholarly attention.

3.2 Leading Country Contributors and International Collaboration

The country-level contribution analysis identifies the United States as the most dominant and productive nation, with a significantly higher number of publications, approaching 350 documents, compared to other countries. Australia and Canada rank second and third, with 76 and 47 publications, respectively, representing notable contributions despite being considerably lower than that of the United States.

Documents by country or territory

Compare the document counts for up to 15 countries/territories.



Source: Scopus database

Figure 2. Documents by Country or Territory

Several countries from other regions have also begun contributing to the field, including India, Iran, China, and Brazil, indicating that adolescent obesity is gaining global attention beyond high-income nations. Additionally, the United Kingdom and the Netherlands represent active European contributors to this research domain. These findings suggest that adolescent obesity is no longer perceived as an exclusive health issue of developed countries, but rather as a global concern that is increasingly acknowledged by developing nations. Although research participation from developing countries remains relatively low, efforts should be directed toward enhancing engagement and fostering collaboration between high-income and low- to middle-income countries in addressing adolescent obesity.

3.3 International Collaboration Network

The analysis of inter-country collaboration networks reveals patterns of cooperation and the influence of various nations in obesity research. Based on international collaboration mapping using VOSviewer, three major clusters were identified, reflecting not only regional collaboration patterns but also disparities in research productivity across countries. Furthermore, the size of the circles (nodes) within each cluster visually indicates the level of productivity of the respective countries in publishing research on adolescent obesity.



Source: Output VOSViewer Software

Figure 3. Network Country Visualization

Based on Figure 3, five countries exhibit relatively larger node sizes compared to others. The United States stands out as the country with the highest number of collaborations, partnering with 46 countries. Canada and the United Kingdom have collaborated with 41 countries, Australia with 42, India and China with 36 each, and New Zealand with 37. The Blue Cluster is dominated by the United States, Canada, and New Zealand, all of which display large nodes, indicating significant research productivity in adolescent obesity. Brazil and Japan, also part of this cluster, show medium-sized nodes, reflecting meaningful contributions. This cluster illustrates how countries engage in cross-regional collaboration within the field of study.

The Red Cluster is dominated by countries with relatively high research productivity, particularly China, which displays a large node, reflecting its role as a key contributor within this cluster. It is supported by countries from Asia (Hong Kong, Japan, China, and Thailand), Europe (Greece, the Netherlands, Portugal, Spain, and Sweden), Africa (Ghana, Nigeria, and South Africa), and the Americas (Brazil). This cluster highlights that several Asian countries have emerged as productive

epicenters in adolescent obesity research. The prominent node sizes of China and India affirm the seriousness with which both nations are addressing the public health burden of adolescent obesity.

The Green Cluster presents a different pattern, with Canada appearing as a medium-sized node that serves as a central hub of collaboration. This cluster also includes Bangladesh, Colombia, France, Mexico, Morocco, and Tunisia, which exhibit smaller nodes, indicating that collaboration within this group is driven more by specific research networks than by large-scale productivity. This combination reflects strategic partnerships between European countries and developing nations in Asia and Africa.

3.4 Leading Institutional Contributors

Based on the collaboration network analysis, research on adolescent obesity is dominated by three major clusters. The United States, Canada, and Australia serve as global hubs with the most extensive collaboration networks. The Asian cluster, led by China and India, demonstrates high productivity and strong commitment to addressing obesity-related challenges. Meanwhile, Canada also emerges as a strategic connector within a cluster that includes developing countries. This pattern affirms that adolescent obesity research has become a global endeavor, although it remains concentrated among a few high-income nations.

3.5 Citation Trend

The citation trend related to adolescent obesity intervention research from 2005 to 2025 is presented in Table 1.

Table 1. Citation Trend

Year	TP	TC	NCP	H	G
2025	20	7	4	2	2
2024	16	29	12	3	4
2023	15	56	13	5	6
2022	19	354	17	7	18
2021	27	222	24	8	14
2020	30	430	28	11	20
2019	33	540	32	16	22
2018	36	2357	34	12	36
2017	40	651	39	16	23
2016	39	780	29	19	26
2015	51	955	48	16	29
2014	36	2549	36	17	36
2013	62	2707	60	24	51
2012	38	3041	37	18	38
2011	44	1457	44	20	37
2010	33	2605	32	20	33
2009	30	1549	29	18	30
2008	32	2513	32	18	32
2007	27	1549	27	22	11
2006	17	1234	17	16	17
2005	14	1267	14	13	14

Note: TP: Total Publication; TC: Total Citation; NCP: Number Citation Paper;
H: h-index; G: g-index

Based on Table 1, the highest total number of citations (NCP) occurred in 2013. Although only 38 articles were published in 2012, the total citation count (TC) reached 3,041. Furthermore, both the h-index and g-index peaked in 2013, indicating that the articles published during that year had a substantial impact on research into adolescent obesity. These publications received a high volume of citations from other scholars, signifying their significant contribution to the advancement and understanding of the topic. Research conducted in 2017 also played an important role and exerted considerable influence in expanding knowledge and insight into adolescent obesity. Table 2 presents the five most-cited studies published in 2012.

Table 2. Most-Cited Publications in 2012

Author	Title	Journal	Citation
(Eaton, Kann, Kinchen, Shanklin, Flint, Hawkins, Harris, Lowry, McManus, Chyen, et al., 2012 [13])	Youth Risk Behavior Surveillance - United States, 2011	Morbidity and Mortality Weekly Report. Surveillance Summaries	1486
(Hardy et al., 2012 [14])	Prevalence and Correlates of Low Fundamental Movement Skill Competency in Children	Pediatrics	282
(Khambalia et al., 2012 [15])	A synthesis of existing systematic reviews and meta-analyses of school-based behavioural interventions for controlling and preventing obesity	Wiley	226
(Kelishadi et al., 2012 [16])	Methodology and early findings of the third survey of the CASPIAN study: A national school-based surveillance of students' high-risk behaviors	International Journal of Preventive Medicine	126
(Bailey et al., 2012 [17])	Accelerometry-assessed sedentary behaviour and physical activity levels during the segmented school day in 10–14-year-old children: the HAPPY study	European Journal of Pediatrics	108

One of the most influential articles in this field, published in 2012, was the study conducted by (Eaton, Kann, Kinchen, Shanklin, Flint, Hawkins, Harris, Lowry, McManus, & Chyen, 2012), titled Youth Risk Behavior Surveillance – United States, 2011. This article has been cited 1,486 times. The study revealed that many high school students engaged in risky behaviors such as texting while driving, alcohol consumption, marijuana use, physical fighting, suicide attempts, sexual activity, poor dietary habits, physical inactivity, and excessive screen time (more than three hours per day on computers or gaming).

In relation to obesity, the study highlighted a rising trend in obesity prevalence among high school students from 1999 to 2011. Low fruit and vegetable intake and sedentary screen time were identified as key behavioral contributors to adolescent obesity, with prevalence varying across demographic groups. The study recommended implementing more effective and comprehensive school health programs, broader policy interventions, and ongoing surveillance to combat obesity and other risk behaviors among adolescents.

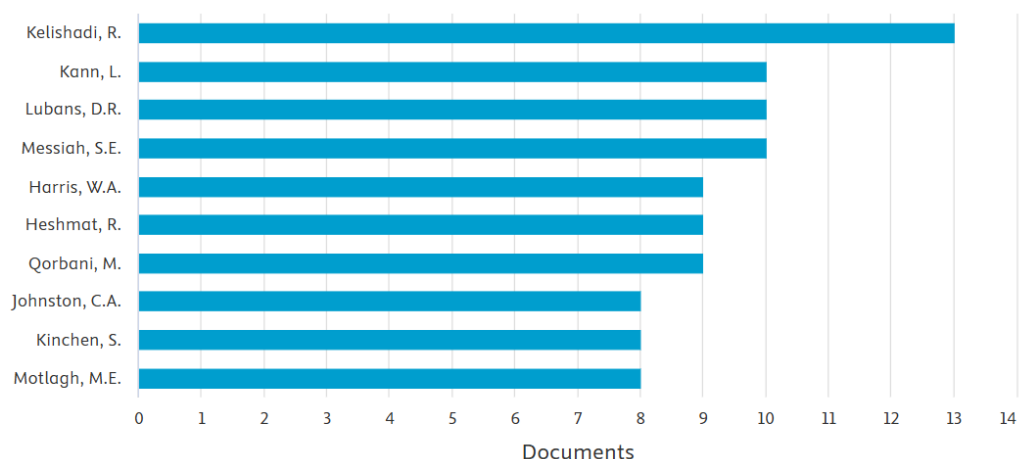
The second most-cited study was conducted by Hardy et al. (2012). With a total of 282 citations. This study aimed to describe the demographic and health characteristics of school-aged children with low fundamental movement skills. The findings revealed that many students exhibited poor motor skill proficiency. Girls from socioeconomically disadvantaged families were found to be twice as likely to experience difficulties in basic movement tasks such as walking or running, compared

to peers from higher-income backgrounds. Low motor skill competence was strongly associated with reduced physical fitness and lower levels of physical activity among children and adolescents. This decline in physical activity poses a risk for childhood and adolescent obesity. The study recommended that interventions targeting fundamental movement skills should begin in preschool and continue through the early years of formal education.

The third most-cited study in 2012 was conducted by Khambalia et al. (2012). This meta-analysis revealed a substantial body of empirical research exploring the effectiveness of school-based obesity prevention programs. The study demonstrated that the most impactful interventions for childhood weight reduction were long-term programs that integrated dietary modifications, physical activity, and family involvement. Subsequently, an author productivity analysis was conducted to identify the most active contributors in the field of adolescent obesity intervention research. Based on visualizations generated from the Scopus database, ten authors with the highest publication output were identified, as shown in Figure 4

Documents by author

Compare the document counts for up to 15 authors.



Source: Database Scopus

Figure 4. Top Ten Authors by Publication Output

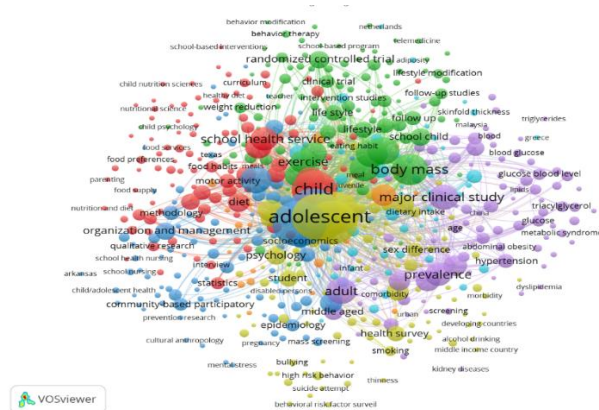
Figure 4 indicates that Kelishadi, R., is the most prolific author, having produced 14 documents that meet the search criteria. Based on an analysis of the three most-cited publications, key themes emerged, including the rising prevalence of the double burden of malnutrition (characterized by both underweight and overweight conditions) and shifts toward unhealthy dietary patterns. Emerging disciplines and sub-disciplines include school-based health surveillance, school and family-based obesity interventions, and digital health strategies such as mobile applications and gamification. Future research recommendations emphasize the integration of digital interventions, parental engagement through technology, the need for data-driven school surveillance policies, and the implementation of holistic approaches to address both obesity and adolescent mental health.[16, 18-19].

The second most prolific author is Kan, L., who produced 10 highly cited documents. Analysis of the three most-cited publications reveals that the primary research focus centers on behaviors contributing to the leading causes of morbidity and mortality among adolescents in the United States. These studies utilized data from the Youth Risk Behavior Surveillance System (YRBS) reports for the years 2011, 2013, and 2017. The central theme identified is the persistence of high-risk behaviors among adolescents. Throughout the survey periods, many adolescents engaged in risky behaviors such as unsafe driving, alcohol consumption, sexual health risks, violence, mental health challenges, and unhealthy lifestyles, including poor dietary habits, low physical activity, and excessive screen time. Emerging disciplines and sub-disciplines include digital health surveillance to monitor adolescent behavior in online environments, the implementation of evidence-based and sustainable

policies within schools and communities, and holistic intervention approaches to adolescent health. [13, 20-22].

3.6 Research Focus and Novelty

The analysis of research focus and novelty was conducted by applying a keyword threshold. Keyword analysis was used to uncover conceptual relationships and construct a knowledge framework related to adolescent obesity. Co-occurring keywords were displayed based on a minimum threshold of five publications, meaning that only keywords appearing in at least five studies were included in the co-occurrence visualization generated using VOSviewer. From a total of 3,330 keywords, the threshold narrowed the selection to 602 keywords, as illustrated in the figure below.



Source: Output VOSViewer Software

Figure 5. Keyword Co-Occurrence (Threshold > 5)

The research focus is evident in the clusters displayed in the figure above. Based on Figure 5, seven distinct colors indicate the presence of seven research clusters related to adolescent obesity. The red cluster, identified as the first cluster, comprises 121 keywords. This cluster is dominated by terms such as child, school health service, and overweight, suggesting that this theme represents a primary focus in studies concerning adolescent obesity interventions. A study conducted by Liu (2023) This finding is reinforced by evidence that school health services play a strategic role in the early detection, prevention, and management of obesity among children and adolescents. The study revealed that the implementation of such services remains far from ideal. Only a small proportion of schools mandate height and weight screening, and even fewer conduct follow-up actions when issues are identified.

The second cluster, represented in green, comprises 106 keywords, with primary focus areas including body mass, controlled study, childhood obesity, and physical activity. The prominence of these keywords, indicated by the size of their circles, suggests that this theme is a central focus in adolescent obesity research. A meta-analysis conducted by Taghizadeh and Farhangi (2020) This cluster's relevance is further supported by findings that obesity prevention policies tested through controlled trials have demonstrated a significant reduction in Body Mass Index (BMI). The effectiveness of these interventions increases when strategies combine physical activity with dietary modifications. The study underscores the importance of adopting an integrated and sustainable approach to managing obesity among young populations.

The blue cluster represents the third group, consisting of 99 keywords. The largest nodes in this cluster are humans, obesity, and health promotion. The yellow cluster, identified as the fourth, comprises 97 keywords, with dominant terms including adolescent, female, male, and health behavior. The purple cluster, the fifth, contains 92 keywords, with central nodes including major clinical study, risk factors, prevalence, and adult. The teal cluster, the sixth, comprises 52 keywords, with prominent terms such as body height, intervention studies, and risk assessment. The orange

cluster, the seventh, includes 20 keywords, with the largest nodes being body weight, prevention, and risk reduction behaviour. Subsequently, a keyword analysis was conducted to identify emerging themes and trending topics in adolescent obesity research. This analysis was performed using the VOSviewer overlay visualization, as illustrated in Figure 6.



Source: Output VOSviewer Software

Figure 6. Overlay Visualization for 2016–2020 and 2021–2025

Figure 6 presents two sets of analyses comparing different time periods: 2015–2020 and 2021–2025. The figure displays keyword nodes in varying colors, which indicate the publication period of each keyword. Yellow nodes represent the most recently studied keywords, while darker shades of green and blue correspond to older publication periods. The analysis reveals that during the 2015–2020 period, several keywords appeared in yellow and green, including sugar-sweetened beverages, fruit consumption, vegetable consumption, unhealthy diets, and high-income countries. In contrast, the 2021–2025 period did not yield any yellow-colored keywords; however, green-colored terms such as social media, sedentary behavior, sex factor, diet, and healthy were identified.

3.7 Publication Trends and Intervention Focus

The prevalence of obesity among children and adolescents has shown a consistently increasing trend across various regions of the world. Data from 1975 to 2016 indicate that North America has experienced a high and continuously rising prevalence of obesity. In contrast, Southeast Asia has recorded lower rates, yet these have been steadily increasing in line with urbanization processes. In Europe, obesity trends tend to vary across countries [23]. Similar findings were reported by other studies that documented a global rise in obesity prevalence from 1990 to 2022. Interestingly, a shift in epidemiological patterns has emerged, with low- and middle-income countries now exhibiting higher obesity prevalence rates compared to high-income industrialized nations [24]. Both studies affirm that the prevalence of obesity among children and adolescents has continued to rise year by year, accompanied by a shifting and increasingly complex disease burden, particularly in regions undergoing social and economic transitions. This trend represents an evolving global challenge in the field of public health.

As global obesity rates climb, the volume of scientific publications addressing this issue has also increased significantly, especially over the past two decades. Analysis presented in Figure 1

demonstrates a rapid and consistent growth in publications between 2012 and 2019. This reflects a growing international awareness of the long-term impacts of obesity, particularly on adolescent physical and mental health. Obesity negatively affects both physical and psychological well-being and can diminish overall quality of life. Moreover, the rising incidence of obesity places a strain on national health systems through increased healthcare costs and reduced productivity. Therefore, strategic cross-sectoral collaboration, including education, health, economics, and technology is essential to design comprehensive, adaptive, and sustainable interventions to mitigate the long-term consequences of obesity [25].

The development of adolescent obesity intervention strategies reflects an increasingly diverse and multidimensional approach, indicating a comprehensive effort to address this public health issue. Chronologically, interventions began with individual-level strategies such as caloric intake reduction, which has proven effective in sustaining long-term weight loss [26]. Subsequently, population-based interventions emerged, focusing on behavioral modifications within school settings, such as restricting the consumption of sugar-sweetened beverages and increasing the duration of physical education [27]. Subsequently, community-based approaches that incorporate social support and peer engagement have demonstrated high effectiveness in promoting healthy lifestyle behaviors [28]. In the current digital era, internet-based interventions integrated into school activities have successfully reached adolescents from diverse backgrounds, demonstrating high levels of participation. [29]. Finally, the diversity of educational and physical activity strategies within school-based interventions, such as teacher training, healthy eating campaigns, and aerobic dance, highlights the importance of tailoring intervention programs to local contexts and the specific characteristics of student populations [30].

3.8 Topic and Keyword Evolution

Keyword analysis reveals a notable shift in research focus on adolescent obesity. During the 2015–2020 period, primary attention was directed toward dietary patterns and social environments, as reflected in the emergence of keywords such as sugar-sweetened beverages, fruit consumption, vegetable consumption, unhealthy diets, and high-income countries. In contrast, the 2020–2025 period, although lacking yellow-colored keywords, featured green-colored terms such as social media, sedentary behavior, sex factor, diet, and healthy. This transition indicates an expanding research focus from nutritional and economic issues toward behavioral and social dimensions, reflecting a more comprehensive understanding that adolescent obesity is not merely a medical concern, but is also shaped by lifestyle factors, social interactions, and digital contexts.

Subsequent topic cluster analysis identified seven major clusters in adolescent obesity research, encompassing a wide range of focus areas, from school health services and overweight status to controlled studies and physical activity. Other clusters emphasize health promotion, adolescent behavior, clinical risk factors, and intervention and prevention strategies. A comparison of keywords between the 2015–2020 and 2021–2025 periods reveals a thematic shift from dietary patterns and sugar-sweetened beverage consumption toward lifestyle-related issues, including sedentary behavior, social media, and psychosocial factors. These findings reflect a growing recognition that adolescent obesity is increasingly associated with environmental influences, social behaviors, and holistic digital approaches.

4. Conclusion

The findings of this study suggest that adolescent obesity interventions must be multisectoral and sustainable. Active involvement from families, schools, and government institutions is essential in designing effective programs. Furthermore, technology-based and culturally sensitive approaches should be developed to enhance the relevance and impact of interventions. Looking ahead, future research should focus on evaluating long-term outcomes and exploring the systemic integration of digital interventions in addressing adolescent obesity.

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