

Sugar-Sweetened Beverages and Obesity Risk: A Narrative Review

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ABSTRACT

Background: Obesity remains one of the most urgent global public health challenges, with sugar-sweetened beverage (SSB) consumption identified as a major modifiable risk factor. Beverages such as sodas, sweetened juices, teas, and energy drinks provide high caloric intake with minimal nutritional value, contributing to weight gain and metabolic disturbances. This narrative review synthesizes recent scientific evidence on the association between SSB consumption and obesity risk, and identifies key sociodemographic determinants and public health policy implications.

Methods: Literature searches were conducted in PubMed, ScienceDirect, and Google Scholar using the keywords “sugar-sweetened beverages,” “obesity,” and “overweight.” From a total of 21,892 records identified (2020–2025), eight cross-sectional and epidemiological studies were included based on relevance and publication quality.

Results: Eight studies from diverse countries (United States, China, Saudi Arabia, and Indonesia) consistently demonstrated a positive association between SSB intake and increased body mass index (BMI), abdominal adiposity, and overall obesity prevalence. Among children and adolescents, consuming more than 25 g of sugar per day increased the likelihood of overweight/obesity by 39%. In adults, daily SSB consumption was associated with a 1.5- to 4.5-fold higher risk of obesity. The principal biological mechanisms include enhanced hepatic lipogenesis, insulin resistance, and systemic inflammation induced by excessive fructose intake. Sociodemographic factors such as socioeconomic status, gender, culture, and lifestyle behaviors further modulate this relationship.

Conclusion: Excessive SSB consumption is a major contributor to the global obesity epidemic through intertwined metabolic and behavioral mechanisms. Effective prevention requires multidimensional strategies encompassing fiscal policies, product reformulation, nutrition education, and promotion of healthier beverage alternatives to reduce obesity and noncommunicable disease burdens worldwide.

Keywords: Added Sugars, Obesity, Public Health Policy, Sugar-Sweetened Beverages

A. BACKGROUND

Obesity is one of the most pressing global health problems, affecting both developed and developing countries. Among the various contributing factors, the consumption of sugar-sweetened beverages (SSBs) has emerged as a major modifiable risk factor. SSBs include soft drinks, packaged fruit juices, energy drinks, sweetened tea, and other beverages containing added sugars such as sucrose and high-fructose corn syrup. These drinks provide a high energy intake but have low nutritional value. Excessive consumption of SSBs can increase total caloric intake, displace nutrient-dense foods, and is strongly associated with weight gain, metabolic syndrome, and obesity.

Globally, the consumption of SSBs continues to rise, particularly among children and adolescents in both high- and middle-income countries. A study by Shamim et al. (2023) reported that nearly one-fourth of Bangladeshi adolescents consume SSBs at least seven times per week, indicating that sweetened beverage consumption has become a common habit among young people⁽¹⁾. Similarly, Dasco et al. (2023) found that in the Philippines, regular SSB consumption is correlated with higher prevalence of overweight and obesity across all age groups⁽²⁾.

A similar trend is also observed in Indonesia. According to the *Indonesian Health Survey (SKI) 2023*, 47.5% of the population aged over three years consume sweetened beverages at least once per day, and 43.3% consume them one to six times per week⁽³⁾. This relatively high proportion indicates that sweetened beverages have become a significant part of Indonesian dietary patterns, especially among children and adolescents. These findings emphasize that the increase in sweetened beverage consumption is not only a global concern but also a critical public health issue in Indonesia.

From a physiological perspective, SSB consumption can trigger obesity through several mechanisms. Experimental studies in animals have shown that chronic intake of high-sugar beverages can disrupt glucose metabolism, reduce insulin sensitivity, and increase fat accumulation in the liver and adipose tissues. Zhao et al. (2022) demonstrated that daily consumption of SSBs in experimental mice led to fat accumulation in hepatic and adipose tissues and impaired autophagy mechanisms essential for maintaining cellular balance⁽⁴⁾. These metabolic disturbances contribute to increased adiposity and elevate the risk of obesity-related diseases such as type 2 diabetes and cardiovascular disorders.

Beyond metabolic impacts, excessive SSB intake is also associated with various public health problems. Epidemiological data indicate that frequent SSB consumption is linked to higher risks of hypertension, dental caries, and other non-communicable diseases (NCDs). The

World Health Organization (WHO) recommends that free sugar intake should not exceed 10% of total daily energy intake, emphasizing the importance of population-level efforts to reduce sweetened beverage consumption.

In response to the growing burden of obesity, several countries have implemented policy interventions such as sugar-sweetened beverage taxation. In Mexico, a 20% tax introduced in 2014 successfully reduced SSB consumption by approximately 16–19%⁽⁵⁾. A similar policy was adopted in the Philippines under the *Tax Reform for Acceleration and Inclusion (TRAIN) Law* in 2018, which contributed to a decline in SSB purchases and consumption. Likewise, South Africa introduced the *Health Promotion Levy* as part of a national strategy to curb obesity and NCDs⁽⁶⁾. These fiscal policies not only aim to discourage the consumption of sugary drinks but also generate revenue that can support public health promotion initiatives.

Despite growing evidence and policy efforts, challenges remain. The beverage industry continues to aggressively market sweetened products, particularly targeting children and adolescents. Additionally, cultural preferences, affordability, and limited access to healthier beverage options contribute to the persistent high levels of SSB consumption. Socioeconomic factors and educational attainment also influence beverage choices and obesity risk across different population groups.

Overall, the increasing global consumption of sugar-sweetened beverages is a key factor in the obesity epidemic. Evidence from both experimental and epidemiological studies consistently supports the link between SSB consumption and increased adiposity, metabolic disruption, and non-communicable disease risk. Therefore, controlling SSB consumption requires a multidimensional approach that integrates fiscal policy, nutrition education, and the promotion of healthier beverage alternatives. This narrative review aims to summarize current scientific evidence on the relationship between SSB consumption and obesity risk and to highlight potential strategies to reduce its impact on public health.

B. METHODS

This article is a narrative review aimed at describing the relationship between the consumption of sugar-sweetened beverages (SSBs) and the risk of obesity based on recent research findings. The narrative review approach was chosen to allow a comprehensive synthesis of scientific evidence derived from experimental and observational studies relevant to the field of nutrition and public health. Literature searches were conducted online through several scientific databases, including PubMed, ScienceDirect, and Google Scholar. The search process included original research articles published between 2020 and 2025, using a

combination of the following keywords: “sugar-sweetened beverages,” “obesity,” and “overweight.” During the search process, Boolean operators (*AND* and *OR*) were used to combine the keywords.

The article selection process in this review was carried out through several screening stages to ensure the relevance and quality of the publications included. From the initial search across the PubMed, ScienceDirect, and Google Scholar databases, a total of 21,892 articles were identified based on the specified keywords. Of these, 2,906 articles met the criteria for *free full-text access* and were further screened based on the type of publication. After filtering by publication type, 524 articles were identified as *original research*. Subsequently, the titles and abstracts were screened for relevance to the review topic, namely the relationship between sugar-sweetened beverage (SSB) consumption and obesity risk. Based on these criteria, 8 articles were considered the most relevant and were included as the primary sources for this narrative review.

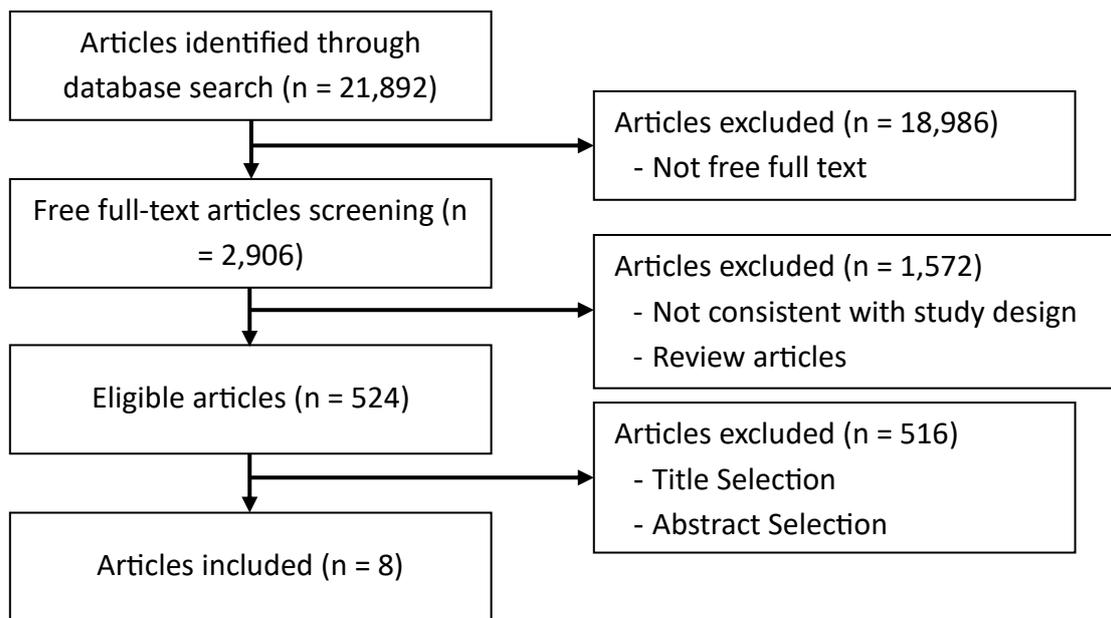


Figure 1 Flowchart of Article Selection Process

Table 1 Selected Studies on Sugar-Sweetened Beverages and Obesity Risk

Title	Author (Year)	Study Design	Country	Result
Consumption of sugar-sweetened beverages and obesity in SNAP-eligible children and adolescents	Twarog, <i>et al.</i> (2019) ⁽⁷⁾	<i>Cross-sectional</i>	Amerika Serikat	Children who reported consuming soda within the past month were more likely to be overweight or obese. Soda consumption was associated with an approximately 1.83-fold

				higher risk of obesity and a 1.60-fold higher risk of being overweight.
Sugar Is the Key Cause of Overweight/Obesity in Sugar-Sweetened Beverages (SSB)	Yu, <i>et al.</i> (2022) ⁽⁴⁾	<i>Cross-sectional</i>	China	This study demonstrated that soft drink (SSB) consumption was significantly associated with an increased risk of obesity among children and adolescents in Shandong Province, China. A total of 44.8% of participants consumed more than 25 grams of sugar from SSBs per day, and this level of consumption was associated with an odds ratio (OR) of 1.391 for obesity.
Sugar-Sweetened Beverages Intake, Abdominal Obesity, and Inflammation among US Adults without and with Prediabetes—An NHANES Study	Lin, <i>et al.</i> (2022) ⁽⁸⁾	<i>Cross-sectional</i>	Amerika Serikat	The study showed that sugar intake from sugar-sweetened beverages (SSBs) was associated with an increased risk of abdominal obesity and systemic inflammation. Individuals consuming ≥ 41 grams of sugar per day had a 2.66 times higher risk of elevated CRP levels compared to those who did not consume SSBs ($p < 0.05$). Moreover, 73.6% of adults with abdominal obesity exhibited high CRP levels, indicating chronic inflammation related to excessive sugar intake from SSBs.
Sugar-Sweetened Beverages Consumption in a Multi-Ethnic Population of Young Men and Association with Sociodemographic Characteristics and Obesity	AlTamimi, <i>et al.</i> (2023) ⁽⁹⁾	<i>Cross-sectional</i>	Saudi Arabia	This study also found that overall sweetened beverage consumption was higher among obese participants, who were 4.53 times more likely to consume soft drinks weekly compared to non-obese participants (OR = 4.53, $p = 0.037$). In addition, sociodemographic factors such as nationality and pregnancy status were also found to influence the level of

				sweetened beverage consumption.
Joint association of physical activity and sugar-sweetened beverages with obesity in young U.S. adults: A cross-sectional analysis of NHANES 2007–2020	Liu, et al. (2025) ⁽¹⁰⁾	<i>Cross-sectional</i>	Amerika Serikat	The results of this study showed that SSB consumption was positively associated with the prevalence of obesity. Individuals who consumed more than one but less than two servings per day had a 19% higher risk (AOR = 1.19; 95% CI: 1.01, 1.41), while those consuming two or more servings per day had a 55% higher risk (AOR = 1.55; 95% CI: 1.30, 1.85) compared to those who did not consume SSBs at all.
Sugar-sweetened beverages consumption in a multi-ethnic population of middle-aged men and association with sociodemographic variables and obesity	AlFaris, et al. (2022) ⁽¹¹⁾	<i>Cross-sectional</i>	Saudi Arabia	The study found that obesity was a significant predictor of weekly sugar-sweetened beverage (SSB) consumption, with obese participants being approximately 3.8 times more likely (OR = 3.80, p = 0.003) to consume SSBs regularly compared to non-obese participants.
Sugar-sweetened beverages as risk factor of central obesity among women in reproductive age	Annisa, et al. (2020) ⁽¹²⁾	<i>Case-control</i>	Indonesia	The results of the study indicated that high consumption of sugar-sweetened beverages (SSBs) was associated with central obesity among women of reproductive age. Specifically, the average SSB intake in the case group (those with obesity) was 56.3 g/day, corresponding to the ≥50 g/day category. In addition, the percentage of energy intake from SSBs was higher in the case group (11.7%), with the maximum energy contribution from SSBs reaching 525.3 kcal/day, accounting for 23% of total daily energy intake.

Beverages and sugar-sweetened beverages consumption pattern and amount among adolescents using beverage frequency questionnaire: cross-sectional study	Aldhirgham, et al. (2025) ⁽¹³⁾	<i>Cross-sectional</i>	Saudi Arabia	The study among adolescents in Riyadh showed a weak and non-significant association between sugar-sweetened beverage (SSB) consumption and obesity. Although the median SSB intake was 478 ml/day (approximately 28% of total beverage consumption) and represented the main source of sugar and liquid carbohydrates, no significant correlation was found with BMI or other body composition parameters. This result is likely influenced by the fact that the majority of participants had a normal body weight.
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C. DISCUSSION

The present narrative review synthesizes evidence from eight cross-sectional and epidemiological studies examining the relationship between sugar-sweetened beverage (SSB) consumption and obesity across diverse populations and settings. Collectively, these studies demonstrate a consistent, positive association between frequent SSB intake and increased body mass index (BMI), abdominal adiposity, and overall obesity prevalence. Although variations exist by age, sex, geography, and socioeconomic status, the converging results strongly suggest that excessive consumption of added-sugar beverages remains a major modifiable contributor to the global obesity epidemic.

1. SSB Consumption and Obesity in Children and Adolescents

A significant body of evidence confirms the obesogenic effects of SSB consumption during childhood and adolescence—a life stage marked by the establishment of long-term dietary habits. In a representative U.S. sample, Twarog et al. (2019) analyzed 1,455 Supplemental Nutrition Assistance Program (SNAP)-eligible children and adolescents and found that those who consumed regular soda or sweetened fruit drinks had substantially higher odds of overweight and obesity compared with non-consumers⁽⁷⁾. The association was especially strong among Hispanic youth and boys aged 2–5 years, where odds ratios exceeded 2.0, suggesting both ethnic and age-related vulnerability. Importantly, SNAP recipients reported higher frequencies of SSB consumption than eligible non-recipients, reflecting the influence of socioeconomic and food-environment disparities on beverage choices.

Evidence from China further reinforces the dose-response nature of this relationship. In a large provincial study, Yu et al. (2022) quantified the threshold at which SSB-derived sugar significantly increased obesity risk among children and adolescents⁽⁴⁾. Their results identified 25 g of sugar per day as the critical limit; consumption beyond this threshold was associated with a 39% higher likelihood of overweight/obesity (OR = 1.39, 95% CI: 1.12–1.73). Mediation and pathway analyses revealed that the sugar content of SSBs, rather than beverage type, was the primary determinant of adiposity—confirming that sugar load drives metabolic imbalance irrespective of the drink’s formulation. Such quantitative insights are essential for translating observational data into policy-relevant dietary targets.

In the Middle East, Aldhirgham et al. (2025) reported that adolescents in Riyadh, Saudi Arabia, consumed a median of 1.7 L of beverages daily, with SSBs accounting for nearly 28% of total fluid intake and providing 100% of beverage-related sugar⁽¹³⁾. Although correlations between SSB intake and measured adiposity were modest, gender and grade level predicted intake frequency, with males reporting greater consumption. The findings highlight adolescence as a critical developmental window for preventive interventions: beverage preferences, autonomy in food choices, and peer influence all interact to shape long-term patterns of high-sugar consumption.

Together, these studies underscore that SSB intake during early life establishes metabolic trajectories conducive to weight gain, particularly in socioeconomically disadvantaged or nutritionally unregulated environments.

2. SSB Consumption and Obesity in Young and Middle-Aged Adults

Research on adult populations consistently mirrors the findings observed in youth. In a large cross-sectional study of 3,600 young men (aged 20–39 years) living in Riyadh, AlTamimi et al. (2023) observed extremely high exposure rates: 93.6% consumed SSBs weekly and 40.8% daily⁽⁹⁾. Obesity independently predicted frequent consumption, with obese participants showing 4.5-fold higher odds of daily intake ($p = 0.037$)⁽¹¹⁾. Similarly, in a multi-ethnic sample of 1,800 middle-aged men (36–59 years) from the same region, AlFaris et al. (2022) found that 93.8% reported weekly and 32.6% daily SSB use, with obesity strongly associated with higher weekly intake (OR = 3.80, $p = 0.003$)⁽¹¹⁾. Nationality emerged as a major determinant: Pakistani and Yemeni participants reported the highest consumption rates, reflecting cultural beverage preferences and potentially occupational differences influencing diet⁽¹¹⁾.

These findings corroborate the role of SSBs as a ubiquitous component of adult diets in rapidly urbanizing, high-income societies and demonstrate that cultural background and acculturation can mediate exposure risk.

A U.S. analysis of 11,318 young adults aged 20–44 years provided additional evidence linking SSB intake to obesity while introducing the moderating role of physical activity. Liu et al. (2025), using data from the National Health and Nutrition Examination Survey (NHANES 2007–2020), found that physical activity attenuated the association between SSBs and obesity only among moderate consumers (1–499 kcal/day)⁽¹⁰⁾. Among heavy consumers (≥ 500 kcal/day), however, physical activity failed to offset the metabolic burden of excessive sugar intake. This finding indicates a “ceiling effect,” where energy imbalance from beverages surpasses the compensatory effects of exercise, emphasizing that activity cannot neutralize extreme dietary excess⁽¹⁰⁾.

Further metabolic insights were provided by Lin et al. (2023), who examined SSB intake, abdominal obesity, and systemic inflammation among 5,250 U.S. adults with and without prediabetes(8). High sugar consumption from SSBs was linked to both prediabetes prevalence (a 1.31-fold increased risk) and elevated C-reactive protein (CRP) concentrations. Among prediabetic adults, heavy SSB consumers had a 1.57-fold higher risk of elevated CRP even after adjusting for waist circumference, suggesting that inflammation is an intermediary mechanism connecting sugary beverages to metabolic dysfunction(8). These data integrate well with the mechanistic understanding of SSBs as promoters of low-grade inflammation, hepatic fat accumulation, and insulin resistance.

In women of reproductive age, Annisa et al. (2020) demonstrated that SSB consumption was a powerful independent predictor of central obesity (OR = 5.93, $p = 0.002$)(12). Additional risk factors included short night-time sleep and prolonged daytime napping (> 2 h/day), while higher physical activity reduced risk (OR = 0.31)⁽¹²⁾. The study illuminates sex-specific vulnerability: women exhibit greater propensity for visceral fat accumulation due to hormonal regulation of lipogenesis, which may interact with high-fructose beverage intake.

Overall, adult-focused evidence from multiple countries establishes a robust and consistent link between SSB consumption and general or central obesity, mediated by metabolic, inflammatory, and behavioral pathways.

3. Mechanistic Pathways Linking SSBs and Obesity

The biological plausibility of SSB-induced obesity is well supported. High-fructose corn syrup and sucrose—common sweeteners in SSBs—provide rapid energy but minimal satiety. Fructose metabolism bypasses key glycolytic control points, leading to unregulated hepatic

uptake and conversion into triglycerides via *de novo* lipogenesis⁽¹⁴⁾. This promotes ectopic fat storage in the liver and viscera, contributing to insulin resistance and metabolic syndrome⁽¹⁴⁾. Furthermore, fructose does not elicit significant insulin or leptin responses, blunting satiety signaling and promoting caloric overconsumption.

The evidence of elevated CRP levels among high-SSB consumers with prediabetes⁽⁸⁾ supports the role of chronic inflammation as a mediator of obesity-related disease. Similarly, Yu et al. (2022) demonstrated through mediation analysis that total sugar intake from SSBs fully explained the association between beverage type and overweight, indicating that sugar dose—not beverage category—is the critical determinant of risk⁽⁴⁾. These mechanistic insights underscore the need to focus public-health messaging on total free-sugar reduction rather than simple substitution between drink types.

4. Sociodemographic and Lifestyle Determinants

Socioeconomic status, culture, and lifestyle behaviors critically shape SSB intake. In the U.S., Twarog et al. (2019) showed that SNAP recipients consumed significantly more SSBs than their low-income peers who did not participate in the program, illustrating how economic assistance structures may inadvertently perpetuate unhealthy food environments⁽⁷⁾. Similar disparities were observed in Saudi Arabia, where AlFaris et al. (2022) and AlTamimi et al. (2023) identified nationality-based differences among expatriate workers. Cultural norms, beverage availability, and limited access to nutrition education likely contribute to these patterns^(9,11).

Gender and lifestyle factors also influence susceptibility. Men consistently report higher beverage volumes, while women often display higher central adiposity at similar intakes, possibly due to hormonal modulation of fat storage⁽¹²⁾. Physical inactivity and inadequate sleep exacerbate these effects, as shown by Liu et al. (2025) and Annisa et al. (2020)^(10,12). Collectively, these studies reveal that SSB-driven obesity is not solely a metabolic issue but a behavioral and structural phenomenon shaped by social context.

5. Public-Health and Policy Implications

The global consistency of evidence linking SSBs to obesity highlights the urgency of multi-level interventions. Policy approaches such as taxation, advertising restrictions, and front-of-package warning labels have proven effective in several countries. In the U.S., debates continue over restricting the use of SNAP benefits for SSB purchases⁽⁷⁾, reflecting tension between equity and health promotion. In Saudi Arabia and China—where daily SSB consumption remains high—public awareness campaigns emphasizing sugar thresholds (e.g., ≤ 25 g/day as proposed by Yu et al. 2022) may offer culturally acceptable strategies⁽⁴⁾.

Education campaigns targeting adolescents are particularly important, as shown by Aldhirgham et al. (2025), who documented substantial intake despite limited correlation with obesity indices—suggesting early preventive efforts may avert long-term effects⁽¹³⁾. Reformulation initiatives encouraging beverage industries to reduce added-sugar content, alongside promotion of water and unsweetened beverages, are essential complements to fiscal policies.

D. CONCLUSION

Across diverse geographic, socioeconomic, and demographic contexts, frequent consumption of sugar-sweetened beverages is consistently linked to elevated risks of overweight, general obesity, and central adiposity. The relationship is primarily mediated by total sugar intake and further amplified by lifestyle factors such as low physical activity, short sleep duration, and socioeconomic disadvantage. Biologically, high fructose and sucrose intake from beverages promotes hepatic lipogenesis, insulin resistance, and systemic inflammation. While the scientific consensus is unequivocal, persistent high intake worldwide indicates a substantial implementation gap between knowledge and action. Comprehensive strategies—combining taxation, reformulation, consumer education, and behavioral interventions—are essential to reduce SSB consumption and mitigate obesity-related health burdens globally.

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