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Short Communication

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The Rising Tide of Obesity and Diabetes: A Review of Global Trends and Risk Factors

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Abstract

The alarming global increase in obesity and diabetes has become a critical public health concern, demanding urgent attention. This review seeks to explore the accelerating trends of these interconnected conditions and evaluate the major contributing risk factors. The purpose is to provide a synthesized understanding of their mutual reinforcement and global burden, highlighting implications for prevention and control. The review presents updated global prevalence data for both obesity and type 2 diabetes, emphasizing their parallel rise across high-, middle-, and low-income nations. It examines the shared pathophysiological mechanisms, particularly insulin resistance and chronic inflammation, that tie these diseases together under the term "diabesity." The role of metabolic syndrome (MetS), non-alcoholic fatty liver disease, and β-cell dysfunction in linking obesity with diabetes is discussed in detail. Lifestyle and environmental influences, including dietary patterns, sedentary behavior, urbanization, and exposure to pollutants-are scrutinized as significant drivers. The review also dissects socioeconomic, genetic, and epigenetic factors shaping susceptibility to these diseases. Importantly, it evaluates current public health and clinical strategies for prevention and intervention, assessing their scope and limitations. This review is significant for consolidating a vast array of epidemiological, clinical, and policy-related insights into one coherent narrative. It offers a clear understanding of how obesity and diabetes are no longer isolated health issues but are emblematic of broader structural, behavioral, and ecological imbalances. The synthesis of global data provides actionable context for researchers, healthcare providers, and policymakers seeking to develop integrated approaches. Looking forward, the findings point to the necessity of systemic change: moving beyond individual-based solutions toward population-level interventions and infrastructure reforms. Future prospects depend on prioritizing early prevention, especially in youth, and investing in long-term, culturally tailored public health strategies.

Keywords

Chronic inflammation, Diabetes, Diabesity, Insulin resistance, Obesity, Public health, Risk factors

Introduction

The modern world is in the grip of a silent epidemic obesity and diabetes [1]. What was once considered a problem of affluence has now permeated every corner of the globe, affecting individuals across socioeconomic boundaries [2]. The sharp rise in these conditions over the last few decades is not merely a matter of individual health but a growing burden on global healthcare systems [3, 4]. These

twin conditions, often intertwined, are reshaping public health policies and the way society's function [5, 6].

Obesity, defined as excessive body fat accumulation, is no longer a rarity [7]. The convenience of modern life sedentary routines, ultra-processed diets, and increased screen time-has created the perfect environment for weight gain [8, 9]. It is not simply a matter of willpower or discipline; structural and cultural shifts have made unhealthy choices the default. The normalization of obesity, even among children, is a telling sign of deeper societal problems [10, 11]. Parallel to this rise is the explosion in diabetes cases, particularly type 2 diabetes, which is largely preventable [12]. This condition, characterized by high blood sugar levels due to insulin resistance, is closely linked to lifestyle factors. Yet it continues to spread like wildfire, with younger populations increasingly affected. The days when diabetes were primarily a concern for the elderly are long gone [13, 14].

The relationship between obesity and diabetes is well-established. Excess body fat, especially around the abdomen, increases the body's resistance to insulin, paving the way for type 2 diabetes [15, 16]. This link has earned the term "diabesity", a recognition of how closely these conditions are interwoven. Addressing one often means confronting the other-yet that is easier said than done in today's world. Efforts to control this rising tide face significant challenges. Public health campaigns, while well-intentioned, often fall short against the marketing might of the processed food industry [17, 18]. Urban environments are rarely designed to promote physical activity, and socioeconomic disparities limit access to healthy food [19]. These are not just medical issues, they are societal failures that require political will and cultural rethinking.

Obesity and diabetes are rapidly escalating global health concerns, posing significant threats to public health and healthcare systems worldwide (Figure 1) [15]. The World Health Organization (WHO) estimates that a substantial proportion of the world's population lives in countries where overweight and obesity cause more deaths than being underweight [20, 21]. This review aims to provide a comprehensive overview of the global trends in obesity and diabetes, explore the key risk factors contributing to their rise, and highlight the interconnectedness of these conditions. Looking ahead, the solution lies not in treating symptoms but in preventing the root causes. Reviving traditional diets, promoting physical activity from a young age, and fostering communities that prioritize well-being over convenience are essential steps. The past holds valuable lessons on balance and moderation principles that must guide us if we hope to reverse this dangerous trend.

Global Trends in Obesity

The prevalence of obesity has reached alarming levels globally, prompting the WHO to recognize it as a significant public health issue [22]. Defined as having a body mass index (BMI) of 30 kg/m^2 or higher, obesity has nearly tripled since 1975, affecting populations across various demographics and regions [23, 24]. This section explores the global trends and statistics surrounding obesity, highlighting its implications for health and society. As of 2022, approximately 16%

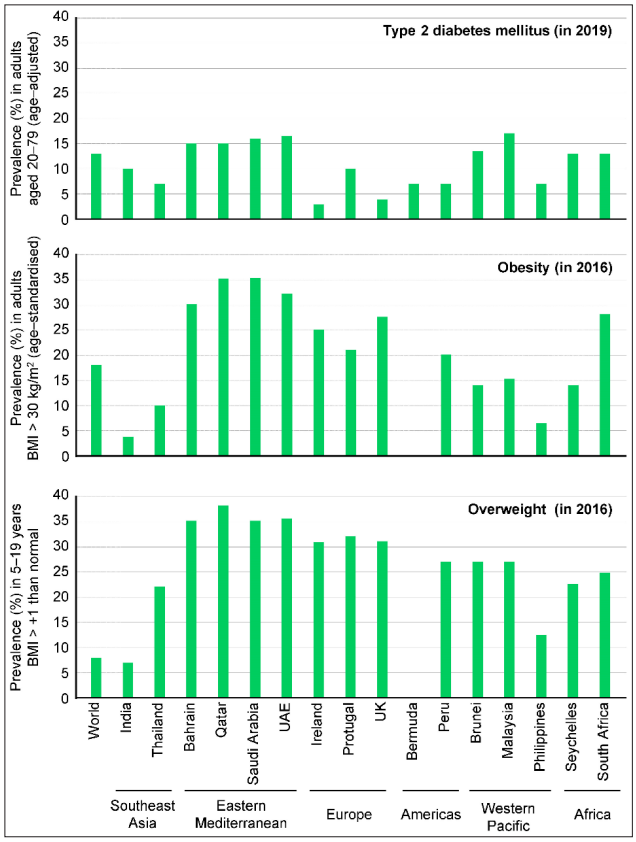


Figure 1: Prevalence of type 2 diabetes mellitus (in 2019), obesity (in 2016) and overweight (in 2016) in selected countries [15].

of adults aged 18 years and older worldwide were classified as obese, a significant increase from previous decades. The global age-standardized prevalence of obesity in school-aged children and adolescents rose from 1.7% in 1990 to 6.9% in 2022, indicating a concerning trend among younger populations [2, 25]. The WHO estimates that around 2 billion adults were overweight in 2021, with 31% of these individuals categorized as obese [26].

Obesity is a major risk factor for numerous chronic diseases, including cardiovascular diseases (CVD), type 2 diabetes, ischemic stroke, and certain cancers [27, 28]. As of 2022, approximately 1 in 8 people worldwide were living with obesity, highlighting the extensive reach of this health issue [2]. The prevalence of obesity among adults has more than doubled since 1990, with significant increases observed in both high-income and low-income countries [29]. The global trend towards increased obesity is alarming. The prevalence of obesity has more than doubled since 1990, with projections indicating that the number of adults living with obesity could rise from 0.81 billion in 2020 to 1.53 billion by 2035 [30]. This trend is exacerbated by factors such as increased caloric intake, sedentary lifestyles, and socio-economic changes that influence dietary habits and physical activity levels [31].

In the United States, for instance, the obesity rate among adults reached 37.9% in 2016, with notable disparities across different racial and ethnic groups [32]. The prevalence of obesity has been increasing globally, including in sub-Saharan Africa [27]. In Nigeria, for example, a systematic review

and meta-analysis revealed a pooled estimate of overweight at 26.0% and obesity at 15.0%, with an increasing trend observed, especially among urban dwellers [27]. These trends are not unique to Nigeria; similar patterns are observed worldwide [33-35]. Demographic factors significantly influence obesity prevalence. In the United States, for example, the obesity rate among black adults was reported at 39.8% in 2015, with rates among black women reaching as high as 44.7% [32]. In contrast, Asian adults exhibited the lowest obesity rates, with figures around 10.7% [32]. These disparities underscore the need for targeted public health interventions that consider cultural, socioeconomic, and environmental factors.

Globally, the rise in obesity is not limited to adults; childhood obesity has also become a pressing concern. Recent studies indicate that the prevalence of obesity among children has shown a significant upward trend, particularly in high- and middle-income countries [36]. For example, a study involving adolescents aged 12 to 15 years across 21 countries reported a pooled prevalence of overweight and obesity increasing from 24.8% to 27.7% between the first and last surveys conducted from 2005 to 2017 [36].

Global Trends in Diabetes

Parallel to the rise in obesity, the prevalence of diabetes mellitus, particularly type 2 diabetes, is also increasing worldwide [37, 38]. The International Diabetes Federation (IDF) estimated that 366 million people had diabetes in 2011, with projections exceeding 552 million by 2030 [39]. Notably, 80% of individuals with diabetes reside in developing countries [39]. Furthermore, diabetes was responsible for 4.6 million deaths in 2011, underscoring its significant global impact [39]. Recent data from Italy show a rise in diabetes prevalence from 7.76% in 2019 to 8.49% in 2022, suggesting that events such as the COVID-19 pandemic may have worsened risk factors for diabetes [40].

The global burden of diabetes has increased dramatically over the past few decades [41]. Data from 2013 to 2017 indicate a heterogenous landscape, revealing hotspots with prevalence higher than global average [42]. In 2017, the global prevalence of diabetes reached 476.0 million, with an incidence of 22.9 million new cases [41]. Projections estimate a rise to 570.9 million cases by 2025, with 26.6 million new cases [41]. By 2022, the number of people living with diabetes had risen from 200 million in 1990 to 830 million [43]. Specifically, Li et al. [42] identified that 68 out of 203 countries and territories exhibited an increasing trend in diabetes prevalence between 2013 and 2017, with China, the United States, and Mexico simultaneously showing a high prevalence and an increasing trend. Hasankhani et al. [44] showed the global mean trend of DM incidence from 1990 to 2019 followed an upward trend with an annual increase of 3.73 cases per 100,000 people.

Diabetes mellitus is a leading cause of mortality and reduced life expectancy [41]. In 2017, diabetes was associated with 1.37 million deaths globally [4]. However, the WHO estimates that diabetes resulted in 1.5 million deaths in 2012, making it the 8th leading cause of death [45]. Furthermore, an additional 2.2 million deaths were attributed to high blood glucose and the increased risks of CVD and other associated complications [45]. In 2017, the IDF estimated that diabetes resulted in 4.0 million deaths worldwide [45]. Ling et al. [46] found that diabetic vascular complication-related deaths increased substantially between 2000 and 2016, mainly driven by the increased mortality of renal complications.

The burden of diabetes varies significantly across different regions and countries [41]. The greatest increase in diabetes rates has been observed in low- and middle-income countries, where over 80% of diabetic deaths occur [45]. Asia and Africa are expected to experience the fastest increase in diabetes prevalence [45]. In China, the age-standardized incidence and mortality rates of diabetes increased between 1990 and 2019 [47]. Notably, mortality due to diabetes in urban areas has been higher than in rural areas for 30 years, although the gap has gradually narrowed in recent decades [48]. The Western Pacific Region also shows an increasing trend in diabetes incidence, especially in association with urbanization and unhealthy lifestyles [49]. In contrast, a study in Australia observed a cyclical pattern in the incidence rate trend of type 1 diabetes in children, with an overall decreasing trend observed only in the youngest age group [50]. In Ukraine, over the past 20 years (2002 to 2021) of peacetime, there has been an annual gradual increase in the prevalence and incidence of diabetes mellitus among children in all age groups with gender balance, which generally corresponds to the global trend [51].

Interconnectedness of Obesity and Diabetes

Obesity and diabetes are closely intertwined, with obesity being a major risk factor for type 2 diabetes [52, 53]. The increasing rates of obesity contribute significantly to the rising incidence of diabetes globally (Table 1) [54]. Several studies highlight the complex interplay between these two conditions. For instance, MetS, a cluster of conditions including abdominal obesity, hypertension, dyslipidemia, and insulin resistance, significantly increases the risk of developing type 2 diabetes [39, 55]. Individuals with MetS have more than seven times the risk of developing diabetes compared to those without MetS [39]. Furthermore, non-alcoholic fatty liver disease, often associated with obesity, is strongly linked to MetS, creating a cycle of metabolic dysfunction [34, 55, 56].

Table 1: Global prevalence of obesity and diabetes (1990 - 2022).

Year	Global obesity prevalence (%)	Global diabetes prevalence (%)	Notable trends
1990	7.9	4.7	Low rates in most regions
2000	10.5	5.9	Rise in urban populations
2010	13.7	7.6	Significant increase in children and adolescents
2020	15.6	9.3	Surge in low- and middle-income countries
2022	16.0	10.5	Over 1 billion obese; ~830 million with diabetes

The interconnectedness of obesity and diabetes, often referred to as "diabesity," is a significant public health concern characterized by a complex interplay of genetic, environmental, and lifestyle factors [57-59]. Obesity is a major risk factor for the development of type 2 diabetes, with the prevalence

of both conditions rising globally. This relationship is driven by shared pathophysiological mechanisms, including insulin resistance and chronic inflammation, which are exacerbated by excessive body fat. Studies indicate that a significant proportion of individuals with type 2 diabetes are also obese. For instance, around 60 to 90% of type 2 diabetes patients are obese, highlighting the strong epidemiological link between these conditions [60, 61]. Obesity is identified as a primary risk factor for diabetes, with lifestyle factors such as poor diet and physical inactivity playing a significant role in the development of both conditions [62]. Understanding these pathophysiological mechanisms figure 2 is crucial for developing effective prevention and treatment strategies.

Insulin resistance and β-cell dysfunction

Obesity is a major contributor to insulin resistance, a condition where the body's cells become less responsive to insulin, leading to elevated blood glucose levels and eventually type 2 diabetes [63, 64]. The excessive accumulation of adipose tissue in obesity leads to the release of adipokines and free fatty acids, which interfere with insulin signaling pathways, exacerbating insulin resistance [65, 66]. Insulin resistance is often accompanied by β-cell dysfunction, where the pancreatic β-cells fail to compensate for increased insulin demand, further contributing to hyperglycemia and diabetes progression [64]. As β-cells fail to keep up with the body's insulin needs, blood sugar levels can rise, leading to a condition known as hyperglycemia. This can cause further damage to the β-cells, creating a vicious cycle that exacerbates diabetes. Chronic high blood sugar can also lead to complications such as CVD and nerve damage [63].

Chronic inflammation

Obesity is associated with a state of chronic low-grade inflammation, characterized by the infiltration of immune cells into adipose tissue and the release of pro-inflammatory cytokines [66]. This inflammatory state contributes to insulin resistance by impairing insulin signaling in target tissues and promoting β-cell dysfunction [66, 67]. The inflammation hypothesis suggests that the chronic inflammatory environment in obesity is a key driver of the pathophysiological link between obesity and diabetes [66]. This means that the immune system is constantly activated, which can have harmful effects on various tissues. In obese individuals, there is an increased presence of macrophages, a type of immune cell, in adipose (fat) tissue. These macrophages produce inflammatory molecules that can disrupt normal metabolic processes. The inflammatory molecules released by macrophages can cause pathological changes in insulin-sensitive tissues, such as muscle and liver. This can lead to insulin resistance, where the body's cells do not respond effectively to insulin. Chronic low-grade inflammation, often seen in obesity, can also contribute to both insulin resistance and β-cell dysfunction. Inflammatory signals can impair the function of insulin-sensitive tissues and the β-cells themselves, worsening the overall metabolic condition [63]. The inflammation hypothesis is one of three main hypotheses that attempt to explain the relationship between obesity and diabetes. The other two are the lipid overflow hypothesis and the adipokine hypothesis, which also explores different mechanisms of how obesity can lead to metabolic disorders [68].

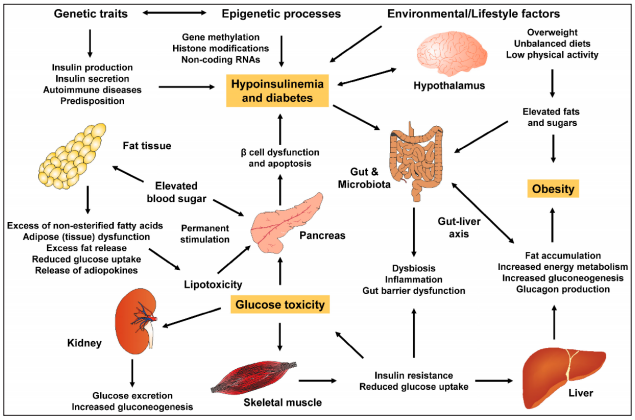


Figure 2: Multifactorial pathophysiology of obesity and type 2 diabetes [15].

Metabolic dysregulation

Obesity leads to metabolic dysregulation, including altered lipid metabolism and ectopic fat deposition, which are critical in the development of insulin resistance and diabetes [64]. The lipid overflow hypothesis posits that the inability of adipose tissue to store excess fat results in ectopic lipid accumulation, which can be toxic to insulin-sensitive tissues and β-cells [66]. The lipid overflow hypothesis suggests that as individuals become obese, their adipose (fat) tissue reaches its capacity to store fat. When this happens, excess lipids begin to accumulate in other tissues, such as the liver, muscle, and pancreas, leading to ectopic lipid storage. The accumulation of lipids in non-adipose tissues can have harmful effects. Certain lipid components and metabolites may become cytotoxic, meaning they can damage cells in these tissues. This damage can disrupt normal cellular functions and contribute to insulin resistance. Understanding the lipid overflow hypothesis is essential for developing strategies to combat obesity-related diabetes. Interventions that target lipid metabolism and promote healthy fat storage could help mitigate the risk of type 2 diabetes in obese individuals [66].

Dysregulated secretion of adipokines from expanded adipose tissue further impairs metabolic homeostasis, contributing to the development of diabetes [66]. The adipokine hypothesis emphasizes that white adipose tissue (fat) functions as an endocrine organ. This means that adipose tissue secretes various hormones and signaling molecules, known as adipokines, which play significant roles in regulating metabolism and insulin sensitivity. In obese individuals, the expansion of fat stores can lead to dysfunctional secretion of these adipokines. This dysfunction can result in an imbalance of hormones that are crucial for maintaining metabolic health, contributing to insulin resistance and other metabolic disorders. The altered secretion of adipokines can impair the function of insulin target tissues, such as muscle and liver. This impairment can lead to reduced sensitivity to insulin, making it more difficult for the body to regulate blood sugar levels effectively. Some adipokines, like leptin and adiponectin, have been studied extensively. Leptin is involved in regulating energy balance, while adiponectin has anti-inflammatory and insulin-sensitizing effects. In obesity, the levels of these adipokines can become dysregulated, further exacerbating metabolic issues. Un-

derstanding the adipokine hypothesis is vital for developing therapeutic strategies aimed at improving insulin sensitivity and metabolic health in obese individuals [66].

Risk Factors Contributing to Obesity and Diabetes

The prevalence of obesity is a growing concern worldwide, with various risk factors contributing to its increase. These factors are often interrelated and can vary significantly across different populations and regions. Fast-food consumption is a significant risk factor, with a prevalence of 61.67% among individuals in urban population study, increasing the risk of adiposity by 1.85-fold [69]. The research identified several key risk factors for adiposity, such as, fast-food consumption was the most common risk factor, affecting 61.67% of individuals. Eating fewer than 3 meals per day was noted by 58.89% of participants. A sedentary lifestyle was observed in 53.33% of the population. Sleeping less than 6 hours per day was reported by 44.22% of individuals. Hypercaloric nutrition (consuming more calories than needed) was found in 43.56%. Excessive alcohol consumption was noted in 42.89% of participants. Symptoms of depression were present in 31.78% of the individuals surveyed [69].

Several factors contribute to the increasing global burden of diabetes. Metabolic risks, such as high BMI, and behavioral factors, including inappropriate diet, smoking, and low physical activity, contribute significantly to diabetes-related deaths and disability-adjusted life years [41]. Li et al. [42] identified BMI, urbanization rate, gross domestic product per capita, and PM pollution as significant influencing factors on diabetes prevalence. A 1% increase in BMI was associated with a 2.371% to 3.045% increase in diabetes prevalence [42]. Richards et al. [70] found that a 1% increase in per capita income and total tobacco consumption is associated with a 0.92% and 0.02% increase in diabetes prevalence respectively. The increasing rates of diabetes in developing countries are linked to urbanization and lifestyle changes, including sedentary lifestyles, less physically demanding work, and the global nutrition transition characterized by increased intake of energy-dense, nutrient-poor foods [45].

Several risk factors contribute to the global rise in obesity and diabetes (Table 2), including:

Lifestyle factors

- Diet: Unhealthy dietary patterns, characterized by high intake of processed foods, sugary beverages, and saturated fats, contribute to weight gain and insulin resistance [28, 71].
- Physical inactivity: Sedentary lifestyles reduce energy expenditure, promote weight gain and increase the risk of insulin resistance [28, 71].
- Socioeconomic factors: Lower education levels are associated with increased hypertension risk and may also be linked to higher diabetes risk [40].

Genetic and epigenetic factors

- Genetic predisposition: Genetic factors play a significant role in the development of both obesity and diabetes [38, 72]. For example, the PNPLA3 I148M variant has a substantial impact on the risk of developing progressive MASLD, which is closely linked to obesity and diabetes [72].
- Epigenetic changes: Environmental factors, such as diet and pollutants, can cause epigenetic changes in genes related to glucose metabolism and insulin function, increasing the risk of gestational diabetes mellitus (GDM) and subsequent type 2 diabetes [73].

Specific conditions

- GDM: GDM is a significant risk factor for the progression

Table 2: Shared risk factors for obesity and type 2 diabetes.

Risk factor	Mechanism of impact	Associated conditions	Evidence strength	Notable studies/sources
Unhealthy diet	Excess intake of sugars, saturated fats, and ultra-processed foods increases adiposity	Obesity, insulin resistance, MetS	Strong	WHO, Global Nutrition Reports
Physical inactivity	Reduces energy expenditure and muscle glucose uptake; promotes insulin resistance	Obesity, type 2 diabetes, dyslipidemia	Strong	Lancet Global Health, IDF
Urbanization	Reduced active transport; increased access to processed foods; disrupted circadian rhythm	Obesity, prediabetes, cardiovascular risk	Moderate	WHO Urban Health Initiatives
Socioeconomic status	Limits access to healthy food, preventive care, and education; increases stress exposure	Obesity, diabetes, depression	Strong	CDC, GBD Study
Genetic predisposition	Alters fat distribution, insulin sensitivity, β-cell function	Obesity, type 2 diabetes, NAFLD	Moderate	NIH reviews
Chronic stress and poor sleep	Elevated cortisol and hormonal imbalances promoting appetite, fat accumulation	Obesity, glucose intolerance, hypertension	Emerging	JAMA, Sleep Medicine Reviews
Endocrine-disrupting chemicals (EDCs)	Interfere with hormonal signaling pathways, promote adipogenesis and β-cell dysfunction	Obesity, diabetes, thyroid disorders	Emerging	Environmental Health Perspectives; EDC Task Force
Smoking and alcohol use	Alters metabolism, increases visceral fat, impairs insulin sensitivity	Central obesity, type 2 diabetes, CVD	Moderate	WHO, PubMed
Sedentary screen time	Lowers energy expenditure; increases snacking behavior	Childhood obesity, insulin resistance	Strong (in children)	Global School-Based Health Surveys

to type 2 diabetes in women [73]. Early detection and management of GDM are crucial to prevent long-term complications.

- Severe obesity in youth: Children and adolescents with severe obesity are at greater risk for type 2 diabetes, hypertension, fatty liver disease, and dyslipidemia [74]. Longitudinal studies indicate an increased risk for cardiomyopathy, heart failure, and cardiovascular mortality in adulthood for adolescents with severe obesity [74].

Environmental and chemical factors

- Persistent organic pollutants: Emerging evidence suggests that exposure to persistent organic pollutants, which are resistant to degradation and accumulate in the body, may act as obesogens and diabetogens, promoting obesity and diabetes [75].
- Obesogenic environments: The modern digital food environment, characterized by easy access to unhealthy food options, further exacerbates the risk of obesity and diabetes [76].

While the relationship between obesity and diabetes is well-established, it is important to consider the broader context of metabolic health. Factors such as genetic predisposition, socioeconomic status, and access to healthcare also play critical roles in the development and management of these conditions. Additionally, the rising prevalence of obesity and diabetes in developing countries underscores the need for global public health efforts to address these interconnected epidemics [77-79]. Understanding the multifaceted nature of diabesity is crucial for developing comprehensive strategies that improve health outcomes and reduce the burden on healthcare systems.

Management and Prevention Strategies

Effective management and prevention strategies are crucial to curbing the rising tide of obesity and diabetes (Table 3). These strategies include:

- Lifestyle interventions: Lifestyle interventions focusing on diet, physical activity, and behavior change are essential for weight management and diabetes prevention [28]. Reducing energy density, controlling portion sizes, and improving diet quality are key components of effective nutritional strategies [28].
- Pharmacological interventions: Several medications, including GLP-1 receptor agonists like semaglutide, have shown promise in promoting weight loss and improving glycemic control in individuals with obesity and diabetes [80].
- Public health initiatives: Public health initiatives aimed at promoting healthy eating habits, increasing physical activity, and raising awareness about the risks of obesity and diabetes are crucial for preventing these conditions at a population level [81]. Government programs like the National Programme for Prevention and Control of Cancer, Diabetes, CVD, and Stroke in India can provide guidelines and support for prevention and management efforts [81].
- Screening and early detection: Intensified efforts to screen for glucose metabolism disorders and other cardiovascular risk factors are necessary for early detection and management [37, 54]. Early detection of GDM is particularly important to prevent the progression to type 2 diabetes in women [37, 73].

Conclusion

The global rise in obesity and diabetes presents a significant challenge to public health. The interconnectedness of these conditions, driven by lifestyle factors, genetic predispositions, and specific health conditions, necessitates a comprehensive and multi-faceted approach to prevention and management. By addressing the key risk factors, implementing effective lifestyle interventions, and promoting public health initiatives, it is possible to mitigate the impact of this rising tide and improve the health and well-being of populations

Table 3: Public health and clinical strategies for prevention and control of obesity and diabetes.

Strategy type	Intervention/Program	Target group	Reported effectiveness	Examples/Notes
Lifestyle interventions	Dietary counseling, exercise regimens, behavioral therapy	Adults and adolescents	High with sustained adherence	Diabetes Prevention Program, WHO lifestyle guidelines
Pharmacological therapy	GLP-1 receptor agonists (e.g., semaglutide), metformin, SGLT2 inhibitors	High-risk and diagnosed individuals	Moderate to high depending on adherence	Significant weight loss and glycemic control observed in trials (e.g., STEP, SCALE)
Early screening and detection	HbA1c testing, oral glucose tolerance tests, MetS profiling	Adults ≥30, pregnant women	High when linked to follow-up interventions	GDM screening reduces long-term maternal and child risk
Public policy measures	Sugar taxes, front-of-pack labeling, trans-fat bans, soda bans	General population	Mixed, depends on enforcement and compliance	Mexico's sugar tax showed reduced soda consumption; Chilean labeling law
Urban planning	Green spaces, pedestrian-friendly design, bike infrastructure	Urban populations	Promising but long-term impact under-studied	WHO Healthy Cities, "15-minute city" initiatives
School and workplace programs	Health education, healthy cafeteria options, activity breaks	Children, working adults	Moderate to high depending on design	India's Fit India Movement; US Healthy Schools initiative
Digital health tools	Mobile apps for activity, glucose tracking, telemedicine support	Tech-accessible populations	Growing impact; improves adherence	MyFitnessPal, Livongo, Virta Health
Community empowerment	Local health promoters, cultural diet campaigns, peer-led activities	Underserved communities	High when culturally tailored	Community Health Workers, Blue Zones Project

worldwide. Future research should focus on standardized assessment tools, longitudinal studies, and diverse samples to enhance the robustness of prevalence estimates and inform effective prevention strategies.

Acknowledgments

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Conflict of Interest

None.

References

1. Yogesh M, Mody M, Makwana N, Patel J. 2024. Exploring the silent epidemic: investigating the hidden burden of normal weight obesity in type 2 diabetes mellitus in India - a cross-sectional study. *Clin Diabetes Endocrinol* 10(1): 1-10. https://doi.org/10.1186/s40842-024-00199-0
2. World Health Organization. Obesity and Overweight. [https://www.who.int/news-room/fact-sheets/detail/obesity-and-overweight] [Accessed September 02, 2025]
3. Mohajan D, Mohajan HK. 2023. Obesity and its related diseases: a new escalating alarming in global health. *J Innov Med Res* 2(3): 12-23. https://doi.org/10.56397/jimr%2F2023.03.04
4. Khunti K, Chudasama YV, Gregg EW, Kamkuemah M, Misra S, et al. 2023. Diabetes and multiple long-term conditions: a review of our current global health challenge. *Diabetes Care* 46(12): 2092-2101. https://doi.org/10.2337/dci23-0035
5. Bruno F, Puleo C, Rizzo A. 2024. Obesity as a multifactorial disease: understanding and addressing stigma for holistic management. *Adv Med Psychol Public Health* 2(4): 266-276. https://dx.doi.org/10.5281/zenodo.14293543
6. Avogaro A, Rigato M, di Brino E, Bianco D, Gianotto I, et al. 2024. The socio-environmental determinants of diabetes and their consequences. *Acta Diabetol* 61(10): 1205-1210. https://doi.org/10.1007/s00592-024-02373-3
7. Bray GA. 2025. Obesity: a 100 year perspective. *Int J Obes* 49(2): 159-167. https://doi.org/10.1038/s41366-024-01530-6
8. Machado-Rodrigues AM, Padez C, Rodrigues D, Dos Santos EA, Baptista LC, et al. 2024. Ultra-processed food consumption and its association with risk of obesity, sedentary behaviors, and well-being in adolescents. *Nutrients* 16(22): 3827. https://doi.org/10.3390/nu16223827
9. Barber TM, Kabisch S, Pfeiffer AF, Weickert MO. 2024. Dietary and lifestyle strategies for obesity. *Nutrients* 16(16): 2714. https://doi.org/10.3390/nu16162714
10. Cohen E, Slemming W, Wrottesley SV, Prioreschi A, Norris SA. 2024. Maternal perceptions of infant's body weight and childhood obesity in South Africa: a qualitative study in Soweto. *Child Soc* 38(2): 277-293. https://doi.org/10.1111/chso.12689
11. Hajizadeh A, Heath L, Ahmad A, Kebbe M, Jebb SA, et al. 2023. Clinician resistance to broaching the topic of weight in primary care: digging deeper into weight management using strong structuration theory. *Soc Sci Med* 329: 115997. https://doi.org/10.1016/j.socscimed.2023.115997
12. Singer ME, Dorrance KA, Oxenreiter MM, Yan KR, Close KL. 2022. The type 2 diabetes 'modern preventable pandemic' and replicable lessons from the COVID-19 crisis. *Prev Med Rep* 25: 101636. https://doi.org/10.1016/j.pmedr.2021.101636
13. Cigolle CT, Blaum CS, Lyu C, Ha J, Kabeto M, et al. 2022. Associations of age at diagnosis and duration of diabetes with morbidity and mortality among older adults. *JAMA Netw Open* 5(9): 1-14. https://doi.org/10.1001/jamanetworkopen.2022.32766
14. Bellary S, Kyrou I, Brown JE, Bailey CJ. 2021. Type 2 diabetes mellitus in older adults: clinical considerations and management. *Nat Rev Endocrinol* 17(9): 534-548. https://doi.org/10.1038/s41574-021-00512-2
15. Chandrasekaran P, Weiskirchen R. 2024. The role of obesity in type 2 diabetes mellitus-an overview. *Int J Mol Sci* 25(3): 1882. https://doi.org/10.3390/ijms25031882
16. Gupta MK, Gouda G, Vadde R. 2024. Relation between obesity and type 2 diabetes: evolutionary insights, perspectives and controversies. *Curr Obes Rep* 13(3): 475-495. https://doi.org/10.1007/s13679-024-00572-1
17. Rampalli KK, Blake CE, Frongillo EA, Montoya J. 2023. Why understanding food choice is crucial to transform food systems for human and planetary health. *BMJ Glob Health* 8(5): 1-14. https://doi.org/10.1136/bmjgh-2022-010876
18. Sokich E, Mendelson A, Weir D, Abdullayev U, Menicucci JA, et al. 2024. Towards Low-Sodium Diets: Educational and Policy Approaches. In 2024 IEEE Global Humanitarian Technology Conference (GHTC). IEEE, pp 211-217.
19. Wang L, He S, Zhao C, Su S, Weng M, et al. 2022. Unraveling urban food availability dynamics and associated social inequalities: towards a sustainable food environment in a developing context. *Sustain Cities Soc* 77: 103591. https://doi.org/10.1016/j.scs.2021.103591
20. Chakraborty PA, Talukder A, Haider SS, Gupta RD. 2022. Prevalence and factors associated with underweight, overweight and obesity among 15-49-year-old men and women in Timor-Leste. *PLoS One* 17(2): 1-13. https://doi.org/10.1371/journal.pone.0262999
21. Alfaris N, Alqahtani AM, Alamuddin N, Rigas G. 2023. Global impact of obesity. *Gastroenterol Clin* 52(2): 277-293. https://doi.org/10.1016/j.gtc.2023.03.002
22. Garg RK. 2025. The alarming rise of lifestyle diseases and their impact on public health: a comprehensive overview and strategies for overcoming the epidemic. *J Res Med Sci* 30(1): 1-6. https://doi.org/10.4103/jrms.jrms_54_24
23. Lynn W, Agrawal S. 2021. Introduction to Obesity. In Obesity, Bariatric and Metabolic Surgery: A Comprehensive Guide. Springer International Publishing, pp 1-12.
24. Gona PN, Kimokoti RW, Gona CM, Ballout S, Rao SR, et al. 2021. Changes in body mass index, obesity, and overweight in Southern Africa development countries, 1990 to 2019: findings from the global burden of disease, injuries, and risk factors study. *Obes Sci Pract* 7(5): 509-524. https://doi.org/10.1002/osp4.519
25. Phelps NH, Singleton RK, Zhou B, Heap RA, Mishra A, et al. 2024. Worldwide trends in underweight and obesity from 1990 to 2022: a pooled analysis of 3663 population-representative studies with 222 million children, adolescents, and adults. *Lancet* 403(10431): 1027-1050. https://doi.org/10.1016/s0140-6736(23)02750-2
26. Epidemiology of Obesity. Wikipedia. [https://en.wikipedia.org/wiki?curid=21111360] [Accessed September 02, 2025]
27. Ramalan MA, Gezawa ID, Musa BM, Uloko AE, Fakhraddeen YM. 2023. Prevalence and trends of adult overweight and obesity in Nigeria - a systematic review and meta-analysis. *Niger J Clin Pract* 26(1): 1-15. https://doi.org/10.4103/njcp.njcp_1903_21
28. Adeola OL, Agudosi GM, Akueme NT, Okobi OE, Akinyemi FB, et al. 2023. The effectiveness of nutritional strategies in the treatment and management of obesity: a systematic review. *Cureus* 15(9): e45518. https://doi.org/10.7759/cureus.45518
29. More Than One Billion People Now Living with Obesity, Global Analysis Suggests. [https://www.imperial.ac.uk/news/251798/more-than-billion-people-living-with/] [Accessed September 02, 2025]
30. World Obesity Atlas 2024: No Area of the World is Unaffected by the Consequences of Obesity. [https://www.worldobesity.org/news/world-obesity-atlas-2024] [Accessed September 02, 2025]
31. Boutari C, Mantzoros CS. 2022. A 2022 update on the epidemiology of obesity and a call to action: as its twin COVID-19 pandemic

appears to be receding, the obesity and dysmetabolism pandemic continues to rage on. *Metabolism* 133: 1-7. https://doi.org/10.1016/j.metabol.2022.155217

32. Obesity in the United States. Wikipedia. [https://en.wikipedia.org/wiki?curid=18958648] [Accessed September 02, 2025]
33. Pappachan JM, Fernandez CJ, Ashraf AP. 2024. Rising tide: the global surge of type 2 diabetes in children and adolescents demands action now. *World J Diabetes* 15(5): 797-809. https://doi.org/10.4239/wjd.v15.i5.797
34. Wong VWS, Ekstedt M, Wong GLH, Hagström H. 2023. Changing epidemiology, global trends and implications for outcomes of NAFLD. *J Hepatol* 79(3): 842-852. https://doi.org/10.1016/j.jhep.2023.04.036
35. Koliaki C, Dalamaga M, Liatis S. 2023. Update on the obesity epidemic: after the sudden rise, is the upward trajectory beginning to flatten? *Curr Obes Rep* 12(4): 514-527. https://doi.org/10.1007/s13679-023-00527-y
36. Fan H, Zhang X. 2022. Recent trends in overweight and obesity in adolescents aged 12 to 15 years across 21 countries. *Pediatr Obes* 17(1): e12839. https://doi.org/10.1111/ijpo.12839
37. Kautzky-Willer A, Leutner M, Harreiter J. 2023. Sex differences in type 2 diabetes. *Diabetologia* 66(6): 986-1002. https://doi.org/10.1007/s00125-023-05891-x
38. Bodke H, Wagh V, Kakar G, Wagh V. 2023. Diabetes mellitus and prevalence of other comorbid conditions: a systematic review. *Cureus* 15(11): e49374. https://doi.org/10.7759/cureus.49374
39. Epidemiology of Metabolic Syndrome. Wikipedia. [https://en.wikipedia.org/wiki?curid=36738647] [Accessed September 02, 2025]
40. Chiavarini M, Dolcini J, Firmani G, Ponzio E, Barbadoro P. 2024. Prevalence of diabetes, hypertension, and associated of cardiovascular diseases: a comparative pre- and post-COVID study. *Diseases* 12(12): 329. https://doi.org/10.3390/diseases12120329
41. Lin X, Xu Y, Pan X, Xu J, Ding Y, et al. 2020. Global, regional, and national burden and trend of diabetes in 195 countries and territories: an analysis from 1990 to 2025. *Sci Rep* 10(1): 1-11. https://doi.org/10.1038/s41598-020-71908-9
42. Li J, Wang S, Han X, Zhang G, Zhao M, et al. 2020. Spatiotemporal trends and influence factors of global diabetes prevalence in recent years. *Soc Sci Med* 256: 113062. https://doi.org/10.1016/j.socscimed.2020.113062
43. Diabetes. World Health Organization. [https://www.who.int/news-room/fact-sheets/detail/diabetes] [Accessed September 02, 2025]
44. Hasankhani MB, Mirzaei H, Karamoozian A. 2023. Global trend analysis of diabetes mellitus incidence, mortality, and mortality-to-incidence ratio from 1990 to 2019. *Sci Rep* 13(1): 1-8. https://doi.org/10.1038/s41598-023-49249-0
45. Diabetes. Wikipedia. [https://en.wikipedia.org/wiki?curid=40017873] [Accessed September 02, 2025]
46. Ling W, Huang Y, Huang YM, Fan RR, Sui Y, et al. 2020. Global trend of diabetes mortality attributed to vascular complications, 2000-2016. *Cardiovasc Diabetol* 19: 1-12. https://doi.org/10.1186/s12933-020-01159-5
47. Jha RP, Shri N, Patel P, Dhamnetiya D, Bhattacharyya K, et al. 2021. Trends in the diabetes incidence and mortality in India from 1990 to 2019: a joinpoint and age-period-cohort analysis. *J Diabetes Metab Disord* 20: 1725-1740. https://doi.org/10.1007/s40200-021-00834-y
48. Su B, Wang Y, Dong Y, Hu G, Xu Y, et al. 2022. Trends in diabetes mortality in urban and rural China, 1987-2019: a joinpoint regression analysis. *Front Endocrinol* 12: 1-10. https://doi.org/10.3389/fendo.2021.777654
49. Liu X, Wu B, Lai Y, Zhang X, Li H, et al. 2025. Temporal trends in the burden of diabetes and its risk factors across the Western Pacific region between 1990 and 2044: a systematic analysis of the Global Burden of Disease Study 2019. *Diabetes Metab Res Rev* 41(2): e70036. https://doi.org/10.1002/dmrr.70036
50. Haynes A, Bulsara MK, Bergman P, Cameron F, Couper J, et al. 2020. Incidence of type 1 diabetes in 0 to 14 year olds in Australia from 2002 to 2017. *Pediatr Diabetes* 21(5): 707-712. https://doi.org/10.1111/pedi.13025
51. Mityuryayeva-Korniyko IO, Volosovets OP, Kryvopustov SP, Burlaka IA, Polukhina MO, et al. 2024. Epidemiological assessment of diabetes mellitus in children of Ukraine during the last 20 years (2002–2021) of peacetime. *SAGE Open Med* 12: 1-7. https://doi.org/10.1177/20503121241255213
52. Weky ND. 2021. Obesity and non-alcoholic fatty liver disease: pathophysiology and management focused. *Eur J Med Health Sci* 3(1): 6-12.
53. Liu J, Ren ZH, Qiang H, Wu J, Shen M, et al. 2020. Trends in the incidence of diabetes mellitus: results from the global burden of disease study 2017 and implications for diabetes mellitus prevention. *BMC Public Health* 20: 1-12. https://doi.org/10.1186/s12889-020-09502-x
54. Dhamotharaswamy K, Selvaraj H, Lakshmanaperumal P, Sasankan AS, Thangavelu P, et al. 2024. Diabetes and TB: confluence of two epidemic and its effect on clinical presentation. *Curr Diabetes Rev* 20(1): 59-66. https://doi.org/10.2174/1573399819666230331113156
55. Gimenez-Palomo A, Gomes-da-Costa S, Dodd S, Pachiarotti I, Verdolini N, et al. 2022. Does metabolic syndrome or its component factors alter the course of bipolar disorder? a systematic review. *Neurosci Biobehav Rev* 132: 142-153. https://doi.org/10.1016/j.neubiorev.2021.11.026
56. Zohara Z, Adelekun A, Seffah KD, Salib K, Dardari L, et al. 2023. The prospect of non-alcoholic fatty liver disease in adult patients with metabolic syndrome: a systematic review. *Cureus* 15(7): e41959. https://doi.org/10.7759/cureus.41959
57. Martemucci G, Khalil M, Di Luca A, Abdallah H, D'Alessandro AG. 2024. Comprehensive strategies for metabolic syndrome: how nutrition, dietary polyphenols, physical activity, and lifestyle modifications address diabesity, cardiovascular diseases, and neurodegenerative conditions. *Metabolites* 14(6): 327. https://doi.org/10.3390/metabo14060327
58. Cuciureanu M, Caratașu CC, Gabrielian L, Frăsinariu OE, Checheriță LE, et al. 2023. 360-degree perspectives on obesity. *Medicina* 59(6): 1119. https://doi.org/10.3390/medicina59061119
59. Shah A, Davarci O, Chaftari P, Avenatti E. 2025. Obesity as a disease: a primer on clinical and physiological insights. *Methodist Debakey Cardiovasc J* 21(2): 4-13. https://doi.org/10.14797/mdcvj.1515
60. Siddiqui S. 2018. Obesity and diabetes: interrelationship. *Adv Obes Weight Manag Control* 8(2): 155-158. https://doi.org/10.15406/aowmc.2018.08.00233
61. Abidoye RO, Izunwa RD, Akinkuade FO, Abidoye GO. 2002. Inter-relationships between lifestyle and diabetes mellitus, overweight/obesity and hypertension in Nigeria. *Nutr Health* 16(3): 203-213. https://doi.org/10.1177/026010600201600306
62. Ali S, Hussain R, Malik RA, Amin R, Tariq MN. 2024. Association of obesity with type 2 diabetes mellitus: a hospital-based unmatched case-control study. *Cureus* 16(1): e52728. https://doi.org/10.7759/cureus.52728
63. Verma S, Hussain ME. 2017. Obesity and diabetes: an update. *Diabetes Metab Syndr Clin Res Rev* 11(1): 73-79. https://doi.org/10.1016/j.dsx.2016.06.017
64. Ruze R, Liu T, Zou X, Song J, Chen Y, et al. 2023. Obesity and type 2 diabetes mellitus: connections in epidemiology, pathogenesis, and treatments. *Front Endocrinol* 14: 1-23. https://doi.org/10.3389/fendo.2023.1161521
65. Tufail T, Ijaz A, Noreen S, Arshad MU, Gilani SA, et al. 2021. Pathophysiology of Obesity and Diabetes. In Egbuna C, Hassan S (eds) Dietary Phytochemicals. Springer, pp 29-42.
66. Chadt A, Scherneck S, Joost HG, Al-Hasani H. 2015. Molecular Links Between Obesity and Diabetes: "Diabesity". StatPearls.
67. Chobot A, Górowska-Kowolik K, Sokołowska M, Jarosz-Chobot P. 2018. Obesity and diabetes-not only a simple link between two epidemics. *Diabetes Metab Res Rev* 34(7): e3042. https://doi.org/10.1002/dmrr.3042

68. Haczeyni F, Bell-Anderson KS, Farrell GC. 2018. Causes and mechanisms of adipocyte enlargement and adipose expansion. *Obes Rev* 19(3): 406-420. https://doi.org/10.1111/obr.12646

69. Popa R, Fratila O, Rus M, Aron RAC, Vesa CM, et al. 2020. Risk factors for adiposity in the urban population and influence on the prevalence of overweight and obesity. *Exp Ther Med* 20(1): 129-133. https://doi.org/10.3892/etm.2020.8662

70. Richards SE, Wijeweera C, Wijeweera A. 2022. Lifestyle and socioeconomic determinants of diabetes: evidence from country-level data. *PLoS One* 17(7): 1-20. https://doi.org/10.1371/journal.pone.0270476

71. Bondolfi C, Taffe P, Augsburger A, Jaques C, Malebranche M, et al. 2020. Impact of incarceration on cardiovascular disease risk factors: a systematic review and meta-regression on weight and BMI change. *BMJ Open* 10(10): 1-15. https://doi.org/10.1136/bmjopen-2020-039278

72. Kozlitina J, Sookoian S. 2025. Global epidemiological impact of PNPLA3 I148M on liver disease. *Liver Int* 45(3): e16123. https://doi.org/10.1111/liv.16123

73. Yahaya TO, Salisu T, Abdulrahman YB, Umar AK. 2020. Update on the genetic and epigenetic etiology of gestational diabetes mellitus: a review. *Egypt J Med Hum Genet* 21: 1-13. https://doi.org/10.1186/s43042-020-00054-8

74. Bendor CD, Bardugo A, Pinhas-Hamiel O, Afek A, Twig G. 2020. Cardiovascular morbidity, diabetes and cancer risk among children and adolescents with severe obesity. *Cardiovasc Diabetol* 19: 1-14. https://doi.org/10.1186/s12933-020-01052-1

75. Yang C, Kong APS, Cai Z, Chung AC. 2017. Persistent organic pollutants as risk factors for obesity and diabetes. *Curr Diabetes Rep* 17: 1-11. https://doi.org/10.1007/s11892-017-0966-0

76. Health at a Glance: Europe 2022. [https://www.oecd.org/en/publications/health-at-a-glance-europe-2022_507433b0-en.html] [Accessed September 02, 2025]

77. Abad-Jiménez Z, Vezza T. 2025. Obesity: a global health challenge demanding urgent action. *Biomedicines* 13(2): 502. https://doi.org/10.3390/biomedicines13020502

78. Ryan D, Barquera S, Barata Cavalcanti O, Ralston J. 2021. The Global Pandemic of Overweight and Obesity: Addressing a Twenty-first Century Multifactorial Disease. In Handbook of Global Health. Cham: Springer International Publishing, pp 739-773.

79. Sharma M, Akhter MS, Roy S, Srejon R. 2025. Future issues in global health: challenges and conundrums. *Int J Environ Res Public Health* 22(3): 325. https://doi.org/10.3390/ijerph22030325

80. Fatima N, Anand A, Palvia AR, Kaur A, Azeez GA, et al. 2024. Efficacy of different doses and forms of the GLP-1 receptor agonist semaglutide in weight reduction among non-diabetic obese or overweight populations. *Cureus* 16(9): e68786. https://doi.org/10.7759/cureus.68786

81. Hedau VN, Patil T. 2024. Mounting stroke crisis in India: a systematic review. *Cureus* 16(3): e57058. https://doi.org/10.7759/cureus.57058