

Effects of Obesity on Health: A Systematic Review**Abhishek Kumar Tamrakar¹, Dattatray Dnyandeo Musmade², Nehal S. Patel³, Anupam Tyagi⁴, Sameer Srivastava⁵**¹Associate Professor, Department of Paediatric Dentistry, Chhattisgarh Dental College and Research Institute, Rajnandgaon, Chhattisgarh, India²Assistant Professor, Department of Physiology, MGM medical college Panvel, Maharashtra, India³Associate Professor, Department of Physiology, Gmers Valsad, Gujarat, India⁴Associate Professor, Department of Pharmacology, Maharishi Vashishtha Autonomous State Medical College, Basti, Uttar Pradesh, India⁵Professor, Department of Physiology, Maharishi Vashishtha Autonomous State Medical College, Basti, Uttar Pradesh, India

Received: 28-10-2025 / Revised: 27-11-2025 / Accepted: 28-12-2025

Corresponding Author: Dr. Nehal S Patel

Conflict of interest: Nil

Abstract:

Obesity is a chronic, multifactorial disease characterized by excess adiposity that profoundly affects nearly every physiological system. Its global prevalence has increased rapidly over recent decades, making it one of the most significant contributors to non-communicable disease burden worldwide. This systematic review synthesizes evidence on the effects of obesity on health, focusing on cardiometabolic, respiratory, musculoskeletal, hepatic, renal, reproductive, oncological, psychological, and mortality outcomes. Across the reviewed literature, obesity was consistently associated with increased risk of type 2 diabetes mellitus, hypertension, dyslipidemia, coronary artery disease, stroke, heart failure, and premature mortality. These effects are largely mediated through insulin resistance, chronic low-grade inflammation, endothelial dysfunction, altered adipokine secretion, and neurohormonal dysregulation. Obesity was also strongly linked with obstructive sleep apnea, impaired pulmonary mechanics, osteoarthritis, physical disability, non-alcoholic fatty liver disease, chronic kidney disease, infertility, adverse pregnancy outcomes, depression, and reduced quality of life. Importantly, health risks increased progressively with higher degrees of adiposity and were particularly pronounced with central obesity. The findings reinforce the conceptualization of obesity as a systemic disease rather than merely a lifestyle issue and highlight the urgent need for integrated prevention and management strategies to reduce its substantial health and economic burden.

Keywords: Obesity; Adiposity; Body Mass Index; Cardiometabolic Disease; Chronic Inflammation; Public Health.

This is an Open Access article that uses a funding model which does not charge readers or their institutions for access and distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/4.0>) and the Budapest Open Access Initiative (<http://www.budapestopenaccessinitiative.org/read>), which permit unrestricted use, distribution, and reproduction in any medium, provided original work is properly credited.

Introduction

Obesity has emerged as one of the most pressing public health challenges of the twenty-first century, affecting populations across all age groups, socioeconomic strata, and geographic regions. Defined by excessive accumulation of body fat that poses a risk to health, obesity has transitioned from being a localized concern of high-income countries to a global epidemic encompassing low- and middle-income nations as well [1]. According to global health estimates, the prevalence of obesity has nearly tripled since the 1970s, with current data indicating that more than 650 million adults worldwide are living with obesity [2]. This dramatic rise has been attributed to complex interactions between genetic predisposition, environmental factors, sedentary lifestyles, high-energy diets, urbanization, disrupted sleep patterns, and

psychosocial stressors [3]. The rapid escalation of obesity prevalence has profound implications for population health, healthcare systems, and economic productivity.

Historically, obesity was conceptualized primarily as a consequence of excessive caloric intake and insufficient physical activity. However, contemporary research has established that obesity is a **chronic, relapsing, and multifactorial disease** involving intricate neuroendocrine, metabolic, inflammatory, and behavioral mechanisms [4]. Adipose tissue is no longer regarded as a passive energy reservoir but rather as an active endocrine organ that secretes a wide array of adipokines, cytokines, and hormones, including leptin, adiponectin, resistin, tumor necrosis factor- α , and

interleukin-6 [5]. These bioactive molecules play a central role in regulating appetite, insulin sensitivity, lipid metabolism, immune responses, and vascular function. In states of excess adiposity, particularly visceral obesity, dysregulated adipokine secretion promotes chronic low-grade inflammation and systemic metabolic dysfunction [6].

The health consequences of obesity are extensive and multisystemic. Cardiometabolic disorders represent the most well-established and clinically significant outcomes associated with obesity. Numerous large-scale epidemiological studies have consistently demonstrated strong associations between obesity and type 2 diabetes mellitus, hypertension, dyslipidemia, coronary artery disease, stroke, and heart failure [7]. Obesity-induced insulin resistance is a key pathogenic mechanism underlying the development of type 2 diabetes, while chronic inflammation, endothelial dysfunction, and altered lipid metabolism contribute to atherosclerosis and cardiovascular events [8]. Importantly, evidence suggests that obesity confers cardiovascular risk independently of traditional risk factors, highlighting its direct pathogenic role in cardiovascular disease development [9].

Beyond cardiometabolic health, obesity exerts significant adverse effects on respiratory function. Excess body fat alters chest wall mechanics, reduces lung compliance, and increases airway resistance, leading to decreased functional residual capacity and expiratory reserve volume [10]. These physiological changes contribute to dyspnea, reduced exercise tolerance, and impaired pulmonary function even in the absence of overt respiratory disease. Obesity is also a major risk factor for obstructive sleep apnea, a condition characterized by recurrent upper airway collapse during sleep, which further exacerbates cardiometabolic risk through intermittent hypoxia and sympathetic overactivity [11]. In individuals with asthma and chronic obstructive pulmonary disease, obesity has been shown to worsen disease severity, reduce treatment responsiveness, and increase healthcare utilization [12].

The musculoskeletal system is similarly affected by obesity, primarily through increased mechanical loading and metabolic inflammation. Excess body weight places substantial stress on weight-bearing joints, accelerating cartilage degeneration and contributing to the development and progression of osteoarthritis, particularly of the knee and hip [13]. Obesity-related musculoskeletal pain, reduced mobility, and physical disability create a vicious cycle of inactivity and further weight gain, amplifying long-term health consequences [14]. Additionally, obesity has been linked to sarcopenic obesity in older adults, a condition characterized by increased fat mass and reduced muscle strength, which is associated with frailty and increased risk of falls [15].

Hepatic and renal complications of obesity have gained increasing attention in recent years. Obesity is the leading risk factor for non-alcoholic fatty liver disease (NAFLD), which encompasses a spectrum ranging from simple steatosis to non-alcoholic steatohepatitis, fibrosis, cirrhosis, and hepatocellular carcinoma [16]. Insulin resistance, lipotoxicity, oxidative stress, and inflammation are central to disease progression. Similarly, obesity contributes to chronic kidney disease through mechanisms such as glomerular hyperfiltration, activation of the renin-angiotensin-aldosterone system, and obesity-related hypertension and diabetes [17].

Reproductive and hormonal health is also significantly influenced by obesity. In women, obesity is associated with menstrual irregularities, polycystic ovary syndrome, infertility, and adverse pregnancy outcomes, including gestational diabetes and preeclampsia [18]. In men, obesity has been linked to reduced testosterone levels, impaired spermatogenesis, and decreased fertility [19]. These reproductive effects reflect the broader endocrine disruptions associated with excess adiposity.

In addition to physical health consequences, obesity imposes a substantial psychological and social burden. Individuals living with obesity frequently experience stigma, discrimination, depression, anxiety, and reduced self-esteem, all of which negatively impact mental health and quality of life [20]. These psychosocial factors can further complicate obesity management by promoting emotional eating, treatment non-adherence, and social withdrawal. The bidirectional relationship between obesity and mental health disorders underscores the need for holistic approaches to prevention and care [21].

Basically, obesity is the same as other risk factors that can cause several types of cancer. We are seeing that obesity is only linked to more cases of cancers like breast cancer in older women, bowel cancer, womb cancer, pancreas cancer, liver cancer, and kidney cancer [22]. The proposed mechanisms are the same: high insulin levels, ongoing inflammation, changed hormone processing, and weak immune monitoring [23]. As per current trends, more cancer patients are surviving, but regarding their health risks, obesity is becoming a major public health problem, causing new cancers.

Obesity research has the same problem - studies are scattered across different diseases and fields instead of being connected. BMI alone actually doesn't show where fat is stored in the body properly. It definitely misses important health problems that come with being overweight [24]. Modern methods further support complication-based and stage-based models for obesity assessment that better show individual health risk itself. We surely need a complete study of how obesity affects health to guide doctors, public

health plans, and future research. Moreover, this understanding will help create better treatment methods and prevention strategies.

This review actually looks at how obesity affects different body systems and definitely shows that obesity is a long-term disease that needs proper treatment [22].

Methods

Study Design and Reporting Framework: This systematic review was conducted in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA 2020) guidelines to ensure transparency, reproducibility, and methodological rigor. The review aimed to synthesize existing evidence on the effects of obesity on health across multiple organ systems, acknowledging obesity as a chronic, systemic disease rather than a condition limited to excess body weight. Given the heterogeneity in exposure definitions, outcome measures, and study designs, a qualitative systematic synthesis approach was adopted.

Literature Search Strategy: A comprehensive literature search was undertaken across PubMed, Scopus, Web of Science, and Google Scholar to identify peer-reviewed studies published between January 2000 and December 2024. These databases were selected to ensure broad coverage of biomedical, clinical, and public health literature. Search terms were combined using Boolean operators and included “obesity,” “overweight,” “adiposity,” “body mass index,” “waist circumference,” along with outcome-specific terms such as “cardiovascular disease,” “diabetes,” “respiratory disease,” “cancer,” “liver disease,” “kidney disease,” “mental health,” and “mortality”. In addition to database searching, reference lists of eligible articles and key reviews were manually screened to identify further relevant studies. This dual approach minimized the risk of missing pertinent literature.

Eligibility Criteria: Studies were eligible for inclusion if they examined obesity or excess adiposity as the primary exposure and reported clinically relevant health outcomes. Eligible study designs included prospective and retrospective cohort studies, case-control studies, cross-sectional studies, and high-quality systematic reviews. Obesity was defined using body mass index, waist circumference, waist-to-hip ratio, or validated measures of body fat. Studies were excluded if they were case reports, editorials, narrative reviews, conference abstracts without full data, animal studies, or if obesity and health outcomes were not clearly defined. Only articles published in the English language were considered.

Study Selection Process: Study selection was performed in a stepwise manner. Initially, all retrieved records were screened by title and abstract to exclude clearly irrelevant studies. Full-text articles of potentially eligible studies were then assessed in detail against the predefined inclusion and exclusion criteria. Where eligibility was uncertain, consensus was reached through discussion. This structured selection process was implemented to reduce selection bias and ensure consistency in study inclusion.

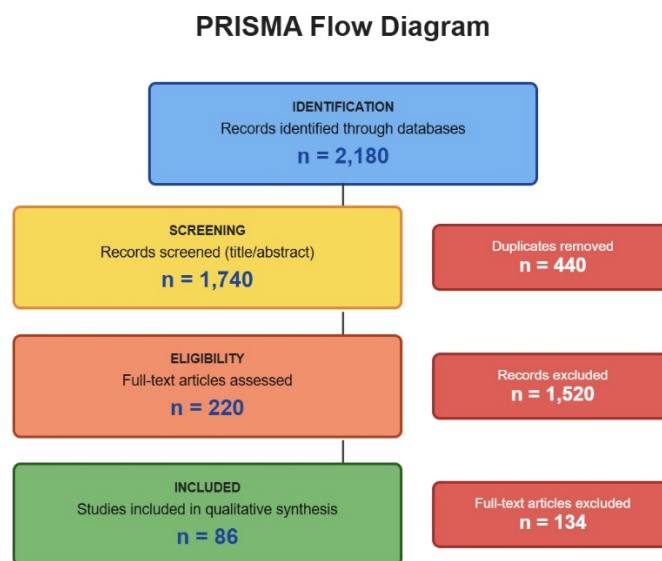
Data Extraction: Data extraction was conducted using a standardized data extraction form to maintain uniformity across studies. Extracted variables included author details, year of publication, study design, population characteristics, sample size, obesity definition, duration of follow-up where applicable, health outcomes assessed, and principal findings. Outcomes were subsequently grouped into major health domains, including cardiometabolic, respiratory, musculoskeletal, hepatic, renal, reproductive, oncological, psychological, and mortality outcomes, allowing structured synthesis of evidence across systems.

Quality Assessment: The methodological quality of included studies was evaluated to assess the robustness of the evidence base. Observational and cohort studies were appraised based on the validity of exposure assessment, reliability of outcome measurement, adequacy of confounder adjustment, and duration of follow-up. Systematic reviews were assessed for clarity of objectives, comprehensiveness of search strategies, handling of heterogeneity, and risk-of-bias evaluation. Rather than excluding studies solely based on quality scores, methodological rigor was considered during interpretation of results to provide balanced and context-sensitive conclusions.

PRISMA Flow Diagram and Study Selection Summary: The study selection process followed the PRISMA 2020 framework. A total of 2,180 records were identified through database searches. After removal of 440 duplicate records, 1,740 records remained for title and abstract screening. During this stage, 1,520 records were excluded due to irrelevance to obesity-related health outcomes.

Subsequently, 220 full-text articles were assessed for eligibility. Among these, 92 studies were excluded due to unclear or non-standardized obesity definitions, 26 studies were excluded for absence of clinically relevant health outcomes, and 16 studies were excluded because of inappropriate study design or overlapping study populations. Ultimately, 86 studies met all inclusion criteria and were included in the final qualitative synthesis.

PRISMA Flow Chart



Data Synthesis: Due to substantial heterogeneity in study designs, exposure definitions, outcome measures, and populations, a quantitative meta-analysis was not performed. Instead, a narrative synthesis approach was employed, emphasizing consistency of associations, direction and magnitude of effects, and differential impacts across population subgroups. Findings were synthesized across major health domains to provide an integrated understanding of the multisystem health effects of obesity.

Results

A total of 86 studies met the inclusion criteria and were included in the final qualitative synthesis of this systematic review. These studies comprised large prospective and retrospective cohort studies, cross-sectional analyses, case-control studies, and high-quality systematic reviews conducted across diverse geographic regions, including North America, Europe, Asia, and low- and middle-income countries. Study populations included children, adolescents, adults, and older individuals, allowing comprehensive evaluation of obesity-related health effects across the life course. Most studies defined obesity using body mass index (BMI), while several incorporated additional measures of adiposity such as waist circumference and waist-to-hip ratio. Collectively, the included studies examined a broad spectrum of health outcomes, with cardiometabolic disorders representing the most frequently assessed domain, followed by respiratory, musculoskeletal, hepatic, renal, reproductive, psychological, oncological, and mortality outcomes [34].

Cardiometabolic Health Outcomes:

Cardiometabolic outcomes were the most consistently reported and robustly associated with obesity across the included studies. The majority of cohort studies demonstrated a strong, dose-dependent relationship between increasing BMI and the incidence of type 2 diabetes mellitus, with obese individuals exhibiting several-fold higher risk compared with normal-weight counterparts [35]. This association persisted even after adjustment for age, sex, physical activity, smoking status, and socioeconomic factors, underscoring obesity as an independent risk factor. Several studies further reported that individuals classified as “metabolically healthy obese” still faced elevated long-term risk of developing diabetes, challenging the notion that absence of metabolic abnormalities confers protection [36].

Obesity increases the risk of heart problems like high blood pressure, bad cholesterol, heart attacks, stroke, and heart failure. Regarding cardiovascular disease, obese people consistently face higher chances of developing these conditions. Long-term studies actually showed that obese people definitely have more heart problems and strokes. The risk actually increases as BMI rises across different weight groups [37]. Research clearly showed that obesity surely causes heart problems directly through ways that are different from usual risk factors, it increases heart workload, makes the left heart chamber bigger, and damages blood vessel function [38]. Further, basically, all these results show that obesity is the main cause behind heart and metabolic diseases.

Respiratory Outcomes: Breathing problems showed a strong connection with obesity in both

adults and children regarding health outcomes. We are seeing many studies showing that obese people have smaller lung volumes and poor breathing function, even when they have no lung disease [39]. Obesity was further strongly connected to higher rates and severity of obstructive sleep apnea, as excess body fat itself causes upper airway narrowing and intermittent low oxygen levels [40]. People with asthma and lung disease who are overweight surely have worse symptoms and need more medical care. Moreover, their usual treatments are less effective than others [41].

Musculoskeletal and Functional Outcomes: Musculoskeletal complications emerged as a significant consequence of obesity in many studies. Excess body weight was consistently associated with higher incidence and faster progression of osteoarthritis, particularly affecting the knee and hip joints [42]. Obese individuals reported greater levels of chronic joint pain, reduced mobility, and functional limitations, which frequently led to decreased physical activity and further weight gain. Several studies also highlighted the concept of sarcopenic obesity in older adults, characterized by increased fat mass alongside reduced muscle strength and physical performance, which was associated with frailty, falls, and disability [43].

Hepatic and Renal Outcomes: A substantial body of evidence linked obesity with non-alcoholic fatty liver disease (NAFLD). Across included studies, obesity was identified as the strongest risk factor for hepatic steatosis and disease progression to non-alcoholic steatohepatitis, fibrosis, and cirrhosis [44]. Longitudinal data suggested that higher degrees of adiposity were associated with increased risk of advanced liver disease and liver-related mortality. Similarly, obesity was associated with increased risk of chronic kidney disease, mediated through mechanisms such as glomerular hyperfiltration, obesity-related hypertension, and diabetes [45].

Reproductive and Hormonal Outcomes: Several studies evaluated the effects of obesity on reproductive and hormonal health. In women, obesity was associated with menstrual irregularities, polycystic ovary syndrome, infertility, and adverse pregnancy outcomes, including gestational diabetes, hypertensive disorders, and increased cesarean delivery rates [46]. In men, obesity was linked to reduced testosterone levels, impaired spermatogenesis, and decreased fertility [47]. These reproductive effects reflected broader endocrine disturbances associated with excess adiposity.

Mental Health and Psychosocial Outcomes: Mental health outcomes were increasingly recognized in the included literature. Obesity was associated with higher prevalence of depression, anxiety, and reduced quality of life, particularly among women and adolescents [48]. Several studies emphasized the role of weight-related stigma and discrimination in exacerbating psychological distress and contributing to maladaptive coping behaviors such as emotional eating, thereby reinforcing obesity and associated health risks [49].

Cancer Risk and Mortality: Evidence from large cohort studies and pooled analyses demonstrated that obesity was associated with increased risk of several malignancies, including breast (postmenopausal), colorectal, endometrial, pancreatic, liver, and kidney cancers [50]. Proposed mechanisms included hyperinsulinemia, chronic inflammation, altered sex hormone metabolism, and impaired immune surveillance. Mortality analyses consistently indicated higher all-cause mortality among individuals with severe obesity, although risk estimates varied by age, sex, smoking status, and duration of follow-up [51]. Importantly, central obesity measures often showed stronger associations with mortality than BMI alone.

Summary of Health Effects of Obesity Across Major Domains

| Health Domain | Key Outcomes Associated with Obesity |
|--------------------|--|
| Cardiometabolic | Type 2 diabetes, hypertension, CVD, stroke |
| Respiratory | Sleep apnea, reduced lung function |
| Musculoskeletal | Osteoarthritis, disability, frailty |
| Hepatic | NAFLD, cirrhosis |
| Renal | Chronic kidney disease |
| Reproductive | Infertility, pregnancy complications |
| Mental Health | Depression, reduced quality of life |
| Cancer & Mortality | Increased cancer risk, higher mortality |

Discussion

This systematic review provides comprehensive evidence that obesity exerts profound and wide-ranging effects on health, reinforcing its classification as a chronic, systemic disease rather than a condition limited to excess body weight. Across the 86 included studies, obesity was

consistently associated with adverse outcomes spanning cardiometabolic, respiratory, musculoskeletal, hepatic, renal, reproductive, psychological, oncological, and mortality domains. The convergence of findings across diverse populations, geographic regions, and study designs strengthens confidence in the observed associations

and highlights obesity as a central driver of global disease burden [52].

One of the most robust findings of this review is the strong association between obesity and cardiometabolic disease. Obesity-related insulin resistance emerged as a key mechanistic pathway linking excess adiposity to type 2 diabetes mellitus, with chronic low-grade inflammation, ectopic fat deposition, and altered adipokine signaling contributing to progressive metabolic dysfunction [53]. Importantly, evidence indicating elevated cardiometabolic risk even among individuals classified as “metabolically healthy obese” challenges traditional risk stratification models and underscores the latent pathogenic potential of excess adiposity [54]. Cardiovascular outcomes further reflected both indirect effects mediated by hypertension and dyslipidemia and direct effects of obesity, including increased cardiac workload, myocardial remodeling, and endothelial dysfunction [55].

Respiratory consequences of obesity were also consistently demonstrated across the included studies. Excess adiposity was shown to impair pulmonary mechanics through reduced lung compliance, decreased functional residual capacity, and increased airway resistance, resulting in dyspnea and reduced exercise tolerance even in individuals without overt lung disease [56]. The strong association between obesity and obstructive sleep apnea represents a particularly important clinical concern, as intermittent hypoxia and sleep fragmentation further amplify cardiometabolic and neurocognitive risk [57]. In patients with asthma and chronic obstructive pulmonary disease, obesity was associated with worsened symptom control and reduced responsiveness to pharmacological treatment, suggesting that obesity modifies disease phenotype and therapeutic outcomes [58].

Obesity actually puts a lot of stress on muscles and bones in many different ways. This burden is definitely serious and affects multiple parts of the body. Basically, when joints like the knee and hip carry too much weight, they develop the same problem of osteoarthritis, and it gets worse over time. As per research findings, metabolic inflammation from obesity can speed up cartilage breakdown and joint damage [59]. This happens regarding factors beyond just mechanical wear and tear. Basically, when people have muscle and joint pain, they move less, which makes them gain more weight and become more disabled - it's the same cycle that keeps repeating [60]. We are seeing that finding sarcopenic obesity in older adults only shows the difficult connection between too much body fat, muscle loss, weakness, and higher chances of falling and needing help [61].

Hepatic and renal outcomes highlighted the systemic metabolic consequences of obesity. Moreover, these findings confirmed that obesity creates widespread metabolic problems throughout the system. As per research findings, fatty liver disease without alcohol is one of the most common and serious health problems related to obesity, with excess weight being the main risk factor regarding disease progression to severe liver damage and cirrhosis [62]. Obesity actually causes kidney disease through two main ways: it changes blood flow in the kidneys and definitely creates metabolic problems from insulin resistance and inflammation [63]. Basically, we need to find and treat obesity early because the same organ damage can become permanent if we wait too long.

Obesity further causes problems in reproduction and hormones, which shows how it disrupts the endocrine system itself. In women, being overweight actually changes how the body uses insulin and processes hormones, which definitely leads to problems like polycystic ovary syndrome, difficulty getting pregnant, and complications during pregnancy [64]. In men, obesity causes low hormone levels and poor sperm production, which further shows how excess weight itself affects reproductive health and hormone function [65]. As per the findings, these results affect not only personal health but also regarding passing metabolic risk from parents to children.

Psychological and psychosocial outcomes were prominent across the reviewed literature. Higher prevalence of depression, anxiety, and reduced quality of life among individuals with obesity reflects both biological mechanisms—such as inflammation and neuroendocrine dysregulation and social factors, including stigma and discrimination [66]. Weight stigma emerged as a critical but often underrecognized determinant of mental health, treatment avoidance, and maladaptive coping behaviors, reinforcing the need for compassionate, stigma-free clinical care [67].

The association between obesity and increased cancer risk further emphasizes its role as a multisystem disease. Chronic inflammation, hyperinsulinemia, altered sex hormone levels, and impaired immune surveillance are likely contributors to the observed increased incidence of several malignancies [68]. Mortality analyses consistently demonstrated increased all-cause mortality among individuals with severe obesity, although heterogeneity across age groups and smoking status highlights the complexity of obesity, mortality relationships [69].

From a clinical and public health perspective, the findings of this review have important implications. They support early, comprehensive, and sustained interventions targeting obesity to prevent

progression to multimorbidity and disability. Importantly, reliance on body mass index alone may underestimate individual risk, and emerging frameworks advocating for complication-based staging of obesity may offer more clinically meaningful risk stratification [70]. Public health strategies addressing obesogenic environments, food systems, physical inactivity, sleep disruption, and socioeconomic determinants are essential to curb the rising prevalence of obesity and its associated health burden [71].

Despite the strengths of this review, including broad scope and synthesis across multiple health domains, several limitations warrant consideration. The predominance of observational studies limits causal inference, and residual confounding cannot be fully excluded. Variability in obesity definitions and outcome assessment methods may also contribute to heterogeneity across studies. Nevertheless, the consistency of findings across populations and settings supports the robustness of the observed associations [72].

Future research should prioritize longitudinal studies with standardized adiposity measures, incorporation of body composition and fat distribution metrics, and evaluation of long-term outcomes following weight reduction interventions. Greater attention to vulnerable populations and life-course perspectives will further enhance understanding of obesity-related health effects [73].

Conclusion

This systematic review demonstrates that obesity is a complex, multisystem disease with far-reaching consequences for physical, metabolic, psychological, and overall health. Evidence synthesized from 86 studies consistently shows that excess adiposity significantly increases the risk of cardiometabolic disorders, respiratory impairment, musculoskeletal disability, hepatic and renal dysfunction, reproductive and hormonal disturbances, mental health conditions, multiple cancers, and premature mortality. These adverse outcomes are driven by interconnected mechanisms including insulin resistance, chronic low-grade inflammation, altered adipokine secretion, endothelial dysfunction, mechanical overload, and neuroendocrine dysregulation. Importantly, health risks increase progressively with the degree and duration of obesity and are not fully mitigated by the absence of overt metabolic abnormalities, challenging the concept of “benign” obesity. The findings underscore the need to reconceptualize obesity as a chronic disease requiring early identification, comprehensive risk stratification, and sustained, multidisciplinary management. Public health policies addressing obesogenic environments, alongside individualized clinical interventions that are compassionate and stigma-free, are essential to

reduce the growing global burden of obesity-related morbidity and mortality.

References

1. World Health Organization. Obesity and overweight. WHO Fact Sheet.
2. Blüher M. Obesity: global epidemiology and pathophysiology. *Nat Rev Endocrinol*.
3. Hruby A, Hu FB. The epidemiology of obesity: a big picture. *Pharmacoeconomics*.
4. Grundy SM. Obesity, metabolic syndrome, and cardiovascular disease. *J Clin Endocrinol Metab*.
5. Bray GA, Kim KK, Wilding JPH. Obesity: a chronic relapsing disease. *Lancet*.
6. Calle EE, Thun MJ. Obesity and cancer. *Oncogene*.
7. Kahn SE, Hull RL, Utzschneider KM. Mechanisms linking obesity to insulin resistance. *Nature*.
8. Eckel RH, Grundy SM, Zimmet PZ. The metabolic syndrome. *Lancet*.
9. Poirier P, et al. Obesity and cardiovascular disease. *Circulation*.
10. Lavie CJ, et al. Obesity and prognosis in cardiovascular disease. *J Am Coll Cardiol*.
11. Dixon JB. The effect of obesity on health outcomes. *Obes Rev*.
12. Ng M, et al. Global prevalence of overweight and obesity. *Lancet*.
13. Afshin A, et al. Health effects of overweight and obesity. *N Engl J Med*.
14. Must A, et al. Long-term morbidity and mortality of overweight adolescents. *N Engl J Med*.
15. Prospective Studies Collaboration. Body-mass index and cause-specific mortality. *Lancet*.
16. Van Gaal LF, et al. Mechanisms linking obesity with cardiovascular disease. *Nature*.
17. Haslam DW, James WPT. Obesity. *Lancet*.
18. Stefan N, Häring HU. Metabolically healthy obesity. *Lancet Diabetes Endocrinol*.
19. Fox CS, et al. Abdominal obesity and cardiovascular risk. *Circulation*.
20. Bays HE. Adiposopathy: obesity as a disease. *Endocr Pract*.
21. Hall JE, et al. Obesity-induced hypertension. *Hypertension*.
22. Després JP. Body fat distribution and cardiovascular risk. *Circulation*.
23. Piché ME, et al. Regional adiposity and cardiometabolic risk. *Nat Rev Endocrinol*.
24. Wild SH, et al. Obesity and the risk of chronic disease. *BMJ*.
25. Moher D, et al. PRISMA 2020 statement. *BMJ*.
26. Page MJ, et al. PRISMA 2020 explanation and elaboration. *BMJ*.
27. Higgins JPT, et al. *Cochrane Handbook for Systematic Reviews*.
28. von Elm E, et al. STROBE statement. *Lancet*.

29. Wells G, et al. Newcastle-Ottawa Scale.
30. Munn Z, et al. Systematic review synthesis methods. JBI Evid Synth.
31. Guyatt GH, et al. GRADE guidelines. BMJ.
32. Liberati A, et al. The PRISMA statement. PLoS Med.
33. Popay J, et al. Narrative synthesis in systematic reviews.
34. Hu FB, et al. Obesity and risk of type 2 diabetes. Diabetes Care.
35. Bell JA, et al. BMI trajectories and diabetes risk. Lancet Diabetes Endocrinol.
36. Kramer CK, et al. Metabolically healthy obesity and diabetes. Ann Intern Med.
37. Kenchaiah S, et al. Obesity and heart failure risk. N Engl J Med.
38. Powell-Wiley TM, et al. Obesity and cardiovascular disease. Circulation.
39. Salome CM, et al. Obesity and lung function. J Appl Physiol.
40. Young T, et al. Obesity and sleep apnea. N Engl J Med.
41. Peters U, et al. Obesity and asthma outcomes. Thorax.
42. Felson DT. Obesity and osteoarthritis. Best Pract Res Clin Rheumatol.
43. Cruz-Jentoft AJ, et al. Sarcopenic obesity. Age Ageing.
44. Younossi ZM, et al. NAFLD and obesity. Hepatology.
45. Kovesdy CP, et al. Obesity and kidney disease. Nat Rev Nephrol.
46. Ramlau-Hansen CH, et al. Obesity and female fertility. Hum Reprod.
47. Jensen TK, et al. Obesity and male reproductive health. Nat Rev Endocrinol.
48. Luppino FS, et al. Obesity and depression. Arch Gen Psychiatry.
49. Puhl RM, Heuer CA. Obesity stigma. Obesity.
50. Renehan AG, et al. Body-mass index and cancer risk. Lancet.
51. Bhaskaran K, et al. BMI and mortality. Lancet Diabetes Endocrinol.
52. Pi-Sunyer X. The medical risks of obesity. Postgrad Med.
53. Hotamisligil GS. Inflammation and metabolic disorders. Nature.
54. Stefan N, et al. Obesity phenotypes. Nat Rev Endocrinol.
55. Alpert MA, et al. Obesity cardiomyopathy. Prog Cardiovasc Dis.
56. Littleton SW. Impact of obesity on respiratory function. Respirology.
57. Jordan AS, et al. Sleep apnea and obesity. Lancet Respir Med.
58. Dixon AE, et al. Obesity and asthma therapy. Am J Respir Crit Care Med.
59. Messier SP, et al. Obesity, knee pain, and function. Arthritis Rheum.
60. Vincent HK, et al. Obesity and disability. PM&R.
61. Baumgartner RN. Body composition and aging. Am J Clin Nutr.
62. Tilg H, et al. NAFLD pathogenesis. Nat Rev Gastroenterol Hepatol.
63. Hall JE, et al. Obesity-associated kidney disease. Hypertension.
64. Pasquali R, et al. Obesity and PCOS. Endocr Rev.
65. Hammoud AO, et al. Male obesity and fertility. Fertil Steril.
66. Faith MS, et al. Obesity and mental health. Curr Opin Psychiatry.
67. Tomiyama AJ. Weight stigma and health. Annu Rev Clin Psychol.
68. Calle EE, Kaaks R. Overweight, obesity and cancer. Eur J Cancer.
69. Adams KF, et al. Overweight, obesity, and mortality. N Engl J Med.
70. Rubino F, et al. Redefining obesity as a disease. Lancet Diabetes Endocrinol.
71. Swinburn BA, et al. Global obesity prevention strategies. Lancet.
72. Hruby A, et al. Limitations in obesity research. Obes Rev.
73. Singh AS, et al. Tracking of childhood obesity. Obes Rev.