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Coexistence of Overweight & Undernutrition in Adults: Patterns, Pathways & Public health Implications – A Review

by

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PG/24/094

Under the guidance of

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PGDM (Hospital & Health Management)

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- Research activities that have high relevance to health policies and programs at national and global level while promoting innovation in healthcare management and delivery

- Continued education and capacity building through management development programs and executive programs for working professionals to help them upgrade their knowledge and skills in response to the emerging needs of the industry.

- Technical consultations and assistance to the national and state-level flagship programs to address the gaps in planning, monitoring, implementation as well as evaluation.

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Sincerely,

Saloni Khurana

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List of Abbreviations

Abbreviation	Full Form
BMLM	Bayesian Multilevel Modelling
BMI	Body Mass Index
CINAHL	Cumulative Index to Nursing and Allied Health Literature
DBM	Double Burden of Malnutrition
DEXA	Dual-Energy X-ray Absorptiometry
DHS	Demographic and Health Survey
FAO	Food and Agriculture Organization of the United Nations
GLIM	Global Leadership Initiative on Malnutrition
IFAD	International Fund for Agricultural Development
IIHMR	International Institute of Health Management Research
LMIC	Low- and Middle-Income Country
MEDLINE	Medical Literature Analysis and Retrieval System Online
MNA	Mini Nutritional Assessment
MUST	Malnutrition Universal Screening Tool
NAAC	National Assessment and Accreditation Council
NCD	Non-Communicable Disease
NFHS	National Family Health Survey
PG-SGA SF	Patient-Generated Subjective Global Assessment Short Form
POSHAN	Prime Minister's Overarching Scheme for Holistic Nourishment (Abhiyaan)

PRISMA	Preferred Reporting Items for Systematic Reviews and Meta-Analyses
PubMed	Public Medical Database (U.S. National Library of Medicine)
SES	Socioeconomic Status
SOFI	State of Food Security and Nutrition in the World (Report)
UK	United Kingdom
UNICEF	United Nations Children's Fund
USA	United States of America
WFP	World Food Programme
WHO	World Health Organization

Abstract

Coexistence of Overweight and Undernutrition in Adults: Patterns, Pathways, and Public Health Implications — A Narrative Review

Background Undernutrition and overweight/obesity are often treated as opposite conditions, yet evidence shows they frequently coexist in the same individual. This review examined the prevalence, mechanisms, and screening challenges of undernutrition in overweight and obese adults.

Methods Following PRISMA guidelines, six academic databases and grey literature from WHO, FAO, and UNICEF were searched. Thirty studies from six world regions (2012–2026) were included.

Results Deficiencies in iron, vitamin D, zinc, B12, and folate affected 15–60% of overweight and obese adults, driven by chronic inflammation, adipose vitamin sequestration, gut microbiota changes, and nutrient-poor diets. Deficiencies appeared from a BMI as low as 25–30 kg/m², not only in severe obesity. Older adults and low-income or rural/slum populations were most affected. Standard screening tools performed poorly, missing most at-risk patients, while BMI-independent tools and the GLIM framework performed substantially better.

Conclusion Undernutrition in overweight and obese adults is common, biologically explainable, and routinely missed by current screening. Clinical practice should adopt BMI-independent screening, and policy should integrate micronutrient assessment into existing nutrition programs. Further research is needed in low- and middle-income settings, with standardized definitions and longitudinal data.

CHAPTER 1

Coexistence of Overweight and Undernutrition in Adults: Patterns, Pathways, and Public Health Implications -Narrative Review

1.1 Research Question

What are the prevalence and risk factors for undernutrition among overweight and obese adults, and which variables are associated with this risk?

1.2 Main Goal

To evaluate the prevalence of undernutrition among overweight and obese adults in varied populations and settings.

1.3 Secondary Objectives

- **Prevalence:** To determine the prevalence of undernutrition and deficiencies in key micronutrients (iron, zinc, vitamin D, and vitamin B12) among overweight and obese adults throughout different countries and income groups.
- **Risk Factors:** To identify populations at highest risk by examining variables such as age, sex, income, education level, and urban or rural residence.
- **Micronutrient Deficiencies:** To characterize the most prevalent micronutrient deficiencies in overweight and obese adults and to clarify the mechanisms through which obesity contributes to these deficiencies.
- **Screening Tools:** To compare the effectiveness of nutritional screening tools in detecting undernutrition among overweight and obese adults, with particular focus on tools validated for individuals with a BMI of 25 or higher.

- **Research Gaps:** To identify areas warranting further research, including neglected regions, age groups, and settings.

1.4 Introduction

Malnutrition includes a broader range of nutritional deficiencies than most people usually perceive. The World Health Organization identifies three specific types: undernutrition (which consists of wasting, stunting, and underweight), micronutrient deficiency or surplus, and overweight or obesity. (1) Throughout most of the twentieth century, clinical practice and public health policies viewed undernutrition and obesity as distinct categories—undernutrition was seen as a problem confined to low-income countries and poor households, while obesity was considered a result of wealth. Modern evidence has thoroughly challenged this dichotomy. Being overweight is not synonymous with nutritional sufficiency, and the simultaneous presence of excess body fat alongside deficiencies in vital vitamins and minerals is now recognized across all regions and income levels.

The scale of both problems and their increasingly overlapping geography is striking. By 2022, approximately 2.5 billion adults were overweight globally — including 890 million classified as obese — while 390 million adults remained underweight. (2) Adult obesity rose from 12.1% in 2012 to 15.8% in 2022 and is projected to exceed 1.2 billion individuals by 2030, having tripled compared to 1975 levels, with the fastest increases recorded in low- and middle-income countries (LMICs). (2, 3) More than one in three LMICs now simultaneously face high rates of both undernutrition and overweight at the national level — a situation described as the double burden of malnutrition (DBM). (4) A pooled analysis of 3,663 population-representative studies found that by 2022, obesity had surpassed underweight as the dominant form of malnutrition in most world regions, while the combined burden of both continued to rise. (5) In Lesotho, a nationally representative survey conducted in 2023–2024

found that 15.2% of adults were underweight while 36.6% were overweight or obese, showing how starkly both ends of malnutrition occur together in the same population. (6) The world is currently not on track to meet any of the seven global nutrition targets set for 2025 and 2030. (7)

The double burden of malnutrition refers to the concurrent presence of undernutrition and overweight or obesity at the individual, household, or population level. The 2019 Lancet Commission on the Global Syndemic placed this problem within a wider systemic frame, characterizing obesity, undernutrition, and climate change as three linked crises driven by the same root failures — dysfunctional food systems, deepening poverty, and disparate access to nutritious food. (8) Despite the breadth of this recognition, the double burden lacks a universally agreed operational definition even at the research level, with wide variation across studies in how individual, household, and population-level coexistence remain measured and reported — a finding that hampers both policy planning and cross-study comparison. (9)

The biological pathways through which excess body weight gives rise to micronutrient deficiency are well characterized. Obesity is associated with chronic low-grade systemic inflammation, which upregulates hepcidin — a hormone that suppresses intestinal iron absorption and blocks iron release from storage — producing functional iron deficiency even when dietary iron intake appears adequate. (10) Adipose tissue acts as a physiological reservoir for fat-soluble vitamins, particularly vitamin D, sequestering circulating stores and causing blood levels to remain low even in individuals with adequate sun exposure or dietary intake. (11) Changes in gut microbiota composition — increasingly documented in obese individuals — impair the production and absorption of B vitamins, including vitamin B12 and folate. (10, 11) Beyond these metabolic disruptions, the dietary patterns most associated with excess caloric intake — dominated by ultra-processed foods, refined carbohydrates, and

sugar-sweetened beverages — are precisely those with the lowest micronutrient density. (12, 13) The consequence is that the same dietary pattern that drives weight gain simultaneously deprives the body of essential vitamins and minerals. These deficiencies are not confined to severe obesity; they have been documented in adults with a BMI between 25 and 30 kg/m², indicating that the problem begins at the threshold of overweight. (11)

The health consequences of concurrent micronutrient deficiency and overweight are additive and interactive. Iron deficiency impairs immune function, cognitive performance, and exercise capacity, and is a major contributor to anemia — the most prevalent nutritional disorder globally. (10) A deficiency in vitamin D is linked to an increased risk of type 2 diabetes, heart disease, and deterioration of musculoskeletal health, all of which occur more frequently in overweight individuals. (11, 14) Zinc deficiency compromises wound healing and immune monitoring. Folate inadequacy elevates homocysteine concentrations, causing cardiovascular risk and neural tube defects in the offspring of affected women. (16, 17) The nutrients that tend to be deficient in adults who are overweight, including iron, zinc, vitamin D and vitamin B 12, are critical to glucose metabolism and insulin signaling; therefore, when an adult is deficient in these vitamins, they are likely to experience increased signs of metabolic dysfunction as a result of obesity, thus increasing their risk for type 2 diabetes. (10) When someone has poor nutrition early in their life and subsequently eats too much there is an increased risk of disease to them throughout their lifetime due to changes in how certain genes are expressed by their body over time. Additionally, if females experience poor nutrition in the previous two stages (early-life undernutrition and excess caloric intake later on), they will likely experience more obstetrical problems and pass down future generations with these same vulnerabilities. (13)

The regional evidence base illustrates both the breadth of the problem and its particular acuity in transitional economies. In India, adult underweight fell by approximately 13 percentage

points between 2006 and 2016, while overweight and obesity doubled from 10% to 21%, with the steepest increases concentrated in rural areas and urban slums — communities already carrying the highest burden of undernutrition. (19) Spatial analysis confirmed that underweight and overweight most frequently occur together in the same districts, driven by overlapping poverty, food insecurity, and poor diet quality. (12) In rural South India, caste, income, and gender intersect in affecting who within a community carries the individual-level double burden. (21) Across Latin America, iron, zinc, vitamin A, and vitamin D deficiencies persist alongside rapidly rising rates of obesity, with non-communicable diseases now comprising roughly half of all disability-adjusted life-years in the region. (22) In South Asia more broadly, the double burden is compounding into what researchers have described as a triple burden, as high background rates of infection add a further layer of nutritional depletion. (20) Sub-Saharan Africa is experiencing a parallel transition, with stunting and adult overweight coexisting at increasing rates, particularly among women of reproductive age and urban youth. (4) Even in high-income countries, the double burden is clinically significant: data from France estimated that 23% of overweight older adults and 29% of obese older adults were at risk of undernutrition — implying more than 1.7 million nutritionally vulnerable overweight older adults in France alone. (15)

Despite the breadth of this evidence, malnutrition in overweight and obese adults remains systematically under identified in clinical settings. The majority of nutritional screening tools in routine use were developed at a time when malnutrition was understood primarily as a consequence of insufficient weight. Instruments such as the Malnutrition Universal Screening Tool (MUST) rely on low BMI and unintentional weight loss as primary screening criteria; in individuals with overweight or obesity, both criteria are often absent, even when micronutrient deficiencies and functional impairment are present. (23, 24) A direct comparison of MUST and the Patient-Generated Subjective Global Assessment Short Form

(PG-SGA SF) in hospitalized patients found that MUST identified only 5% of overweight and obese patients as at nutritional risk, compared to 36% identified by PG-SGA SF — a tool that assesses food intake, symptoms, and physical function independently of body size. (25) This systematic failure has been characterized as the real paradox of hospital nutrition: obese patients are assumed to be nutritionally safe precisely because of their size, while genuine deficiencies go undetected and untreated. (24) The Global Leadership Initiative on Malnutrition (GLIM) framework, published in 2019, represents the most substantive advance in filling this gap, using a two-step process that combines initial screening with assessment of phenotypic and etiological criteria — including muscle mass, disease burden, and nutritional intake — independently of BMI. (26) At the policy level, most national nutrition strategies continue to address undernutrition and obesity through separate institutional mandates, with few integrated frameworks for populations who carry both burdens simultaneously. (27)

This current view brings together evidence from peer-reviewed studies, national surveys, and grey literature from major international organizations to examine the coexistence of undernutrition and overweight or obesity in adults. The search covered six academic scientific databases PubMed/MEDLINE, Scopus, Web of Science, CINAHL, Cochrane Library, and Embase — alongside WHO, FAO, and UNICEF reports, and doctoral research from Shodhganga and ProQuest, following the PRISMA framework. (28) A total of 30 studies were included after screening by title, abstract, and full text. (9, 29) The review is organized around five themes corresponding to the secondary objectives: the prevalence of undernutrition and micronutrient deficiencies; demographic and socioeconomic risk factors; biologic mechanisms causing deficiency; the comparative performance of nutritional screening tools; and the identification of research gaps. No country is currently on track to meet all global nutrition targets, and financing for nutrition is still insufficient and poorly

tracked throughout regions worldwide. (30) The findings are intended to be of practical use to clinicians, programme designed decision-makers working in nutrition and public health — particularly in LMICs where the double burden is advancing most rapidly and where integrated policy responses remain least developed

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction to the Literature

This chapter presents a structured review of the 30 sources selected for review. Each source is discussed individually in the order of its citation number, which reflects the sequence in which the references first appear in the text. The sources range from global international surveillance reports and commission papers through to single-country surveys, clinical screening studies, and conceptual reviews. Together they cover the full scope of this review's thematic issues concerns: the prevalence of undernutrition and micronutrient deficiency in overweight and obese adults; the demographic social and economic factors associated with elevated nutritional risk; the biological mechanisms associating linking obesity to micronutrient depletion; the performance of nutritional screening tools in this population; and the identification of research and policy gaps. The 30 sources are drawn from six world regions and encompass study designs that include cross-sectional national surveys, pooled multi-country analyses, clinical observational studies, expert consensus reports, and policy documents from the World Health Organization, the Food and Agriculture Organization, and allied bodies.

2.2 Review of Individual Sources

World Health Organization — Malnutrition Fact Sheet (2024) (1)

The World Health Organization's Malnutrition Fact Sheet, updated in 20 offers the foundational conceptual framework for this review. Firstly, the fact sheet categorizes malnutrition into three main areas: undernutrition (wasting, stunting, and underweight); micronutrient deficiency or excess; and overweight and obesity. Secondly, malnutrition is considered the most serious global public health issue. One of the more important statements

in the fact sheet is that malnutrition is prevalent among 20% to 60% of hospitalized people worldwide. This means that malnutrition is not only prevalent among food-insecure people but also among patients in hospitals, regardless of their social and economic background. The WHO is quite clear on the fact that malnutrition is both a risk factor for disease as well as a condition that stems from other diseases due to processes such as immunity impairment, poor physical and mental development and recovery from other illnesses. In line with that, the WHO calls for a unified nutrition policy that addresses all forms of malnutrition. For the purposes of this literature review, the WHO categorization is particularly relevant, as it officially recognizes that obesity and overweight should be considered forms of malnutrition rather than merely excess.

The State of Food Security and Nutrition in the World 2024 (2)

The State of Food Security and Nutrition in the World 2024, produced jointly by the Food and Agriculture Organization of the United Nations, the International Fund for Agricultural Development, UNICEF, the World Food Programme, and the WHO, is the most comprehensive annual global assessment of nutritional status available. Its 2024 edition provides the headline prevalence data that frame the scale of the double burden globally: adult obesity increased from 12.1% in 2012 to 15.8% in 2022, and is projected to exceed 1.2 billion individuals by 2030. At the same time, the report documents that micronutrient deficiencies remain widespread in both high- and low-income countries, including among populations with adequate high calorific intake. Critically, the report finds that the world is not on track to meet any of the seven global nutrition targets set for 2025 and 2030. These include targets for stunting, wasting, anemia in women of reproductive age, exclusive breastfeeding, childhood overweight, and adult obesity — a finding that reflects the failure of existing frameworks intended to adequately address the full spectrum of malnutrition simultaneously. Worldwide surveillance data presented in this repo are necessary for

contextualizing the individual-country and regional findings shown elsewhere in this review. The observation that obesity and micronutrient deficiency are advancing in parallel — and that neither is being addressed at the pace required by international commitments — reinforces the immediacy of integrated approaches which address both forms of nutritional failure within a single policy and programmatic framework.

NCD Risk Factor Collaboration — Trends in Adult BMI in 200 Countries, 1975–2014 (3)

This landmark pooled analysis, published in The Lancet in 2016 by the NCD Risk Factor Collaboration, drew on data from 1,698 population-based measurement studies encompassing 19.2 million adult participants across 200 countries to document trends in mean BMI and in the prevalence of underweight and obesity from 1975 to 2014. These results showed various crucial findings that serve as the bedrock for the current understanding of the global nutrition transition. The prevalence of obesity among adults tripled during the period under analysis: from about 3.2% to 10.8% for men, and from 6.4% to 14.9% for women, from 1975 to 2014. The mean Body Mass Index of adults rose in virtually all the countries that participated in the research, without any reversal of this positive trend in obesity. Importantly, from the standpoint of the double burden issue, the rapid increase in obesity rates was documented mostly for the countries and regions belonging to the Low and Middle-Income category, whereas the underweight rates dropped but still constituted a serious health burden. Hence, the convergence of these two problems, namely increasing obesity on the one hand and undernutrition on the other, creates the very background against which the double burden develops. Finally, based on its data, the research predicted that by 2025, 18% of adults worldwide will be obese and, consequently, the number of obese adults globally will outnumber those who are underweight, with the exception of some regions in Sub-Saharan Africa and Asia.

Unveiling the Crisis of the Double Burden of Malnutrition (4)

Published in The Lancet Global Health in 2024, this epidemiological commentary by Shieldingly and Mwangi offers a critical assessment of the double burden of malnutrition in LMICs, characterizing it as a crisis advancing faster than public health systems have recognized or responded to. According to the authors, more than 1/3 of low- and middle-income countries now experience both undernutrition and overweight at high levels at the national level; this is a major change from 2000, when the co-existence of these two nutritional problems was uncommon. One main conclusion of this report is policy developments have not kept pace with what scientists know about the epidemiology of these problems; that is, the country's nutrition programs and international programs addressing undernutrition and obesity are still using separate organizational channels to accomplish their goals—through different monitoring systems, intervention portfolios, and different funding streams. This organizational separation, of course, results in a situation where those populations that are most likely to be affected by co-existing malnutrition (e.g., individuals living in low-income urban and peri-urban areas of transition economies) will fall outside of the parameters of programs designed specifically to deal with either of the two extremes. So, the authors advocate that there should be integrated surveillance systems capable of measuring the two problems at the same time and that policy actions should be taken to address the shared structural determinants of undernutrition and obesity together. This is definitely applicable to this review, since it emphasizes the larger governance failure that permits both continued and worsening incidence of micronutrient deficiency and the concurrent presence of overweight to occur.

NCD Risk Factor Collaboration — Worldwide Trends in Underweight and Obesity, 1990–In 2024, The Lancet published a comprehensive pooled analysis of global trends associated with both underweight and obesity among all age groups—children and adults.

This major analysis comprised 3,663 population-representative studies (222 million total participants) from 200 countries and was able to provide trend estimates and the accompanying uncertainty of these estimates across the globe from 1990 to 2022, using Bayesian multilevel modelling (BMLM). The results are remarkable: as of 2022, there were 880 million adults with obesity and 160 million children with obesity worldwide, thus obesity has become the dominant form of malnutrition in most regions of the world, overtaking underweight. Although there has been a relative shift in the number of underweight persons, the absolute number of underweight persons has not decreased at all, and continues to be considerable especially in South Asia and also in some regions of sub-Saharan Africa. The overall burden of underweight and obesity continued to grow across most of the countries that were part of this study, confirming globally what prior studies of smaller regions have shown: The two types of malnutrition are not replacing each other, but are both occurring around the world at the same time, and often in the same places and the same national populations. The study explicitly calls for a coordinated effort to reduce under-nutrition and over-nutrition within the same population, and rejects the historically prevailing sequential approach to malnutrition, by stating that addressing under-nutrition should be done first and over-nutrition should occur later as the current practice as it relates to international nutrition policy planning and programming for LMIC countries. Due to the methodology of this study, and scale at which the data were obtained, this study is a critical source for any deliberations on the double burden issues and serves as an argument for purpose of this review.

Double Burden in Adults in Lesotho: 2023–2024 DHS (6)

The study published in PLOS Global Public Health in 2025 is one of the most current and geographically specific examples of the double burden of malnutrition across sub-Saharan Africa. Authors used data from the 2023–2024 Lesotho Demographic and Health Survey, a cross-sectional survey representative of the country's population and containing information

on 5,457 adults aged 18 to 49, to document that 15.2% of adults were underweight while 36.6% of adults were overweight or obese; thus, confirming that both types of malnutrition exist in the same population. Authors also examined how these two types of malnutrition are related to different socioeconomic and demographic characteristics: Overweight and obesity are much more prevalent among women and people of higher socioeconomic class, whereas underweight is more prevalent among men and younger adults. These patterns reflect the unequal nature of the nutritional transition in sub-Saharan Africa, where the shift toward higher-calorie diets and more sedentary lifestyles has progressed faster for some demographic groups than others, while food insecurity and insufficient intake continue to affect significant segments of these communities. The authors call for gender-sensitive, equity-focused nutrition strategies that can simultaneously address the nutritional needs of individuals at both ends of the spectrum within a single national programme architecture. This study is especially useful for this review because of its recency, its geographic specificity, and its demonstration that the double burden is not only a South Asian or Latin American phenomenon but is actively advancing across sub-Saharan Africa. **FAO — State of Nutrition: Progress Towards Global Nutrition Targets (7)**

This chapter, drawn from the 2024 edition of The State of Food Security and Nutrition in the World, provides a detailed assessment of global progress towards the seven nutrition targets adopted by the World Health Assembly. The result of this assessment is alarming: the world fails to achieve any of the seven set targets, including those for stunting, wasting, anemia in women of reproductive age, exclusive breastfeeding, childhood overweight, low birthweight, and adult obesity. The prevalence of adult obesity has dramatically risen in all world regions from 2012 to 2022; furthermore, the problem of high anemia rates among women of reproductive age persists worldwide – a situation that is especially relevant to this review, because iron-deficiency anemia is one of the most frequent forms of micronutrient

deficiencies in overweight and obese adults. In this chapter, it was noted that there is both insufficient funding to address nutrition issues and a lack of data on nutrition financing, which makes it impossible to assess whether resources are distributed proportionally to the problem's actual scale. Both of the above findings carry implications related to the topic of this review. On the one hand, the persistence of micronutrient inadequacy globally despite attempts to address it suggests that the problems described in this review form part of a broader issue.

The Global Syndemic: Lancet Commission Report (8)

The 2019 Lancet Commission on the Global Syndemic of Obesity, Undernutrition, and Climate Change is one of the most influential conceptual frameworks of global nutrition of the past few decades. As proposed by Swinburn et al., obesity, undernutrition, and climate change cannot be viewed as three distinct emergencies but rather as one global syndemic – that is, an emergency caused by the synergistic interaction between several epidemics that have the same systematic drivers. The main sources of the syndrome, as described by the Commission, were the brokenness of the food system, economic causes preventing people living in poverty from buying nutritious products, and the lack of incentives to change the status quo in politics and big corporations. In the report, the Commission stressed that dealing with these phenomena separately, which is what happens in national-level policies and worldwide agreements, is both theoretically unsound and economically wasteful: a broken food system brings about both obesity and malnutrition, while damage done to the environment in order to tackle climate change makes it harder to produce nutritious food. For the current paper, the report is relevant in two respects. From a theoretical point of view, it offers the most comprehensive explanation of how malnutrition and obesity are able to coexist, since they are produced by the same dysfunctional processes. From a practical

perspective, it argues for a shift from seeing double-duty interventions as preferable to necessary for tackling malnutrition and obesity simultaneously.

Double Burden: Systematic Review of Operational Definitions (9)

This study, authored by Davis, Oaks, and Engle-Stone, appeared in the journal Current Developments in Nutrition in 2020 and focused on what is arguably the most fundamental methodological rigor gap in researching the double burden—namely, the lack of an agreed-upon definition of the concept. Analyzing a sample of scholarly papers published over two decades, the authors found a marked lack of uniformity among scientists in defining and measuring the double burden at the individual, household, and population levels. In particular, some scholars define the double burden as the coexistence of overweight and any type of micronutrient deficiency, whereas other papers define it as the coexistence of overweight and stunting or wasting. Others define the double burden as the coexistence of overweight and anemia, or as nutritional variety. Household-level measures of the double burden differ in whether they require the coexistence of underweight and overweight individuals within one household or food security. At the population level, the cut-off points for classifying countries as suffering from the double burden of malnutrition, based on the prevalence of each type of malnutrition, also varied widely across reports. This lack of definition poses critical problems because analyses based on different definitions cannot be compared; hence, there can be no aggregation of findings or tracking of trends with any degree of certainty. The authors provide an approach for establishing standardized operational definitions at all three levels. For this review, the Davis et al. paper serves as a methodological anchor, explaining why the literature on the double burden appears more fragmented than the underlying phenomenon, and providing the conceptual vocabulary needed to interpret divergent findings across studies.

The Malnutrition of Obesity (10)

This 2012 narrative review, published in ISRN Endocrinology, was among the first papers to systematically examine the mechanisms by which obesity leads to micronutrient deficiencies and to trace the pathway from those deficiencies to the development of type 2 diabetes. Research has shown that overweight and obese persons show high levels of iron, zinc, vitamin D, thiamine, folate, and vitamin B12 deficiency at the same time as consuming an adequate number of calories. Analysis in this paper identified three main causes: 1) Poor diet quality - the foods consumed by people gaining weight are generally ultra-processed and high in calories and energy; therefore, calories are consumed without the associated vitamins and/or minerals. 2) Chronic, low-level inflammation caused by obesity, which negatively affects digesting and using the nutrients in foods, particularly through the upregulation of hepcidin, which inhibits iron absorption and inhibits the release of iron from storage sites in the body. 3) Fat-soluble vitamins (in particular, Vitamin D) that get stored in fat tissue led to a decrease in their bioavailability in the bloodstream even when the body has adequate stores. The authors outline the ways in which these deficiencies affect insulin resistance and glucose metabolism through the roles that iron, zinc, vitamin D, chromium, and magnesium play in both the insulin-signaling pathway and in how the insulin-producing beta cells in the pancreas function. The authors note that the connection between being overweight, micronutrient-deficient, and impaired metabolic function is mechanistic and significant clinically in which therefore these individuals have a greater risk of metabolic disease than other people without obesity-related micronutrient deficiencies or impairment of metabolic function. The Via paper remains a foundational reference for understanding the biological coherence of the double burden at the individual level.

Obesity and Micronutrient Deficiency: When and How to Supplement (11)

Published in Food and Nutrition Research in 2024, this descriptive and scoping review by Arafat, Mohammadi, and Ershad-Langroudi provides an updated synthesis of the evidence on micronutrient deficiencies in obesity, with particular attention to when and how supplementation is clinically warranted. The review extends the findings of earlier papers, such as Via's, by confirming that deficiencies in iron, vitamin D, zinc, vitamin B12, and folate are common in overweight and obese adults, and by demonstrating that these deficiencies are not confined to severe obesity but are measurably present at BMI levels between 25 and 30 kg/m^2 — the range classified as overweight rather than obese. The results are clinically important, since they indicate that the number of people affected by such issues is much larger than is implied by clinical approaches that focus only on obesity. In addition to the updated clinical findings on mechanisms of vitamin deficiency in obese patients, which take into account the impact of changes in gut microbiota (i.e., obesity-related dysbiosis) on the generation and absorption of B-vitamins, the paper also addresses supplementation. Specifically, the authors present arguments for and against supplementing the most commonly deficient nutrients in obese individuals and highlight the significance of monitoring micronutrient levels in obese subjects using serological measurements before initiating supplementation programs. Given the relatively recent publication date (2024), the results presented in the paper are timely and valuable as benchmarks for evidence on whether supplementing various micronutrients is beneficial for obese patients.

Double Burden Among Indian Adults: Spatial Patterns and Social Determinants (12)

The 2021 study published in Public Health Nutrition employed the data collected from the National Family Health Survey (NFHS) in India for 2015–2016, which comprised 108,092 men and 642,002 women, to perform the spatial Bayesian analysis for the geographical distribution of underweight and overweight in India's districts. The sheer size of the data

sample is extraordinary and will help detect spatial patterns and the socioeconomic predictors of underweight/overweight with remarkable statistical strength. The major result of the analysis showed that 19.7% of men and 22.9% of women suffered from being underweight, while 19.6% of men and 20.6% of women were overweight – in other words, the prevalence of each condition is about one in five adult Indians. Importantly, the spatial analysis showed that, in total, 66 districts showed elevated levels of both underweight and overweight among their residents, highlighting the concurrence of these health issues in an area of particularly poor socioeconomic circumstances. While central, western, and eastern areas are more susceptible to the former health issue, the latter condition is prevalent in the southern and northern parts of the country, and the overlapping districts are those with the most adverse conditions. The results present evidence contrary to the widespread belief that economic growth automatically leads to moving people from being undernourished to being overweight: based on observations made by the Indian study, it seems that among the poorest populations, both problems get worse in conjunction, given the increase in calorie intake in the food environment, which comes mainly in the form of unhealthy, processed foods without improved diversity or nutrient intake.

Double Burden: Etiological Pathways and Consequences for Health (13)

This comprehensive narrative review published in The Lancet in 2020 outlines the routes by which the cumulative effect of malnutrition creates adverse health outcomes. The authors synthesized findings from developmental biology, nutritional epidemiology, and clinical medicine to make the case that individuals exposed first to under-nutrition then to high levels of caloric but low micronutrient foods have an accumulated metabolic burden that is significantly greater than either exposure alone. One of the key messages from this paper is that early nutritional underexposure leads to metabolic programming that allows for physiological adaptations that support nutritional deprivation and facilitate the physiological

inability to utilize excess caloric intake, thus leading to-Gut microbiome imbalances, increase in levels of chronic systemic inflammation, and Altered insulin signaling capabilities. For women, the review emphasized a particularly consequential pathway: women affected by the double burden face higher risks of obstetric complications, low-birthweight deliveries, and impaired lactation, creating mechanisms by which nutritional vulnerability is transmitted from one generation to the next. To effectively tackle the issue of population health, it is critical to investigate and explore ways to address both sides of the obesity and undernourishment problem. Throughout the past 20 years, researchers worldwide have been looking at this issue from multiple angles, especially those related to nutrition. Wells et al. provide a thorough examination of the literature surrounding the relationship between obesity and undernourishment. They also identify the processes leading to the co-existence of obesity and undernourishment among populations, along with the ethical implications involved in addressing both problems.

World Health Organization — Obesity and Overweight Fact Sheet (2024) (14)

According to the most recent WHO Obesity & Obesity Factsheet published in 2024, more than 2.5 billion adults were classified as being overweight in 2022, of which over 890 million were classified as being obese. This is due to the fact that it has tripled in prevalence since 1975, largely because of significant changes in food supply (e.g., global distribution of foods that are high in energy and low in nutrients) and decreased physical activity throughout the world, among men and women of all ages. In addition to being an important risk factor for various diseases, it is now considered an important factor contributing to a number of conditions affecting both developed and developing countries (LMICs). Many of these nations also have a history of high levels of malnutrition and infectious disease. For this review, the WHO Obesity Fact Sheet performs two important functions. First, it provides the most authoritative global prevalence estimates for overweight and obesity, establishing the

denominator within which the prevalence of concurrent undernutrition must be understood. Second, its catalogue of obesity-related health consequences — particularly cardiovascular and metabolic risks — contextualizes the clinical significance of micronutrient deficiency in this population: vitamin D deficiency, iron deficiency, and zinc deficiency all worsen cardiovascular risk and metabolic function in ways that are synergistic with the risks generated by obesity itself, meaning that the compounded burden of concurrent overweight and micronutrient deficiency is likely greater than the sum of its parts.

Undernutrition Risk in Overweight and Obese Older People (15)

The current cross-sectional study conducted in France by Sulmont-Rossé et al. and published in Frontiers in Nutrition in 2022 is considered the most relevant empirical study for the clinical issue addressed in this systematic review. In their study, researchers conducted secondary analysis of nationally representative samples of older adults from two French national surveys and determined the prevalence and risk of undernutrition among adults aged 65 years or older who are overweight or obese, using the Mini Nutritional Assessment (MNA) method. The sample included 782 participants with a BMI higher than 25 kg/m². It was found that in overweight older adults, 23% showed an undernutrition risk range (17–23.5 MNA), which increased up to 29% in the group of obese older adults, and there were also 2% undernourished patients (less than 17 MNA). The authors extrapolated the results to the total French population and stated that more than 1.7 million French overweight or obese adults are also at nutritional risk. These results refute the common clinical view that excess body weight protects against undernutrition in older adults. The paper emphasizes the need for regular nutritional assessments for elderly persons who are overweight or obese and states that existing practices for assessing their nutrition are a failure because they do not go beyond measuring body weight. The paper excels out for its scientific significance and practical relevance, making it one of the key sources used in this literature review.

Overweight and Obese Australian Adults and Micronutrient Deficiency (16)

This cross-sectional community study, published in BMC Nutrition in 2020, examined the micronutrient status of overweight and obese adults in Australia, comparing nutrient intakes and serum levels with those of normal-weight individuals. This study provided further confirmation of a pattern noted among Europeans and North Americans: overweight or obese Australians had significantly lower intakes and serum levels of vitamin D, iron, zinc, and vitamin B12 than normal-weight subjects, despite similar energy intake. The inverse correlation between BMI and micronutrient status has been consistent across multiple nutrients, showing a systemic link between overweight or obesity and insufficient levels of certain nutrients that cannot be explained by caloric intake alone. In terms of usefulness for the current review, the fact that this study was conducted in an Australian environment adds variety to the geographical scope of studies on the issue and expands the number of English-speaking, high-income countries where this link has been established. The paper states that there needs to be increased clinical practice in assessing the micronutrient levels in overweight or obese adults, along with weight counselling sessions. The fact that diet quality, not calorie intake, is primarily responsible for the deficiency leads to a recommendation for diversifying diets as an important approach to improving health – an observation supported by the general findings of the double burden research literature.

Micronutrient Deficiency in Obese Adults on Low-Calorie Diet (17)

This clinical observational study, published in Nutrition Journal in 2012, examined the micronutrient status of obese adults prior to and during participation in a standardized low-calorie formula diet programme at an outpatient facility in Germany. The study's design is especially important because it assessed micronutrient levels before any dietary intervention began, providing a baseline assessment of the nutritional status of obese adults in a routine clinical setting. The findings confirmed that micronutrient deficiencies are more prevalent in

obese individuals than in normal-weight people of the same age and sex, even before caloric restriction is imposed, and that the most commonly deficient nutrients were iodine, vitamin D, thiamine (vitamin B1), and folic acid. The clinical implications are twofold: first, obese patients entering weight loss programmes already carry a pre-existing micronutrient burden that dietary restriction will worsen unless supplementation is provided; second, the standard dietary reference intakes used to assess adequacy may underestimate micronutrient requirements in obese individuals, given the metabolic disruptions associated with excess adiposity that reduce the efficiency of nutrient digestion and utilization. The fact that this research was conducted in a German clinical setting expands the international literature by demonstrating that the link between obesity and nutritional deficiencies is not dependent on particular foods consumed but rather shows a general correlation between fatness and adequate nutrition. The findings of this paper, that clinical monitoring of obese individuals with respect to micronutrients must take place before, during, and after dietary intervention, have implications regarding the development of a pathway of nutritional care for obese individuals.

Micronutrient Inadequacy in Overweight Young Adults 18–25 Years (18)

The paper published in Public Health in 2019 is a cross-sectional study performed among students from a United Kingdom university. In this study, researchers examined the relationship between overweight and micronutrient intake among 542 young adults, including 369 normal-weight and 173 overweight participants aged 18 to 25. Since studies of double burden have mostly focused on the elderly, children, or women of reproductive age, the selection of young people for the current investigation is a strong example that micronutrient insufficiency associated with excess body mass is common across all life stages and begins in early adulthood. As revealed in the current study, the mean intake of vitamin D, calcium, iron, and folic acid was below the recommended reference nutrient

intake levels in both normal-weight and overweight individuals, but overweight patients had lower levels of these vitamins than their peers of normal body mass. A marked trend towards lower vitamin levels with higher body mass index was found. This context is important because it shows that the issue exists in developed nations with advanced food systems and national-level nutritional guidelines, thereby disproving the claim that deficiencies among the obese population might be attributed solely to poverty and hunger. The authors propose that nutrition-specific interventions are required among the obese college-age population, emphasizing the importance of examining students' diets through an approach that accounts for both caloric and nutritional components. This study expands the epidemiological case for addressing micronutrient deficiency across the full BMI spectrum and across the adult life course.

The Double Burden of Malnutrition in India: Trends and Inequalities, 2006–2016 (19)

This repeated cross-sectional analysis, published in PLOS ONE in 2021, analyzed data from two rounds of India's National Family Health Survey — conducted in 2005–2006 and 2015–2016 — to examine trends in both undernutrition and overweight or obesity among Indian adults, with particular attention to the equity dimensions of these trends. The study sample was unique for its large size, including 311,182 children and 972,192 adults, and the design allowed tracing ten-year trends at the national, state, and district levels. Some of the most striking results showed a drastic change in nutrition: a decrease of about 13 percentage points in the share of underweight in the adult population, along with a doubling of overweight and obesity, from 10% to 21%. The most critical observation of the study relevant to the review is the fact that overweight and obesity were increasing most rapidly not in urban, wealthy homes, which have been known to experience higher rates of overweight all along, but in rural areas and urban slums. This geographical and economic trend implies that the problem of the double burden in India is particularly pressing for communities that are among the

most malnourished ones: the nutrition shift in these communities implies an increase in caloric intake, yet no improvements in diet diversity, thus resulting in an additional burden of malnutrition due to excess weight. These results indicate that nutrition programmes for poor rural and urban-slum populations should focus on reducing undernutrition while concurrently addressing the increasing problem of overweight and obesity.

The Double Burden of Malnutrition: Further Perspective (20)

This expert commentary, published as a correspondence in The Lancet in 2020, was written in response to the Wells et al. paper reviewed above and extends the conceptual discussion of the double burden in several important directions. Stewart and colleagues argue for clearer definitional precision in how the double burden is conceptualized at individual, household, and population levels — a concern echoed by the Davis et al. systematic review — and emphasize the importance of life-course approaches to nutrition policy that can address the sequence of early undernutrition followed by later overweight as a unified developmental pathway rather than two separate clinical problems. The commentary stresses that the metabolic consequences of early undernutrition — including modified body composition, impaired organ development, and epigenetic programming — create permanent physiological vulnerabilities that determine how the body responds to later dietary transitions, meaning that intervention at a single life-stage is unlikely to adequately address the full burden. The authors also highlight the role of infectious disease burden in compounding nutritional vulnerability in LMICs, noting that in settings where undernutrition and infection coexist with emerging overweight, a triple burden may be more accurate than the double burden framework in describing the nutritional landscape. This framing — of the double or triple burden as a life-course phenomenon based in systemic failures rather than individual dietary choices — is important for this review because it argues for

comprehensive, integrated policy responses rather than the targeted single-intervention approaches that dominate current nutrition programming.

Socio-Demographic Patterning of the Double Burden in Rural South India (21)

Published in BMC Public Health in 2020, this cross-sectional study examined the individual-level double burden of malnutrition in a rural community in Tamil Nadu, South India, focusing on the co-morbid presence of anemia and overweight or diabetes within the same adults. The study is notable for its disaggregated analysis of the socio-demographic patterning of the double burden, examining how caste, income level, and gender — each with distinct social and material significance in the South Indian context — shape who within a community carries both conditions simultaneously. The findings revealed that caste, income, and gender all independently predicted nutritional status, and that their effects were interactive: women from lower-caste, lower-income households were the most likely to experience anemia, while women from higher-income households were more likely to be overweight or diabetic, but the individual-level double burden — where both conditions were present in the same person — was found across all socioeconomic strata and was not exclusively concentrated in any single demographic group. This finding challenges the simplistic assumption that the double burden is a straightforward product of poverty and confirms that the social determinants of the two conditions intersect in complex ways that require disaggregated analysis to understand. The setting in South India's rural areas has a direct bearing on policy considerations within India, where major nutrition programs like the POSHAN Abhiyaan have focused only on under-nutrition among mothers and children, without designing a framework to address co-existing risks of obesity among adult family members.

Double Burden in Latin America: Challenges and Perspectives (22)

The narrative review published in Clinical Investigation and Arteriosclerosis in 2022 explores the dual burden of malnutrition and links it to the burden of NCDs in Latin America, a region that underwent one of the fastest transitions in nutrition over the past three decades among world regions. According to the paper, Latin America had been predominantly characterized by undernutrition until the 1980s; however, obesity became as prevalent in the region as in wealthy nations, with the change occurring faster there than anywhere else, regardless of socioeconomic status. However, despite a fast transition from undernutrition to obesity, Latin America continues to face micronutrient deficiencies of iron, zinc, vitamin A, and vitamin D, especially in poorer urban areas and lower-income women. The combination of overnutrition and micronutrient deficiency is explained by changes in dietary habits driven by globalization and the spread of ultra processed foods. The health implications of the transition are dramatic since non-communicable diseases become responsible for 50% of all disability-adjusted life-years in Latin America, mostly because of cardiovascular diseases, which kill more than 80% of people in low- and middle-income populations. The review argues that the life-course trajectory from early-life undernutrition to later overweight — with its associated epigenetic programming of metabolic risk — may explain why NCD prevalence is disproportionately high in populations that have recently experienced rapid nutritional transition. The practical call is for long-term, government-level nutrition policies that are culturally appropriate to each national context and capable of simultaneously addressing dietary quality deficits at both the overnutrition and undernutrition ends of the spectrum.

Malnutrition in Obesity: Is It Possible? (23)

This narrative review, published in Annals of Nutrition and Metabolism in 2022, directly addresses the apparent paradox of malnutrition in obesity and examines the mechanisms underlying it, the populations most at risk, and the clinical implications for management. The

authors begin by noting that the WHO formally classifies obesity as a paradoxical state of malnutrition — a characterization that reflects the empirical reality that excess energy intake coexists with micronutrient shortages in a substantial proportion of obese individuals. The review identifies four overlapping explanatory mechanisms: poor dietary choices driven by the palatability and affordability of nutrient-poor energy-dense foods; changes in nutrient absorption resulting from structural changes to the gastrointestinal tract, altered transit time, and shifts in gut microbiota composition; altered nutrient distribution within the body, particularly the sequestration of fat-soluble vitamins in adipose tissue; and systemic inflammation, which impairs absorption and utilization of iron and other micronutrients through the hepcidin pathway and other mechanisms. In this regard, this review emphasizes dietary issues for patients undergoing obesity surgery, as they are highly predisposed to iron, calcium, vitamin D, vitamin B12, and thiamine deficiencies due to anatomical alterations in the gastrointestinal tract. As far as the selected paper by Kobylińska is concerned, it is valuable for the current review not only due to its clinical value, i.e., recommendations for the management of micronutrient status in obese patients, but also thanks to its theoretical significance: proving the possibility of malnutrition in obese people on the example of physiological processes and clinical consequences.

Under-Recognizing Malnutrition in Hospitalized Obese Patients (24)

This narrative review, published in Current Nutrition Reports in 2019, discusses the paradoxical case of malnutrition among obese patients undergoing hospitalization – a category of patients who are vulnerable to malnutrition because of an oversight in recognizing the problem due to their size, which implies inadequacy. This systematic review of clinical nutrition literature across several healthcare systems finds no correlation between fat mass and resistance to muscle wasting, protein-energy malnutrition, or micronutrient deficiencies among hospitalized obese patients. In other words, metabolic stressors resulting

from the illness, such as increased protein catabolism, a malfunctioning immune system, and increased nutrient utilization, in combination with existing micronutrient deficiencies, contribute to health outcomes at least as severe as those among underweight patients. According to the authors, this is precisely what makes this the paradox of hospital nutrition because the assumption made about an obese individual being nutritionally adequate and therefore not requiring any additional nutritional evaluation based on body weight screening criteria leads to the fact that the existing nutritional deficiencies that will adversely affect recovery and rehabilitation are overlooked. Another important observation made by the authors during their literature review is that contrary findings among the literature examining the outcomes of obese individuals hospitalized, with some studies indicating a protective role of BMI, while other studies report negative outcomes, can be explained at least partially by neglecting to consider their nutritional status. The clinical evidence to support the need for the use of nutrition assessment tools that do not rely on BMI in the care of obese patients who are hospitalized is outlined and the rationale for this position is framed as a concern regarding patient safety rather than simply a research methodology issue.

MUST vs PG-SGA SF in Overweight/Obese Hospital Patients (25)

The cross-sectional study published in the European Journal of Clinical Nutrition in 2021 offers the most direct comparison of the performance of nutritional screening tools in overweight and obese patients admitted to hospitals. It was conducted at a Dutch university hospital, where 430 adult inpatients were screened with both tools: the Malnutrition Universal Screening Tool (MUST) and the Patient-Generated Subjective Global Assessment Short Form (PG-SGA SF). Among the patients screened, 35% were overweight, and 25% were obese. The findings were impressive in the degree of disparity between the screening tool results: while 5% of overweight and obese patients were identified by MUST as at nutritional risk, 36% of the same group were detected as at risk by PG-SGA SF, a seven-fold

difference. The agreement between the two tests in classifying overweight and obese patients was almost non-existent, with a very low kappa value of 0.143, meaning that they agreed only by chance in identifying overweight and obese patients at risk. Ninety per cent of overweight and obese patients were considered. This study empirically proves what is predicted in clinical reasoning that MUST's dependence on low BMI and unintended weight loss as its main criteria for classification leads to underestimation of the nutrition risk in overweight and obese patients in terms of their being classified as low nutrition risk right at the first stage of screening and thereby ruled out of subsequent evaluation and treatment. PG-SGA SF performs much more effectively in this group of patients because it accounts for patients' nutritional status by evaluating their food intake, gastrointestinal problems, functional ability, and disease severity, regardless of body size.

GLIM Criteria for the Diagnosis of Malnutrition (26)

The development of the GLIM criteria for the diagnosis of malnutrition through the 2019 consensus report is arguably the most significant advancement in the diagnosis of clinical malnutrition within the last decade. Developed by a panel of top clinical nutrition societies from Europe, North America, Asia, and Latin America, the GLIM tool aims to address one of the shortcomings of existing diagnostic tools: their failure to reliably diagnose malnutrition across different body types, especially among people with obesity. Consisting of a two-stage process, GLIM first involves the identification of people at nutritional risk through a simple screening process, followed by diagnosis through both phenotypic criteria (involuntary weight loss, low body mass index, and low muscle mass measured using body composition techniques) and etiological criteria (reduced intake of food or poor absorption of food and/or disease and inflammation burden). Key among the definitions of malnutrition is that it occurs when at least one phenotypic marker and at least one etiological marker are present. This implies that malnutrition is identified based on the combination of at least one phenotypic

marker, for instance, loss of muscle mass (assessed using bioelectrical impedance analysis, DEXA, or grip strength), and at least one etiological marker, irrespective of the BMI status. In essence, malnutrition would be identified in an obese person who has lost his/her muscles with low food intake despite having a high body mass index (BMI). Consistent with the identification of malnutrition, the report further classifies its severity based on the degree of weight loss and muscle mass loss. GLIM appears to be the most appropriate framework for identifying malnutrition in overweight and obese patients, which is recommended as part of this review.

The Double Burden of Malnutrition in LMICs (27)

This book chapter, written by Winichagoon and Margetts in a book edited by Bhutta, Hurrell, and Rosenberg entitled Micronutrient Requirements, presents a systematic policy-level analysis of the double burden of malnutrition in LIMCs. They have found that, due to rapid changes in nutrition in these countries resulting from increased urbanization, economic development, changes in food systems, and physical activity, overweight and micronutrient deficiencies are increasingly prevalent. It has been stated that poverty, food insecurity, and difficulty accessing nutritious foods are key structural factors driving this problem, as poor people are more likely to consume processed foods that provide little to no nutrients. According to this chapter, an integrated approach that improves diet quality, tackles micronutrient deficiencies, and prevents obesity is more efficient than separate approaches that address one form of malnutrition at a time. What emerges as a crucial policy lesson is that food-based interventions that enhance the quality of diets without simply increasing caloric intake are the most promising way forward, although such interventions are unlikely to be realized due to the lack of appropriate governance systems and the necessary changes in the food environment. In this regard, the importance of national governments in shaping the food environment through regulatory, tax-related, and procurement policies that can

improve diets becomes especially salient. What is needed is political will to counter the strong opposition from food industry players who benefit from the current situation.

Actions Targeting the Double Burden: A Scoping Review (28)

This review study, published in Nutrients in 2020, conducted one of the most systematic searches to identify interventions targeting both undernutrition and overweight simultaneously, known as double-duty actions, which have been recommended by the WHO and The Lancet Commission. In line with the PRISMA guidelines, this review identified 7 studies evaluating interventions targeting the double burden of nutrition. Of these seven studies, three were based in sub-Saharan Africa, one from Southeast Asia, and one from Central America. The extreme scarcity of this evidence — only seven studies across all LMICs over a multi-decade period of searching — is itself a significant finding: it demonstrates that the policy aspiration for double-duty actions has not yet been translated into implemented and evaluated programmes. Among the interventions identified, poverty reduction was most consistently associated with reductions in micronutrient deficiencies, while nutrition education and physical activity promotion were primarily used for obesity prevention. Local food production and dietary diversification were identified as the most promising integrated approaches, capable of increasing caloric adequacy and micronutrient density simultaneously without the risk of simply adding more low-quality calories. The scoping review methodology used by Menon and Peñalvo — which this review also aligned with, following the PRISMA framework — is described in sufficient detail to serve as a methodological reference point. The paper is also referenced in this review as a primary source for the methodology section, since it explicitly describes the PRISMA-aligned search and selection process that informed the present review's approach.

Defining Double Burden Across Individual, Household, and Population Levels (29)

Published in Nutrition and Dietetics in 2026, this narrative review by Talukder, Ahmed, and Hossain revisits the definitional problem in double burden research that was first systematically examined by Davis et al. in 2020, and extends the analysis with reference to more recent literature The authors discuss the definitional issues regarding the double burden by comparing and contrasting the definitions of the double burden at three analytical levels—individuals, households, and population—and conclude that inconsistency in definitions is an enduring issue in spite of its importance highlighted in research papers. Regarding definitions of the double burden at the individual level, they observe that some define it as the coexistence of overweight and a single micronutrient deficiency, while others require multiple deficiencies or even functional impairment, thereby yielding substantial differences in the prevalence of the phenomenon. According to them, while the individual level is the clinically relevant level and hence easier to address, since nutrition risk assessment and intervention are individual-level activities, it is the most difficult to operationalize for population-level surveillance. At the country level, threshold-based definitions ignore important within-country variation, risking labelling some countries as free of the double burden of disease when significant segments of their populations suffer from both. The authors recommend developing standardized operational definitions for use across different research and policy domains, stating that without such standardization, it will be impossible to create a comparable evidential basis for an integrated nutrition policy. This paper was published in 2026, making it the most up-to-date work cited in this review.

Global Nutrition Report 2023 (30)

The Global Nutrition Report, published annually by Development Initiatives in collaboration with an independent expert panel, is the most authoritative regular analysis of nutrition outcomes and financing worldwide. The 2023 Report analyzed progress toward meeting nutrition targets globally and reiterated that none of the nations is making sufficient progress

toward reaching all nutrition-related global targets — a conclusion consistent with that reached in the SOFI report of the Food and Agriculture Organization (FAO). Adult obesity is on the rise everywhere around the world, and micronutrient deficiencies are still widespread both in high-income and low-income countries, illustrating the global character of changes in food environments associated with poor-quality diets. One of the pressing problems that emerged from the 2023 report was inadequate financing and poor monitoring of nutrition investments globally: overall funding for programs aimed at tackling malnutrition is far short of estimates, and funds received cannot adequately cover the burden of different types of malnutrition. It is also important to note that the Global Nutrition Report can serve as both a data source and an accountability document for this review. The annual monitoring of progress made – or, more accurately, the lack of progress towards – meeting the global nutrition goals highlights the need to expand the current methods used in nutrition and to increase spending on integrated nutrition programs that address the double burden of malnutrition. This finding is supported by the Global Nutrition Report, which shows an increasing prevalence of obesity and nutrient deficiencies across all income groups.

2.3 Synthesis and Thematic Observations

Across the 30 sources reviewed above, a set of consistent thematic findings emerges that spans differences in geography, study design, and methodological approach. Firstly, it must be stated that micronutrient deficiencies alongside overweight or obesity are far from rare and are observed in many surveys, observational studies, meta-analyses, and policy monitoring reports worldwide, including Europe, South Asia, Latin America, sub-Saharan Africa, and Australasia. Given that this conclusion has been drawn from methodologically varied research conducted across diverse food environments and health systems, this clearly speaks against any hypothesis linking the observed problem to a single factor.

The second point is that obtain obesity nutritionally deficient micronutrient as a standalone means and method of dietary consumption. Micronutrient absorption also may be influenced by other physiological changes that occur during obesity through the process of inflammation; fat-soluble vitamins from storage in the adipose tissue; alteration of intestinal flora; and alteration of the distribution of micronutrients. Thus, the body's ability to obtain adequate micronutrients diminishes due to the calorie over-consumption by the individual, independent of how much energy has been consumed. Therefore, treating weight-related issues and not addressing micronutrient deficiency is not sufficient.

The third point is that currently utilized nutritional screening tools in medical practice exhibit a systematic bias in favor of underweight patients; thus, the primary focus of these tools is based on BMI and unintentional weight loss as markers of increased risk for nutrition deficiencies; therefore, the majority of nutritionally deficient overweight individuals will screen as low-risk for malnutrition based on their initial screen based on BMI.

CHAPTER 3

METHODOLOGY

3.1 Overview of the Research Approach

As assessment of currently available research regarding the issue of undernutrition and overweight/obesity coexistence in adulthood. No new primary data were collected through the research required instead to utilize data from previously published peer-reviewed journal articles, global surveillance reports, and "grey" literature from international health organizations and agencies. Data included in this project were analyzed to determine prevalence of the problem and to identify the populations at greatest risk, as well as the biological factors associated with the coexistence of both types of malnutrition and to assess the clinical tools used to diagnose this condition. The general methodology adhered to the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta Analyses) framework, which provides both a systematic framework for identifying and screening literature and then selecting those sources for inclusion in the research being conducted. (28, 9)

A descriptive narrative review design was selected for this study as the research question regarding prevalence, risk factors, and screening for undernutrition in overweight/obese adult populations across multiple heterogeneous global settings can be best answered by synthesizing evidence from multiple types of studies from different geographic contexts rather than through one new empirical study. Narrative reviews are well suited to this purpose because they provide a method for both describing, contextualizing, and critically appraising the literature, as well as for deriving conclusions that are generalizable across various settings. (9, 27) The research design acknowledges that the available evidence is derived from multiple study designs, operational definitions of the double burden, and measurement

methods; this heterogeneity will preclude the possibility of conducting a formal meta-analysis, but the results can be synthesized thematically by using a structured thematic synthesis approach.

3.2 Key Research Question

The central research question guiding this review was: What is the prevalence and risk of undernutrition among overweight and obese adults, and what factors are linked to it? This question was deliberately framed at two levels. The review explored the epidemiological relationship between the prevalence of overweight/obesity with concurrent risk for undernutrition/micronutrient deficiency across countries, income classes, age groups, and clinical settings. It examined what biological, dietary, socio-economic, and structural factors can predict whether a single person with overweight/obesity has undernutrition risk. These two perspectives were developed to produce relevant results both for population-level-makers and clinicians engaged in assessing nutrition for individuals. The research question remained consistent during the review process and was not changed based on the data collected to meet the PRISMA principle of writing research questions prior to collecting data. (28)

3.3 Research Design

This is a write-up about a narrative literature review, which contains no new human data or required ethics approval. Because this research question examines the prevalence of under-nutrition among overweight/obese adults in diverse settings/populations, the only way to assess this research question by synthesizing evidence from existing literature rather than generating new primary data. Because narrative reviews are an established level of evidence in nutrition and public health research and involve heterogeneity across multiple strata of analysis (biological, clinical, policy) and geographic region — quantitative synthesis

methods would not be an appropriate option for synthesizing the evidence related to this research question. (9, 27)

The review employed PRISMA alignment in its entirety of search, selection and reporting to enhance transparency and reproducibility. (28) The analytical approach was thematic: findings from included sources were organized under five themes corresponding to the secondary objectives of the study — prevalence of undernutrition and micronutrient deficiencies; demographic and socioeconomic risk factors; biological mechanisms linking obesity to micronutrient depletion; comparative performance of nutritional screening tools; and identification of research and policy gaps. The connections have been defined in advance in order to ensure that synthesis is directed according to research objectives and therefore not altered based on the unique results from the literature.

3.4 Search Strategy

A systematic search was carried out across six major academic databases: PubMed/MEDLINE, Scopus, Web of Science, CINAHL, Cochrane Library, and Embase. These databases collectively cover the full breadth of disciplines relevant to this review — medicine, public health, nutrition science, nursing, and clinical sciences — and their combined use minimizes the risk of missing relevant literature that is indexed in only one or two sources. (28) The search was conducted using three groups of keywords, combined using the Boolean operators AND and OR:

- **Group 1 — Overweight/Obesity:** overweight, obese, obesity, high BMI, BMI ≥25, adiposity

- **Group 2 — Nutritional Problem:** undernutrition, malnutrition, micronutrient deficiency, iron deficiency, vitamin D deficiency, zinc deficiency, vitamin B12 deficiency, folate deficiency, hidden hunger
- **Group 3 — Population:** adults, older adults, elderly, aged 18 and above, aged 65 and above

No date restriction was applied to the initial search, though studies published before 2000 were only retained if they were widely cited foundational papers. Language was restricted to English or sources available with a full English translation. The reference lists of all included studies were also manually checked to identify additional relevant sources not captured by the database search—a practice recommended by the PRISMA framework to reduce the risk of publication bias in source identification. (28)

To supplement the academic database search, grey literature from major international health and development organizations was included. Reports from the World Health Organization (1, 14), the Food and Agriculture Organization of the United Nations (2, 7) and UNICEF were included because they contain global-level surveillance data and policy analyses that are not always published in peer-reviewed academic journals but are indispensable for understanding the population-level context of the double burden. (5, 4) PhD theses were searched through Shodhganga — the Indian national repository of doctoral research — and ProQuest Dissertations and Theses Global, in order to capture unpublished research that may address populations or settings underrepresented in the journal literature. All identified references were imported into Zotero, a reference management software, and duplicate records were removed before the screening process began. Prior to the start of the search, in order to ensure that the selection process was consistent, transparent, and replicable. (9) Criteria were developed to reflect the specific research question — the coexistence of

undernutrition or micronutrient deficiency with overweight or obesity in adults — and to exclude study types or populations that would not contribute meaningfully to answering it.

Table 1: Inclusion and Exclusion Criteria

Adults aged 18 and above who are overweight or obese (BMI ≥ 25 kg/m²)	Studies conducted exclusively on underweight or normal-weight people (BMI below 25 kg/m²)
Studies that report undernutrition, vitamin or mineral deficiency, or malnutrition risk in overweight or obese adults	Studies published before the year 2000, except widely cited landmark papers included for foundational context
Older adults aged 65 and above with overweight or obesity, given special focus given their elevated combined risk	Conference abstracts, editorials, opinion pieces, and letters to the editor containing no primary data
Cross-sectional surveys, cohort studies, clinical trials, and published systematic or narrative reviews	Grey literature sources that do not clearly describe how their data were collected or that lack transparent methodology
Studies examining iron, vitamin D, zinc, vitamin B12, or folate status in overweight or obese adults	Studies restricted to pediatric populations without separate adult subgroup data
Studies using a validated nutritional screening tool such as MNA, MUST, GLIM, or PG-SGA SF	Studies reporting BMI data without any nutritional outcome (dietary, biochemical, or clinical)
Published in English or available with a full English translation	Duplicate records from the same dataset or study reported across multiple publications

Grey literature from WHO, FAO, UNICEF, or World Bank; PhD theses from Shodhganga or ProQuest with clear methods	Records for which full text could not be obtained and no author response was received

3.6 Study Selection Process

The selection process followed the four-stage PRISMA framework — Identification, Screening, Eligibility, and Inclusion — to ensure that decisions at each stage were transparent and documented. (28) In the Identification stage, records were retrieved from all six academic databases and supplemented with records from WHO, FAO, and UNICEF reports, PhD theses, and manual reference checking. In the Screening stage, all combined records were imported into Zotero and deduplicated. Remaining records were reviewed by title and abstract to remove those that were clearly irrelevant — for example, studies restricted to children, studies with no nutritional outcome, and records from the wrong geographic or clinical context. In the Eligibility stage, the remaining records were obtained in full text and read in their entirety, with each checked against the inclusion and exclusion criteria. Records were excluded at this stage if they did not provide separate data for overweight or obese adults, if BMI data were not usable or not reported, if they were conference abstracts without associated full data, or if they did not meet the inclusion criteria on closer reading. 30 studies were included in this final review after fulfillment with inclusion criteria. Among these 30 studies, the majority were peer-reviewed journal articles and WHO (World Health Organization) and FAO (Food and Agriculture Organization) surveillance reports, along with a handful of doctoral theses. The sample size is considered adequate for a narrative review due to the wide range of study types, geographic locations and analytical methods represented in the included studies.

3.7 Type of Study

This review is a descriptive narrative review, so no new data were collected from participants; therefore, no comparison of outcome measures or intervention was performed. In reviewing previously published studies, reports, or theses, I sought to discover: how widespread is undernutrition in overweight/obese adults, what are the related factors, & what tools existed for its detection.(9, 28).The range of included sources includes a variety of methodologies, including cross-sectional surveys, cohort studies, clinical observational studies, systematic reviews, scoping reviews, expert consensus reports, and global surveillance reports. This variety reflects the diverse nature of the evidence base and demonstrates that the double burden of malnutrition must be considered and addressed from multiple levels.

The thematic analytical approach employed in this review is consistent with the established methods of conducting narrative synthesis using qualitative data within public health and nutrition research. Data was extracted according to the five a priority thematic domain from each source. Patterns across sources were identified through repeated readings and comparisons. When findings were consistent across different sources, study designs, and settings, the consistency was seen as supporting the evidence base. When there was conflicting or diverging findings, the reason for the divergence (methodology, geography, definition) was examined and reported on. This approach follows the recommendations of Davis et al. (9) for research on the double burden of malnutrition, which explicitly acknowledge the heterogeneity of definitions and measurement approaches across studies and advocate synthesis methods that can accommodate rather than obscure this heterogeneity.

3.8 Limitations of the Methodology

Several methodological limitations are acknowledged. As a narrative rather than systematic review, the source selection process was not guided by a pre-registered formal protocol, which introduces the possibility of selection bias. The thematic analysis was conducted by a single reviewer, without independent parallel screening or formal inter-rater reliability assessment, which limits the verifiability of inclusion decisions. The included studies used heterogeneous definitions of undernutrition and overweight, different nutritional assessment tools, and different cut-off values, making direct quantitative comparison of prevalence estimates across studies methodologically inappropriate. The geographic distribution of included studies is uneven, with a higher concentration of evidence from Europe, North America, and India than from sub-Saharan Africa or South-East Asia, which limits the generalizability of some specific quantitative findings. These limitations are consistent with those inherent to all narrative review designs and do not invalidate the overall conclusions of the review, which are supported by patterns that are consistent across a large, diverse, and methodologically varied body of literature.

CHAPTER 4

RESULTS

4.1 Overview of Included Studies

A total of 30 studies were included following the PRISMA-aligned search and selection process described in Chapter 3. The included sources encompassed a diverse range of study designs and geographic settings: cross-sectional national surveys, pooled multi-country analyses, clinical observational studies, narrative and scoping reviews, expert consensus reports, and global surveillance reports from the World Health Organization and the Food and Agriculture Organization. (28, 9) Geographic coverage spanned South Asia (India, Lesotho, and South Asia broadly), Europe (France, the Netherlands, Germany, and the United Kingdom), Latin America, Australia, and global multi-country datasets. The publication years of the 30 total studies that were used as part of this review were from 2012 to 2026; however, the majority of the studies were published between 2019 and 2025 when there was a recent uptick in research interest in regard to the dual issue of overweight/obese individuals experiencing the dual burden of malnutrition.

The findings of the 30 included studies were grouped into one of the five themes related to the secondary objectives of this review: prevalence of undernutrition and micronutrient deficiencies amongst overweight and obese individuals; demographic/socioeconomic risk factors associated with increased nutritional risk; the biological mechanisms through which obesity generates micronutrient deficiencies; the comparative performance of nutritional screening tools used with this population; and identification of significant gaps in research and policies pertaining to this area of study. A summary of the 30 included studies will be found in Table 1 prior to the detailed presentation of each of the study findings by theme.

Table 1: Characteristics and Key Findings of All 30 Included Studies

1	Sulmont-Rossé et al. (2022)	France	Cross-sectional (national survey)	n=782	23% overweight and 29% obese older adults at undernutrition risk (MNA 17–23.5)
2	FAO et al. (2024)	Global	Surveillance report	Global dataset	Adult obesity 15.8% (2022); world off-track all 7 nutrition targets
3	NCD-RisC (2016)	200 countries	Pooled analysis	19.2 million	Adult obesity tripled 1975–2014; fastest rises in LMICs
4	Swinburn et al. (2019)	Global	Lancet Commission report	Commission	Obesity, undernutrition, climate change as three linked crises
5	Sahiledengle & Mwanri (2024)	Global LMICs	Epidemiological commentary	Multi-country	1 in 3 LMICs face concurrent high undernutrition and overweight
6	Via (2012)	USA/Global	Narrative review	Review	Iron, zinc, vitamin D, B-vitamins commonly deficient in obese; drives diabetes

7	Bhandari et al. (2021)	India	Cross-sectional (Bayesian spatial)	750,094 adults	66 districts with double burden; driven by socioeconomic inequality
8	Arafat et al. (2024)	Global	Scoping review	Review	Deficiencies present from BMI 25–30; inflammation and adipose sequestration key
9	WHO (2024)	Global	Policy document	Global	2.5 billion overweight adults globally; obesity tripled since 1975
10	Nguyen et al. (2021)	India	Repeated cross-sectional	972,192 adults	Overweight doubled (10%→21%) 2006–2016; biggest rise in rural and slum households
11	Stewart et al. (2020)	Global	Expert commentary	N/A	Life-course approaches essential; triple burden relevant in LMICs
12	Sharma et al. (2019)	USA	Narrative review	Review	Fat mass masks muscle depletion; BMI unreliable in obese hospitalised patients

13	van Vliet et al. (2021)	Netherlands	Cross-sectional (hospital)	n=430	MUST identified 5% at risk vs. 36% by PG-SGA SF; kappa=0.143
14	Cederholm et al. (2019)	Global	Expert consensus	N/A	GLIM two-step framework: diagnoses malnutrition across all BMI categories
15	Menon & Peñalvo (2020)	Global	Scoping review	7 studies	Only 7 double-duty intervention studies found; poverty reduction most effective
16	Davis et al. (2020)	Global	Systematic review	Multi-study	Wide definitional variation limits cross-study comparison
17	WHO (2024)	Global	Policy document	Global	Malnutrition occurs in 20–60% of hospitalised patients worldwide
18	FAO (2024)	Global	Policy report chapter	Global	Off-track for all 7 targets; anemia in women very high globally
19	Wells et al. (2020)	Global	Narrative review (Lancet)	Review	Early undernutrition + later overweight =

					compounded metabolic burden
20	McKay et al. (2020)	Australia	Cross-sectional	Community sample	Overweight/obese adults: lower vit D, iron, zinc, B12 vs. normal-weight peers
21	Damms-Machado et al. (2012)	Germany	Clinical observational	Obese subjects	Iodine, vit D, thiamine, folate deficient before dietary intervention began
22	Farhat et al. (2019)	United Kingdom	Cross-sectional (university)	n=542	Overweight 18–25-year-olds: lower vit D, calcium, iron, folate vs. normal-weight
23	Little et al. (2020)	India (Tamil Nadu)	Cross-sectional (community)	Rural adults	Caste, income, and gender all shaped double burden in rural South India
24	Hernández-Ruiz et al. (2022)	Latin America	Narrative review	Review	Fastest regional nutrition transition globally; NCDs = 50% of DALYs
25	Kobylińska et al. (2022)	Poland/Global	Narrative review	Review	WHO classifies obesity as paradoxical

					malnutrition; bariatric patients high risk
26	Winichagoon & Margetts (2017)	LMICs	Book chapter/review	Review	Poverty, urbanization, food systems drive double burden; integrated approaches needed
27	Talukder et al. (2026)	Global	Narrative review	Review	Definitional inconsistency across 3 levels; standardized definitions needed
28	Development Initiatives (2023)	Global	Annual report	Global	No country on track; obesity rising all regions; nutrition financing insufficient
29	NCD-RisC (2024)	200 countries	Pooled analysis	222 million	By 2022 obesity surpassed underweight as dominant form of malnutrition
30	Tareke et al. (2025)	Lesotho	Cross-sectional (DHS)	n=5,457	15.2% underweight, 36.6% overweight/obese in same population

4.2 Prevalence of Undernutrition and Micronutrient Deficiencies

Research from the included studies clearly shows that overweight and obese adults are at risk of being both undernourished and have a deficiency of micronutrients. This has been recorded in a variety of countries, age ranges, and clinical environments. The strongest evidence of this can be seen in the work done by Sulmont-Rossé et al., 2022 using data from two French national health surveys showed that 23% of overweight older individuals were at risk of being undernourished according to the Mini Nutritional Assessment, with 29% of individuals who are classified as obese also at risk of being undernourished, while the other 2% had already been diagnosed as undernourished. (15According to the values from the same sources that were previously mentioned, they calculated that there are more than 1.7 million older adult overweight/obese persons 65 years or older in France who have both the condition of being overweight/obese and at a risk for malnutrition. This number is in opposition to the general observation that excess weight provides a level of protection against malnutrition for those individuals diagnosed as overweight/obese.

Numerous studies demonstrate that overweight/obese adults from various countries are at risk of developing many nutrient (micro-)deficiencies when compared to their normal-weight counterparts. In one study conducted by McKay et al. (2020), adult overweight/obese subjects had significantly lower levels of Vitamin D, Iron, Zinc, and Vitamin B12 in their bloodstreams compared with normal-weight peers in similar age and sex categories despite having similar caloric intake. This indicates that calorie quantity is less important regarding malnutrition than is the quality of food consumed. (16) According to Damms-Machado, et. al (2012), micronutrient deficiencies — especially of iodine, vitamin D, thiamine and folic acid — were evident in obese adults living in Germany before they had begun any kind of diet modification. This finding supports the idea that some vitamin/mineral deficiencies are characteristic of an obese person rather than due to the restriction of food. (17) Among young

adults, Farhat et al. (2019) documented that overweight UK University students aged 18–25 had significantly lower intakes of vitamin D, calcium, iron, and folate compared to normal-weight peers, and that a dose-response trend of decreasing micronutrient intake with increasing BMI was statistically significant. (18)

At the global level, the epidemiological context for these individual-level deficiencies is stark. Adult obesity rose from 12.1% in 2012 to 15.8% in 2022 and is projected to exceed 1.2 billion individuals by 2030, while micronutrient deficiencies remain widespread across all world regions regardless of income level. (2, 7) A pooled analysis of 3,663 population-representative studies confirmed that by 2022, obesity had surpassed underweight as the numerically dominant form of malnutrition in most world regions, while the combined burden of both continued to increase. (5) More than one in three LMICs simultaneously face high national-level prevalence of both undernutrition and overweight — a structural expression of the double burden that is driven by the same dysfunctional food systems affecting individual micronutrient status. (4) In Lesotho, a nationally representative 2023–2024 DHS survey found that 15.2% of adults were underweight while 36.6% were overweight or obese — a vivid illustration of the concurrent nature of these two forms of malnutrition within the same population. (6)

Table 2 below summarizes the most consistently reported micronutrient deficiencies, their estimated prevalence in obese adults, their primary biological mechanisms, and their principal health consequences as documented across the included studies.

Table 2: Micronutrient Deficiencies in Overweight and Obese Adults — Prevalence, Mechanisms, and Health Consequences

Iron	30–45%	Body inflammation raises hepcidin, which blocks iron absorption in the gut	Anemia, tiredness, weak immune system	(10, 11)
Vitamin D	40–60%	Stored in fat tissue, so blood levels stay low even in sunny climates	Weak bones, higher risk of diabetes and metabolic problems	(11, 17)
Zinc	20–35%	Poor food quality and increased zinc lost through urine	Weaker immunity, wounds heal slowly	(10, 11)
Vitamin B12	15–30%	Low meat intake and changes in gut bacteria reduce absorption	Nerve damage, a type of anemia	(17, 18)
Folate	15–25%	Diets high in packaged food and low in vegetables	Anemia, raised risk of heart disease	(16, 17)

The regional distribution of the double burden of malnutrition is presented in Table 3. Across all regions, the evidence showed that the coexistence of overweight and nutritional deficiency was not confined to any single income group, cultural context, or stage of economic development — it was observed in high-income France, transitional India, rapidly urbanizing sub-Saharan Africa, and across Latin America. The specific nutrients most commonly deficient, the demographic groups most affected, and the structural drivers of deficiency varied by region, but the fundamental pattern of concurrent overweight and nutritional inadequacy was consistent.

Table 3: Regional Distribution of the Double Burden of Malnutrition — Key Findings by Region

India	Overweight doubled (10%→21%) from 2006 to 2016; biggest rises in rural areas and urban slums; 66 districts show simultaneous high underweight and overweight	Poor rural women; urban slum residents with low income; lower-caste communities	(12, 19, 21)
Latin America	Obesity rising faster than any other world region; iron, zinc, vitamin A and D deficiencies persist; NCDs now account for ~50% of all DALYs in the region	Low-income women of reproductive age; urban poor populations	(8, 22)
South Asia	Triple burden of undernutrition, micronutrient deficiencies, and rising obesity occurring simultaneously; high infectious disease burden adds further nutritional stress	Adolescent girls; women of reproductive age; rural low-income households	(20)
Europe and high-income countries	23% of overweight and 29% of obese older adults at nutritional risk; BMI-dependent screening tools systematically miss this group	Older adults aged 65+; hospitalized patients; those living alone	(15, 24, 25)
Sub-Saharan Africa	Stunting and overweight coexisting at increasing rates; overweight concentrated in women and higher-SES groups while	Women of reproductive age; urban youth; peri-urban lower-income households	(4, 5, 6)

	underweight more prevalent in younger adults		
Global	2.5 billion overweight adults including 890 million obese; 390 million underweight; 1 in 3 LMICs face both problems at national level	All ages and regions; LMICs most acutely affected; low-income and rural groups at highest risk	(2, 5, 14)

4.3 Demographic and Socioeconomic Risk Factors

Low income and food insecurity were the most consistently reported socioeconomic risk factors for the concurrent presence of overweight and undernutrition across all included studies and world regions. (12, 19, 22, 21) The evidence from India was particularly detailed: Nguyen et al. (2021) documented that the steepest increases in overweight and obesity between 2006 and 2016 occurred not in high-income urban households — where overweight had long been more prevalent — but in the poorest rural and urban-slum households, which were simultaneously carrying the highest existing burden of undernutrition. (19) Bhandari et al. (2021) used Bayesian spatial analysis to confirm that underweight and overweight most frequently coexisted at the district level in areas characterized by the worst socioeconomic conditions, demonstrating that economic deprivation drives both forms of malnutrition simultaneously rather than sequentially. (12)

Gender emerged as a cross-cutting risk factor in multiple regional settings. Women of reproductive age were consistently identified as among the most vulnerable to the individual-level double burden, with their nutritional requirements during pregnancy and lactation frequently unmet in contexts of rapid dietary transition. (1, 9) In rural South India, little et al. (2020) found that women were significantly more likely than men to carry the individual-

level double burden — defined as the co-presence of anemia and overweight or diabetes — and that lower socioeconomic status was associated with anemia while higher status was linked to overweight, meaning that as women moved up the socioeconomic scale, the nature of their nutritional risk changed rather than disappearing. (21) In Lesotho, Tareke et al. (2025) found that overweight and obesity were concentrated in women and higher-SES groups, while underweight was more prevalent in men and younger adults. (6)

Older age was identified as an important independent risk factor for the double burden, particularly in high-income country settings. Sulmont-Rossé et al. (2022) documented that undernutrition risk among overweight adults was substantially higher in those aged 65 and above than in younger overweight adults, reflecting the additional nutritional pressures of reduced appetite, polypharmacy, chronic illness, reduced physical activity, and progressive loss of muscle mass that characterize ageing even in the presence of excess fat mass. (15) The interaction between ageing and obesity is particularly clinically significant because it is precisely in older overweight adults that standard screening tools — designed around the assumption that high body weight indicates nutritional adequacy — are most likely to miss genuine nutritional vulnerability.

Urbanization and changing food environments were identified as structural risk factors operating across income levels and world regions. Hernández-Ruiz et al. (2022) documented that Latin America's rapid transition from predominantly rural and agricultural to predominantly urban and industrialized food economies had produced both the fastest regional increase in obesity and the persistence of micronutrient deficiencies in the same populations, driven by the replacement of traditional, nutritionally diverse dietary patterns with globalized ultra-processed food environments. (22) The Lancet Commission's syndemic framework contextualized these findings within the broader failure of food systems, political governance, and economic structures to provide equitable access to nutritious food —

arguing that the double burden is a predictable consequence of these systemic failures rather than the product of individual dietary choices. (8)

4.4 Micronutrient Deficiency Patterns and Biological Mechanisms

Iron, vitamin D, zinc, vitamin B12, and folate were the most frequently reported deficient nutrients across the included studies, each associated with well-characterized biological mechanisms linking their depletion to the obese physiological state. (10, 11, 8) Four primary mechanisms were identified across multiple included sources, and these mechanisms were not mutually exclusive — in most overweight and obese individuals, several operate concurrently.

The first mechanism is dietary: the patterns of food intake most commonly associated with excess weight gain — dominated by ultra-processed foods, refined carbohydrates, and sugar-sweetened beverages — are precisely those with the lowest micronutrient density per calorie. (10, 12) High caloric intake from these foods does not translate into adequate micronutrient intake because their processing removes or degrades vitamins and minerals while maximizing energy content and palatability. The second mechanism is inflammatory: obesity is characterized by chronic, low-grade systemic inflammation arising from adipose tissue, which upregulates hepatic hepcidin. (10) Hepcidin suppresses intestinal iron absorption and blocks iron release from macrophages and hepatocytes, producing functional iron deficiency even when total body iron stores are theoretically adequate — a phenomenon that renders standard haemoglobin-based anemia screening insufficient for detecting iron-related nutritional risk in obese individuals. The third mechanism is sequestration: fat-soluble vitamins — particularly vitamin D — are distributed into adipose tissue, where they are stored rather than circulated, producing low serum concentrations even in individuals with apparently adequate dietary intake or sun exposure. (11) Vitamin D's role in calcium

metabolism, immune function, and insulin signaling means that its adipose sequestration in obesity has consequences that extend well beyond bone health. The fourth mechanism is macrobiotic: obesity is associated with changes in the composition and functional activity of the intestinal microbiota — a shift toward reduced bacterial diversity and altered fermentation profiles — that impair the synthesis and absorption of B vitamins, including folate and vitamin B12. (10, 11)

Arafat et al (2024) made an important clarification clinically, that there exists a continuum of deficiency that can be measured in people with BMI between 25 and 30kg/m2 (Classed as Overweight, different than Classed as Obese). (11) Micronutrient monitoring and nutrition assessment should start at the threshold category of 'overweight' instead of only testing individuals with clinically severe obesity. Biological processes exist at all points along the entire BMI spectrum but become more apparent than earlier as the level of adiposity increases. Wells et al (2020). also added a life-course perspective to this information indicating that adults who experienced undernutrition during childhood and then went on to become overweight have both the effects from epigenetic and physiological adaptation from early nutritional deprivation compounded by the interaction of nutrition deprivation and later obesity together will lead to equally greater deficiencies in iron, zinc and vitamin D than either alone. (13)

4.5 Performance of Nutritional Screening Tools

The evidence from included studies consistently demonstrated that nutritional screening tools currently in routine clinical use are poorly suited to identifying nutritional risk in overweight and obese adults. This failure is structural: most tools were developed for populations in which malnutrition was understood primarily as a condition of insufficient weight, and their reliance on low BMI or significant unintentional weight loss as primary risk indicators means

that overweight and obese patients are systematically excluded from further nutritional assessment on the basis of body size alone. (24, 25)

The most direct empirical evidence came from van Vliet et al. (2021), who compared the performance of MUST and PG-SGA SF in 430 adult inpatients at a Dutch university hospital, of whom 35% were overweight, and 25% were obese. (25) MUST identified only 5% of overweight and obese patients as at nutritional risk, while PG-SGA SF identified 36% of the same patients — a sevenfold difference. Agreement between the two tools was very low, with a kappa coefficient of 0.143, indicating near-chance concordance in their classification of nutritional risk in this population. Ninety per cent of overweight and obese patients classified as at risk by PG-SGA SF were classified as low risk by MUST. The performance advantage of PG-SGA SF in this population is directly attributable to its design: it assesses food intake, gastrointestinal symptoms, functional capacity, and diagnosis independently of body size, meaning that a patient's elevated BMI does not automatically exclude them from being identified as at nutritional risk.

Sharma et al. (2019) characterized this systematic failure as the real paradox of hospital nutrition: obese patients are assumed to be nutritionally replete and are excluded from further assessment precisely because their body size appears to argue against nutritional inadequacy, while the actual deficiencies — in iron, vitamin D, zinc, or protein — that will impair their recovery, wound healing, immune function, and rehabilitation go undetected and untreated. (24) The clinical consequences of this paradox are not trivial: micronutrient-depleted obese patients face compounded risks from both their obesity-related comorbidities and their unrecognized nutritional deficiencies, and the failure to identify the latter means that patients leave clinical settings without the nutritional intervention that could meaningfully improve their outcomes.

The MNA and the GLIM framework performed substantially better in overweight and obese populations, though for different reasons. The MNA's inclusion of functional and dietary parameters beyond BMI enabled Sulmont-Rossé et al. to identify 23–29% of overweight and obese older adults at nutritional risk — a finding that would have been invisible using MUST alone. (15) GLIM represents the most clinically rigorous advance: its two-step framework allows the formal diagnosis of malnutrition in overweight and obese patients through the criterion of reduced muscle mass, which can be met independently of BMI through validated body composition assessment methods, and through etiological criteria that assess food intake and disease burden regardless of body size. (26) Table 4 summarizes the comparative performance characteristics of the four screening tools examined in the included studies.

Table 4: Comparison of Nutritional Screening Tools in Overweight and Obese Adults

MUST	Malnutrition Universal Screening Tool	BMI, percentage weight loss, and effect of acute disease score	Poor — primary reliance on low BMI means overweight and obese patients are classified as low risk at the first step; only 5% of at-risk overweight patients correctly identified in Dutch hospital study	(24, 25)
MNA	Mini Nutritional Assessment	Appetite, mobility, psychological stress, BMI, neuropsychological problems, dietary intake	Better than MUST for older adults — assesses functional and dietary factors beyond body weight; validated in overweight older adults;	(15)

			successfully identified 23–29% of overweight and obese older adults at risk in French national study	
PG-SGA SF	Patient-Generated Subjective Global Assessment Short Form	Food intake, gastrointestinal symptoms, functional capacity, and disease/diagnosis	Good — entirely BMI-independent; identified 36% of overweight/obese hospitalized patients at risk vs. 5% for MUST in the same study; recommended for overweight and obese clinical populations	(25)
GLIM	Global Leadership Initiative on Malnutrition Criteria	Two-step: (1) screen using validated tool; (2) assess phenotypic criteria (weight loss, low BMI, reduced muscle mass) plus etiological criteria (food intake, disease burden)	Best — formally recognizes malnutrition across all BMI categories including obese; reduced muscle mass criterion can be met independently of BMI; represents the most significant clinical advance for this population	(26)

4.6 Research Gaps Identified

The review identified several important gaps in the existing evidence base for undernutrition and micronutrient deficiency in overweight and obese adults. These gaps are not minor: they represent structural limitations that constrain the precision of clinical recommendations and

the specificity of policy guidance that can currently be offered to practitioners and policymakers working in this area.

First, most existing research on the double burden of malnutrition has focused on children and women of reproductive age; studies focusing specifically on overweight and obese adults as the primary population of interest are substantially less common. (25, 10, 16) This age-group gap means that the prevalence of micronutrient deficiency in working-age overweight adults aged 18–64 — a large and economically active population — is poorly characterized. Second, the geographic distribution of the available evidence is markedly uneven: the clinical literature on overweight-associated micronutrient deficiency is dominated by studies from Europe, North America, and Australasia, while evidence from South Asia, Sub-Saharan Africa, and Central Asia is limited, despite these being the regions where the double burden is advancing most rapidly. (1, 4, 16) Third, no nutritional screening tool has been specifically designed and prospectively validated for overweight and obese adult populations; the comparative evidence available — most notably van Vliet et al. (2021) — documents performance failures rather than recommending a validated replacement. (25, 26) Fourth, definitional inconsistency across the literature limits comparability: Davis et al. (2020) and Talukder et al. (2026) both document that the double burden lacks a universally agreed operational definition at any level of analysis, and that this inconsistency makes aggregating findings across studies methodologically problematic. (9, 29) Fifth, the evidence base is almost entirely cross-sectional; longitudinal studies tracking how micronutrient status changes as overweight develops over time, and intervention studies evaluating the effects of integrated nutritional support in overweight and obese adults, are rare or absent. (8, 17, 18) Table 5 summarizes the key research gaps identified, their descriptions, and their implications for future research directions.

Table 5: Summary of Key Research Gaps Identified in the Literature

Age-specific evidence	Most double burden research focuses on children or women of reproductive age; studies of overweight and obese adults aged 18–64 are underrepresented	Dedicated surveys and clinical studies targeting working-age overweight adults are needed to quantify prevalence and risk factors in this group
Geographic coverage	Most clinical evidence on overweight-associated micronutrient deficiency comes from Europe, North America, and Australia; data from sub-Saharan Africa, South-East Asia, and Central Asia are limited	Population-based studies with biochemical micronutrient assessment in overweight adults are needed across LMIC regions
Screening tool validation	No validated nutritional screening tool has been specifically designed and tested for overweight and obese adults; MUST, MNA, and PG-SGA SF were all developed for different populations	Prospective validation studies comparing tool performance in overweight and obese adults across different clinical settings and age groups are required
Operational definitions	Wide variation in how the double burden is defined at individual, household, and population levels limits cross-study comparison and hampers policy planning	Standardized operational definitions agreed through international consensus, as proposed by Davis et al. (9) and Talukder et al. (29), should be adopted across research and surveillance

Integrated policy frameworks	Most national nutrition strategies and international frameworks address undernutrition and obesity through separate institutional channels	Double-duty policy actions that simultaneously improve diet quality and micronutrient status without simply adding calories need to be designed, implemented, and rigorously evaluated
Longitudinal and intervention data	Almost all available evidence is cross-sectional; longitudinal studies tracking how micronutrient status changes with weight gain over time are rare	Cohort studies and randomized controlled trials examining the effects of integrated nutritional interventions in overweight and obese adults are needed to build an intervention evidence base

The convergence of these gaps — the absence of age-specific data, limited LMIC evidence, lack of validated screening tools, definitional heterogeneity, and absence of longitudinal data — means that the evidence base, while consistent in its overall direction, cannot yet support the precise quantification of prevalence, the confident identification of the highest-risk subgroups in all settings, or the recommendation of a single validated clinical pathway for the nutritional assessment of overweight and obese adults. Addressing these gaps is a research priority that is both scientifically important and practically urgent, given the continued acceleration of the global double burden of malnutrition. (5, 28, 29).

CHAPTER 5

DISCUSSION

5.1 Overview of Principal Findings

This review confirmed, across 30 diverse sources spanning six world regions, that overweight and obese adults regularly carry simultaneous nutritional inadequacy in the form of micronutrient deficiencies and broader undernutrition risk. This is a systematic, reproducible finding that has been documented in cross-sectional surveys, multi-country pooled analyses, clinical observational studies, and global surveillance data. The central finding that having an excessive amount of body weight does not protect someone from nutritional deficient status and, in fact, often leads to greater levels of nutritional deficiencies, directly challenges the assumption found in nearly every clinical screening methodology and nutrition policy framework, which is that being overweight excludes being undernourished. This chapter has examined findings in this review and compared with findings from the existing literature regarding how contemporary evidence supports, broadens, or complicates previously established knowledge. Practical implications for clinical practice, nutrition policy and future research will also be discussed.

5.2 The Nutritional Paradox of Obesity: Confirmed and Extended

The original study by Via (2012) provided a comprehensive evaluation of how obesity leads to loss of key micronutrients through several mechanisms including : 1) Chronic inflammation creating a blockade of iron due to hepcidin, 2) Sequestration of fat-soluble vitamins in adipose tissue, 3) Gut dysbiosis impairing the absorption of B vitamins, and 4) Low nutrient density diets that contribute to excess weight gain and obesity. Thus, in summary, the primary conclusion supporting the high prevalence of micronutrient

deficiencies among overweight and obese adults is based upon earlier literature demonstrating multiple biological mechanisms by which obesity causes micronutrient deficiency. (10) Recent evidence published by Arafat and colleagues confirms these deficiencies are measurable from first onset of clinical obesity at 25-30 kg/m². Thus, the current literature supports these findings, furthering our understanding of this breadth of evidence. As mentioned above, the present review is an extension of these literature findings and will also review Arafat's research (2024). (11By expanding the at-risk population to include individuals who are overweight, we create an important change. The new definition indicates that overweight individuals must also be included in the monitoring of micronutrient intake. Since the previous definition only included those who were severely obese, expanding the definition of 'at risk' from the original definition (severe obesity) to include both overweight and obese individuals means that the number of people needing to have their nutrition evaluated will now be larger than originally thought. Based on current clinical practice, only patients who are considered 'clinically severely obese' require further nutrition evaluation based on micronutrient needs.

The cross-national consistency of this deficiency pattern is notable. Damms-Machado et al. (2012) documented iodine, vitamin D, thiamine, and folate deficiencies in obese German adults before any dietary intervention; McKay et al. (2020) found lower vitamin D, iron, zinc, and B12 in overweight and obese Australian adults compared to normal-weight peers despite similar total caloric intake; and Farhat et al. (2019) demonstrated a dose-response relationship between BMI and micronutrient inadequacy in young UK adults aged 18–25. (17, 16, 18) The replication of this pattern across three distinct high-income countries with different food environments and national dietary cultures argues strongly that the deficiencies are driven by the physiology of obesity itself — specifically the four mechanisms described above — rather than by any country-specific dietary tradition or food system. This interpretation is further

supported by Wells et al. (2020), who traced the etiological pathways through which both early-life undernutrition and later overweight converge to produce compounded micronutrient depletion through overlapping inflammatory and metabolic mechanisms. (13)

5.3 Older Overweight Adults: A Clinically Vulnerable Group

The finding that approximately one in four overweight older adults and nearly one in three obese older adults were at risk of undernutrition in the French national data of Sulmont-Rossé et al. (2022) is among the most clinically actionable results in this review. (15) This prevalence — translating to an estimated 1.7 million nutritionally at-risk overweight and obese older adults in France alone — is proportionally large enough to constitute a major clinical challenge in any healthcare system with a substantial ageing population. It validates a theory that clinical judgement may forecast; however regular clinical practice has not acted upon this prediction (nutritional vulnerabilities created by aging – decreased appetite, polypharmacy's effect on nutrient uptake, progressive sarcopenia, and physiological impact of chronic illness) are compounded by excess fat mass, not reduced by it.

Earlier literature on malnutrition in older adults has primarily concerned itself with underweight or unintentionally weight-losing patients, for whom tools such as the MNA and MUST were originally designed and validated. The Sulmont-Rossé findings are important precisely because they reveal how the standard clinical response to an overweight older patient — prioritizing weight reduction — may be clinically counterproductive if it is not preceded by identification and correction of existing micronutrient deficiencies. An older patient who is both overweight and iron-deficient, vitamin D-insufficient, and losing muscle mass behind a screen of apparent adiposity presents a clinical challenge that neither the obesity management literature nor the geriatric nutrition literature has yet fully addressed. The present review calls attention to this gap and identifies it as requiring dedicated clinical

research — particularly longitudinal studies tracking the trajectory of micronutrient status in older overweight adults — that does not yet exist in adequate form.

5.4 Screening Tool Failure: Structural Rather Than Incidental

The result of van Vliet et al. (2021) regarding MUST's identification of just 5% of hospitalized overweight and obese patients being at risk of malnutrition versus PG-SGA-SF identifying 36% has a disparity of nearly seven times and a kappa statistic of just 0.143, indicating this is not simply a small error in methodology. (25) It represents a structural failure with direct patient safety implications. Sharma et al. (2019) characterized this as the real paradox of hospital nutrition: obese patients are assumed to be nutritionally replete and excluded from further assessment on the basis of their body size, while genuine deficiencies that will impair recovery, wound healing, and immune function go undetected and untreated. (24) The present review's findings are consistent with this characterization and confirm that the problem is not limited to any single tool or healthcare system but reflects a fundamental design flaw in screening instruments that treat BMI as the primary indicator of nutritional status.

The existing literature had identified this problem in conceptual terms — Kobylińska et al. (2022) provided a thorough mechanistic account of why obesity paradoxically constitutes a form of malnutrition, and the WHO had formally classified obesity as such — but the empirical evidence for the scale of screening failure was limited before van Vliet et al. (25, 23) The PG-SGA SF's superior performance in this population is directly attributable to its design philosophy: by assessing food intake, gastrointestinal symptoms, physical function, and diagnosis independently of body weight or BMI, it can identify patients whose nutritional vulnerability is masked by excess fat mass. The results are in agreement with the general argument proposed by Cederholm et al. (2019) about the GLIM Consensus, that formal

diagnosis of malnutrition should be possible in all categories regardless of BMI; should be made based upon phenotypic criteria (primarily reduced muscle mass, which can be evaluated independently to ISIS) where these criteria are particularly susceptible to the unique nutrition vulnerabilities present in patients. (26)

In terms of practical implications, it is apparent that clinical practice should implement clinical nutrition screening protocols utilizing MUST as the only basis of screening is inadequate for clinical practice in all acute hospital settings treating a high volume of overweight and obese patients, which is now essentially all hospital settings in middle-income and developed countries. Tools that are Independent of BMI, including PG-SGA-SF or the GLIM framework, should be utilized to supplement or replace the MUST tool for nutrition screening in the acute hospital setting. The evidence presented here is clear justification for implementing this change; the only obstacle to implementation will be the need to incorporate this evidence into revised clinical guidelines and institutional protocols.

5.5 Socioeconomic and Regional Patterning: Poverty as a Double Driver

According to the theoretical framework laid out by the Lancet Commission's Global Syndemic report (Swinburn et al., 2019), the fact that the double burden of malnutrition is concentrated among households with low income, rural areas, and urban slum areas in LMICs — as opposed to being entirely a problem experienced by wealthier individuals with obesity— supports the assertion that poor food systems create obesity as well as undernutrition at the same time, especially within food-insecure areas where poverty influences the ability of people to access adequate nutrition. (8) The Indian data from Nguyen et al. (2021) and Bhandari et al. (2021) provided the most detailed quantification of this pattern: the steepest increases in overweight were recorded in the poorest rural and urban-slum households — the same communities already carrying the highest undernutrition

burden — and spatial analysis confirmed that district-level coexistence of underweight and overweight was concentrated in areas with the worst socioeconomic conditions. (19, 12) This geographic and socioeconomic patterning directly contradicts the framing of obesity as a condition of abundance: in the Indian context, and across Latin America as documented by Hernández-Ruiz et al. (2022), the nutritional transition is producing more calories without improving dietary quality, generating weight gain alongside persistent micronutrient deficiencies in the same households. (22)

Sahiledengle and Mwanri (2024) and the NCD Risk Factor Collaboration's 2024 pooled analysis both confirmed that this pattern is not confined to India: more than one in three LMICs now face concurrent national-level burdens of undernutrition and overweight, and the combined burden continues to rise in the majority of countries studied. (4, 5) In sub-Saharan Africa, Tareke et al. (2025) found the double burden in Lesotho's nationally representative 2023–2024 DHS data — 15.2% underweight alongside 36.6% overweight or obese in the same adult population — providing one of the most recent and geographically specific confirmations of the phenomenon in an African context. (6) These findings strengthen the argument, advanced by Winichagoon and Margetts (2017) and by Davis et al. (2020), that treating undernutrition and overweight as separate policy problems with separate institutional mandates is both analytically incorrect and programmatically wasteful, and that integrated approaches capable of simultaneously improving diet quality and micronutrient adequacy in low-income communities are the appropriate policy response. (27, 9)

Little et al. (2020) contributed another level of complexity in how low-income rural communities in South India experience the double burden of obesity and undernourishment: i.e., caste, gender, and income level all affect an individual’s nutrition status independently with women at low socio-economic status being much more likely than men and women at moderate to higher socio-economic status being more likely to have high rates of obesity and

diabetes. (21) This within-community heterogeneity means that aggregate prevalence estimates can obscure the specific sub-groups most in need of integrated nutritional support, and that policy and programme design requires disaggregated data that can identify distinct patterns of risk within communities rather than treating communities as nutritionally homogeneous.

5.6 Policy Implications

The findings of this review have direct implications for nutrition policy at both the national and international levels. The most fundamental implication is that nutrition surveillance, screening, and intervention programmes designed around a single-condition model — either undernutrition or overweight — will systematically fail a substantial proportion of the population whose nutritional vulnerability spans both. The FAO's assessment that the world is off-track for all seven global nutrition targets (2, 7) is in part a consequence of this single-condition design: programmes targeting undernutrition in children and women of reproductive age are not reaching overweight adults in the same households, and obesity prevention programmes are not screening for or addressing micronutrient deficiencies in their target populations.

Menon and Peñalvo (2020) found that only seven studies globally had evaluated interventions specifically designed to address both forms of malnutrition simultaneously — a finding that reflects the near-complete absence of double-duty action at the programmatic level despite sustained advocacy from the Lancet Commission, the WHO, and the FAO. (28) For a country like India, where the double burden is documented at scale and where large national nutrition programmes, including POSHAN Abhiyaan, reach millions of households, the practical question is not whether integrated approaches are desirable but how existing programme architectures can be adapted to include micronutrient assessment in overweight

adults as a routine component of community health worker visits and primary care consultations. Both Stewart et al. (2020) and Wells et al. (2020) stressed that the framework for developing effective strategies to address the double burden of malnutrition must include longitudinal approaches within nutrition programs to address the impact of under-nutrition in early life as well as balance benefits across the life span by providing long-term investments in prevention through adult nutrition and/or other means. Utilizing the metabolic programming associated with these early nutritional deprivations creates ongoing vulnerabilities; therefore, addressing the double burden through effective policy development to mitigate the impact of early childhood undernutrition will result in long-term success in preventing childhood obesity. (20, 13) This framework regarding one's entire life will help to widen our view when examining the role of policies today. The double burden (both underweight and overweight) that today's overweight adult is experiencing, is partly a result of a poor nutrition environment before the present-day adult was born. Therefore, if we want to reduce the prevalence of the double burden in tomorrow’s adult population, we must invest in improving the nutritional environment of all individuals, from conception through childhood.

5.7 Definitional and Methodological Considerations

The various definitions and measurement methods used in the studies examined for this review provided a common dilemma for researchers. This problem has been well documented by Davis et al. (2020) on a systematic basis, with substantial variability in operational definitions for the double burden at individual, household, and population levels constraining comparisons of prevalence estimates and making it difficult to compile results across studies. (9) Talukder et al., (2026) return to this topic with a review of more recent literature and they

discovered that the issue of definitional inconsistency continues to exist, despite the focus on it in

previous works. The authors recommend that a method for generating operational definitions that

creates comparable evidence must be created through international consensus prior to developing a more complete evidence base. (29) The present review is constrained by the same inconsistencies: because included studies used different cut-off values for micronutrient deficiency, different anthropometric criteria for overweight, and different screening or assessment tools, it is not possible to provide a single precise global prevalence estimate for undernutrition in overweight adults.

The near-complete dominance of cross-sectional study designs in the available literature represents a related methodological limitation, noted by multiple included sources. (8, 17, 18) Cross-sectional studies can establish the co-occurrence of overweight and micronutrient deficiency at a single point in time but cannot determine whether obesity preceded and caused the deficiency, whether pre-existing deficiency contributed to weight gain, or how the relationship between the two evolves over time. Longitudinal cohort studies and randomized controlled trials are necessary to address these causal and temporal questions, and their near-absence from the current evidence base represents a significant gap. The evidence reviewed here is sufficient to justify clinical and policy action, given the consistency of the cross-sectional pattern across multiple settings and study designs, but the mechanistic and causal questions that would most precisely inform the design of interventions require prospective evidence that does not yet exist at an adequate scale.

5.8 Limitations of This Review

Several limitations of this review are acknowledged. As a narrative rather than systematic review, the source selection process was not guided by a pre-registered formal protocol, introducing the possibility that the selection of included studies was influenced — however unintentionally — by the reviewer's prior knowledge of the literature. The thematic analysis was conducted by a single reviewer without independent parallel screening or inter-rater reliability assessment, limiting the formal verifiability of inclusion and thematic assignment decisions. The geographic distribution of included studies, while broad, over-represents European and Indian populations relative to sub-Saharan African and South-East Asian settings, which constrains the extent to which specific quantitative findings can be generalized to these underrepresented regions. While these limitations align with narrative review designs and do not negate the central findings, they encourage researchers to continue to conduct additional primary studies to fill in the gaps across various regions and population segments and warrant future systematic reviews that can employ formal meta-analytic methods as the evidence base develops and becomes more uniform.

This review advances research by aggregating for the first time in one document the results from 30 distinct sources that examine the impact of undernutrition among overweight and/or obese individuals from biological, clinical, epidemiological, and public policy perspectives. Furthermore, the congruency of evidence across all of these perspectives (the hepcidin pathway in the lab, screening tools working in Dutch hospitals, clusters of districts in India, as well as the analysis of public policy in LMICs) supports both that the occurrence is real and has consequences and that the clinical and policy interventions needed are also attainable.

CHAPTER 6

CONCLUSION

6.1 Summary of Findings

This review set out to answer one central question: Can a person who is overweight or obese also be undernourished? The answer, confirmed across 30 sources from six world regions, is yes — and this is not a rare exception. It is a well-documented, globally consistent pattern. Iron, vitamin D, zinc, vitamin B12, and folate deficiencies are regularly found in overweight and obese adults across high-income and low-income countries alike, and the biological reasons why this happens are well understood. (10, 11)

Obesity triggers long-term low-grade inflammation that blocks iron absorption through the hormone hepcidin. Fat-soluble vitamins such as vitamin D become trapped in adipose tissue and cannot circulate freely in the blood. Gut bacteria change in ways that reduce the body's ability to absorb B vitamins. On top of this, the diets that tend to cause weight gain — high in ultra-processed foods and low in variety — are exactly the diets lowest in essential vitamins and minerals. (10, 11, 13) These four processes work together, meaning that a high BMI and a well-nourished body are two very different things.

Crucially, Arafat et al. (2024) confirmed that these deficiencies begin at a BMI of 25–30 — the overweight range — not only in severe obesity. (11) This means the population at nutritional risk is far larger than clinical practice currently recognizes. Studies from Australia, Germany, the United Kingdom, France, India, the Netherlands, and Lesotho all point to the same conclusion: body size is not a reliable indicator of nutritional adequacy. (15, 16, 17, 18, 6)

6.2 Key Conclusions

The following conclusions can be drawn from the findings of this review:

- **Micronutrient deficiency in overweight and obese adults is common and clinically significant.** Iron, vitamin D, zinc, vitamin B12, and folate were the most frequently deficient nutrients, with estimated prevalence ranging from 15% to 60% depending on the specific nutrient and study population. (10, 11, 15, 16, 17)
- **Standard nutritional screening tools fail this population.** MUST identified only 5% of at-risk overweight and obese hospital patients compared to 36% identified by PG-SGA SF in the same study — a sevenfold gap driven by MUST's reliance on low BMI as a primary risk indicator. (25)
- **The GLIM framework is the best available clinical response.** By using muscle mass and etiological criteria independently of BMI, GLIM can formally diagnose malnutrition in overweight and obese patients who would be missed by BMI-dependent tools. (26)
- **Older overweight adults are a particularly high-risk group.** 23% of overweight and 29% of obese older adults were at nutritional risk in a French national study — yet this group is routinely excluded from nutritional assessment because of their body weight. (15)
- **Poverty and food insecurity drive both overweight and undernutrition simultaneously.** In India, the fastest increases in overweight were recorded in the poorest rural and urban-slum households — the same communities with the highest existing undernutrition burden. (12, 19)

- **Treating undernutrition and overweight as separate policy problems is wrong and wasteful.** The same broken food systems and social inequalities generate both. Integrated approaches that improve diet quality without simply adding more calories are the right response, but remain largely untested at scale. (8, 27, 28)

6.3 Implications for Practice and Policy

For clinicians, the practical message of this review is straightforward: do not assume that an overweight or obese patient is nutritionally well. A routine clinical encounter with an overweight adult should include, at a minimum, a brief dietary assessment and, where resources allow, biochemical testing for the most commonly deficient nutrients — particularly iron, vitamin D, and vitamin B12. BMI-independent screening tools such as PG-SGA SF should be used in place of MUST in overweight and obese adult populations, and the GLIM framework should be adopted where a formal malnutrition diagnosis is required. (24, 25, 26)

For policymakers, particularly in countries like India, where the double burden is advancing rapidly, and large national nutrition programmes already exist, the implication is that programme architectures need to expand. POSHAN Abhiyaan and similar initiatives have made important progress on child undernutrition and maternal anemia, but the nutritional needs of overweight adults in the same low-income households fall outside their current scope. Adding micronutrient screening for overweight adults to routine primary health care and community health worker visits would be a practical, low-cost first step. (8, 12, 21) At the international level, the evidence reviewed here supports the Lancet Commission's call for double-duty actions — policy interventions that simultaneously address both ends of the

malnutrition spectrum by improving food environments, diet diversity, and access to nutritious food, rather than simply targeting one condition at a time. (8, 28)

6.4 Suggestions for Future Research

The evidence base for undernutrition in overweight and obese adults, while consistent in direction, remains incomplete in several important ways. The following priorities for future research emerge from the gaps identified in this review:

- **Longitudinal cohort studies** tracking how micronutrient status changes as body weight increases over time, to establish the causal direction of the relationship between obesity and specific deficiencies. (8, 13)
- **Population-based studies in LMICs** — particularly in sub-Saharan Africa and South-East Asia — that assess biochemical micronutrient status in overweight adults alongside anthropometric data, to fill the major geographic gap in the current evidence base. (4, 5, 6)
- **Prospective validation of nutritional screening tools** specifically designed for overweight and obese adults across different clinical settings, age groups, and world regions, building on the comparative evidence provided by van Vliet et al. (25, 26)
- **Randomized controlled trials of integrated nutritional interventions** that simultaneously address micronutrient deficiency and support healthy weight management in overweight and obese adults, particularly in LMIC primary care settings. (28)
- **Standardized operational definitions** for the individual-level double burden, agreed through international consensus, to enable cross-study comparison and more reliable tracking of trends over time. (9, 29)

6.5 Closing Remarks

The coexistence of overweight and undernutrition in the same person is no longer a paradox — it is one of the defining nutritional challenges of our time. The continued evolution of food systems, the increase in ultra-processed food consumption, and the rise in obesity in areas that previously suffered from food insecurity will cause even more individuals to be afflicted by both epidemics as time goes on. (2, 5, 30) The evidence reviewed in this dissertation shows that we already have the biological understanding, the clinical tools, and the policy frameworks needed to begin addressing this challenge. Currently, what is required is the determination to utilize existing practices when responding to malnutrition globally, including clinical, national and international policies related to nutrition — and how these policies will impact how people act towards malnutrition.

This review has shown that addressing malnutrition of overweight or obese adults is not a specialization issue — rather, it is critical to improving the overall health of people in a world where dietary patterns are changing. Therefore, this subject should also be considered a priority area for both nutrition research and policy development.

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