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Review Article

Obesity beyond individual choice: food environments, geolocation technologies, and public policies for obesity prevention

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ABSTRACT

Obesity is a major public-health challenge shaped not only by individual behavior but also by the environments in which people obtain, purchase, prepare, and consume food. Latin America and the Caribbean face a particularly severe burden, marked by high obesity prevalence, food insecurity, and limited affordability of healthy diets. This narrative review examines how food environments, geolocation technologies, territorial inequalities, and public policies influence obesity prevention, weight management, and health promotion in adults. The reviewed evidence indicates that food choices and weight-related outcomes are influenced by the availability, affordability, and type of foods offered within home, retail, institutional, workplace, and mobility-related environments. Geolocation technologies expand this assessment by identifying exposure around residences, workplaces, and commuting routes and by revealing food deserts, food swamps, and territorial inequalities that residential measures alone may overlook. Geographic Information Systems can also support public-health planning, service allocation, and the identification of vulnerable populations, although individual GPS tracking is not a standard WHO method for obesity surveillance. Brazil has a strong normative framework for food and nutrition policy, but implementation varies across institutions and regions. Other Latin American countries have advanced through coordinated regulatory and fiscal measures, while the WHO European Region has placed greater emphasis on regional surveillance, physical-activity policy, product reformulation, and integration with health services. Effective obesity prevention requires coordinated action across food systems, health systems, social policy, and urban planning. Priority actions include improving access to nutritious foods, strengthening healthier community and institutional food environments, protecting children, expanding equitable obesity care, and using geospatial surveillance to identify populations and territories facing the greatest barriers. These findings reinforce that obesity cannot be attributed

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solely to individual choice and requires structural, territorially informed, and context-specific responses.

KEYWORDS: Food environment; Geolocation technologies; Geographic Information Systems; Obesity; Public policy; Territorial inequalities

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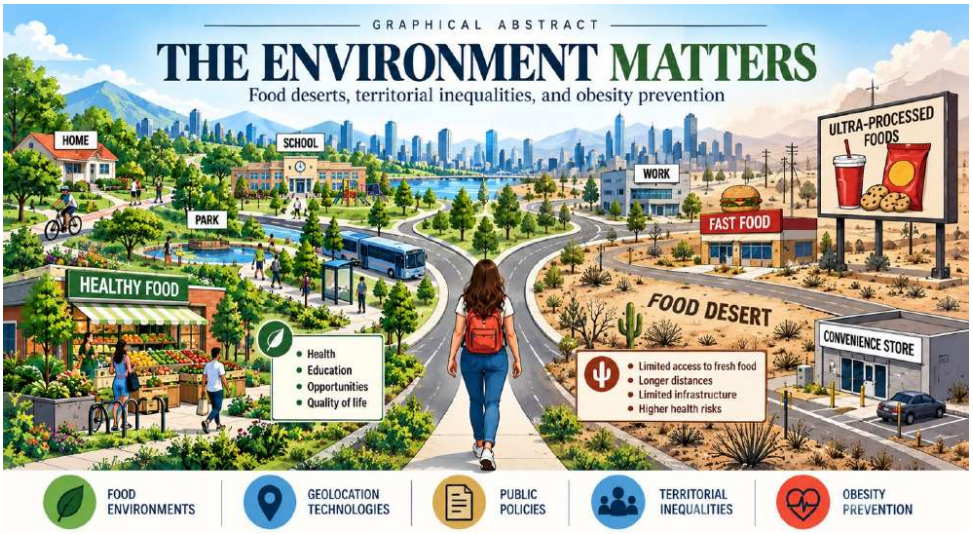
GRAPHICAL ABSTRACT:



INTRODUCTION

According to the World Health Organization [1], in 2022, approximately 2.5 billion adults aged 18 years and older were overweight, including more than 890 million who were living with obesity. Defined as an abnormal or excessive fat accumulation that presents a health risk, a higher-than-optimal body mass index was responsible for an estimated 5 million noncommunicable disease deaths in 2019 [2]. Furthermore, this condition is no longer confined to high-income nations; today, some middle-income countries exhibit among the highest prevalence rates worldwide, illustrating a shift where obesity now surpasses underweight in almost every region [2]. Obesity is a chronic, relapsing, and multifactorial disease arising from complex interactions among genetic, neurobiological, behavioral, commercial, and broader environmental factors. Therefore, it should not be understood solely as the result of an imbalance between energy intake and energy expenditure or as a consequence of individual choices.

Latin America and the Caribbean have experienced a rapid nutrition transition characterized by increased availability of ultra-processed products, urbanization, persistent socioeconomic inequality, and unequal access to healthy diets. According to the 2025 Regional Overview of Food Security and Nutrition [3], adult obesity in the region reached 29.9% in 2022, corresponding to approximately 141 million adults. This prevalence was almost twice the global estimate of 15.8% and nearly doubled from the 15.4% recorded in 2000.

The regional burden coexists with food insecurity and substantial economic barriers to healthy eating. In 2024, approximately 181.9 million people, representing 27.4% of the population of Latin America and the Caribbean, were unable to afford a healthy diet. The estimated cost of a healthy diet reached USD 5.16 per person per day, adjusted for purchasing power parity, the highest regional cost worldwide [3]. The coexistence of obesity, food insecurity, and unaffordable healthy diets illustrates the double burden of malnutrition and reinforces that excess body weight cannot be interpreted solely as the result of individual behavior.

The Pan American Health Organization [4] reports that the Region of the Americas has the highest prevalence of overweight and obesity among all World Health Organization regions. In 2022, the estimated age-standardized prevalence of overweight or obesity among adults was 67.5%, while obesity alone affected 33.8% of the adult population. Nevertheless, regional averages conceal substantial variation between countries and population groups. Therefore, the Latin American context requires policies that address food affordability, commercial determinants, urban food access, social protection, and the prevention and management of noncommunicable diseases.

The themes addressed in this review are particularly relevant to Sustainable Development Goals (SDGs) [5]. SDG 2 includes access to safe, nutritious, and sufficient food and the elimination of malnutrition in all its forms, while SDG 3 encompasses the prevention of noncommunicable diseases and health promotion. Socioeconomic and territorial inequalities in access to healthy food can also be related to SDG 10, whereas the influence of neighborhoods, mobility, and urban planning is relevant to SDG 11. Finally, the principles of sustainable healthy diets proposed jointly by the Food and Agriculture Organization of the United Nations and the World Health Organization [6] support the relationship between food systems, responsible production and consumption, and SDG 12.

In this complex scenario, recent literature highlights the necessity of shifting focus from purely individual behavior to the broader environmental context. The overall food environment, and more specifically, the exposure to explicitly obesogenic environments, significantly influences the purchasing and consumption practices of people engaged in weight management [7]. Dietary choices are shaped by the interaction between these environmental cues and individual neurobiological determinants, such as hedonic hunger and food craving [8].

The influence of these environments operates across multiple scales, from the built and community domains [9] to the domestic sphere, where household food availability can either support or undermine behavioral interventions [10,11]. However, for structural changes to be effective, it is essential to translate national policies into coordinated municipal actions [12].

Given the multifactorial nature of obesity and the varying levels of policy implementation across regions, a comprehensive synthesis of how spatial, domestic, and regulatory environments interact is necessary. Therefore, this narrative review aims to describe and synthesize the current evidence regarding the impact of the food environment on weight management, exploring the role of geographic inequalities, geolocation technologies, and public policy responses, with a particular focus on the Latin American context.

To discuss, through a narrative review of the scientific literature, how food environments and geospatial approaches influence obesity prevention, weight management, and health promotion in adults.

The specific objectives are to examine how domestic, community, workplace, institutional, and mobility-related food environments may support or hinder weight management; discuss Geographic Information Systems and geolocation-based methods for characterizing exposure and territorial inequalities; assess Brazilian policies and implementation gaps; compare selected policy approaches in Brazil, other Latin American countries, and the WHO European Region; and discuss priorities for global action on obesity and noncommunicable diseases.

THEORETICAL FRAMEWORK

DISTINGUISHING THE FOOD ENVIRONMENT FROM THE OBESOGENIC ENVIRONMENT

Neve and Isaacs [7] define the food environment as the settings and conditions that influence food availability, accessibility, affordability, and convenience. It is crucial to distinguish this broad, neutral concept from an

obesogenic environment. While the food environment encompasses all contexts of food acquisition, not every characteristic within it directly influences the risk of obesity. An obesogenic environment represents a specific, detrimental condition within this broader landscape. The Brazilian Ministry of Health defines it as a setting that actively favors excessive energy consumption and makes healthier choices more difficult [13]. This distinction is evident in extreme spatial manifestations: *food deserts* (areas where access to affordable and nutritious foods is limited) and *food swamps* (areas where outlets selling energy-dense, nutrient-poor foods are highly concentrated relative to healthier food sources).

DETERMINANTS OF EATING BEHAVIOR: HEDONIC HUNGER AND ENVIRONMENTAL CUES

Eating behavior is influenced not only by physiological needs but also by food reward, craving, and environmental exposure. Crane et al. [8] examined hedonic hunger, food craving, and uncontrolled eating, showing that although these constructs overlap, they represent distinct dimensions of responsiveness to highly palatable foods, particularly when individuals are exposed to an explicitly obesogenic home food environment. Conversely, when looking at the broader, neutral consumer food environment, Borges et al. [14] demonstrated that characteristics such as price, convenience, product availability, presentation, and promotional practices can function as either barriers or facilitators to healthy eating, rather than automatically promoting weight gain.

DOMESTIC FOOD ENVIRONMENT AND PLANNING

The home food environment includes all foods available, accessible, and routinely purchased within the household. It serves as a baseline setting that can lean toward being protective or obesogenic. Although individuals may have comparatively greater control over this setting than over community or commercial environments, preventing the home from becoming obesogenic is not determined by intention or planning alone. Interventions that modify food purchasing, delivery, and availability may support healthier choices, but their effects on weight outcomes depend on broader behavioral and environmental conditions.

PUBLIC POLICIES AND FOOD SECURITY

At a macro level, food environments are shaped by policies related to health, agriculture, education, social protection, food production, retail, and urban planning. The transformation of agri-food systems through evidence-based policy recommendations is essential to ensure that healthy diets remain available, accessible, and sustainable [15]. In Brazil, the National Food and Nutrition Policy provides an intersectoral framework for promoting adequate and healthy eating and coordinating actions with the National Food and Nutritional Security System. This perspective is consistent with the Sustainable Development Goals related to food security, health, inequality reduction, sustainable cities, and responsible consumption and production, aiming to shift global food environments away from obesogenic tendencies.

METHODOLOGY

SEARCH STRATEGY AND ELIGIBILITY CRITERIA

To capture robust and relevant data regarding the influence of the food environment on weight management, a targeted literature search was conducted, primarily utilizing the PubMed database. The inclusion criteria were designed to encompass high-level evidence, limiting eligibility to randomized controlled trials (RCTs), adaptive clinical trials, multicenter and comparative studies, observational research, systematic reviews, meta-analyses, and official clinical practice guidelines. Conversely, publications were excluded if they consisted of non-original data, such as opinion pieces, letters, and editorials, or if their primary outcomes did not directly correlate with the central focus of this manuscript.

SELECTION PROCESS AND DATA SYNTHESIS

The procedure for identifying appropriate literature began with a preliminary evaluation of titles and abstracts to determine their potential relevance. Because the search strategy relied heavily on specific database filters within a single primary platform, the use of automated reference management software for duplicate extraction was deemed unnecessary.

Following the initial screening phase, a curated selection of potentially eligible articles underwent comprehensive full-text scrutiny. Studies that demonstrated weak methodological frameworks or deviated from the overarching theme were subsequently discarded. As this manuscript is structured as a narrative overview rather than a systematic review, the extraction and synthesis of data were performed qualitatively by a single researcher. The authors recognize that the absence of a blinded, multi-reviewer process inherently introduces a degree of selection bias. Additionally, standardized bias-assessment protocols, such as AMSTAR 2 or the Cochrane Risk of Bias tool, were intentionally omitted. These instruments are specifically designed for quantitative meta-analyses and systematic reviews, whereas the objective of the current paper is to provide a comprehensive, descriptive synthesis of the contemporary literature surrounding obesogenic environments and weight loss interventions.

RESULTS AND DISCUSSION

THE COMPLEXITIES OF FOOD ACCESS AND URBAN ENVIRONMENTS

The reviewed literature consistently demonstrates that local food environments are unequally distributed and strongly influenced by socioeconomic factors, though the relationship between food access and dietary outcomes is highly complex. Urban environments play a critical role in this dynamic, as how cities are shaped and planned directly encourages or hinders healthy diets and active lifestyles [16]. A systematic review by Caspi et al. [17] highlighted heterogeneous findings that varied according to how food access and dietary outcomes were measured. Their synthesis supports treating geographic accessibility as only one component of food choice, warning against the assumption that mere proximity to supermarkets results in healthier intake.

Consistent with the theme of territorial inequality, Brazilian studies reveal structural disparities. Lopes et al. [18] analyzed geographic access to fruit and vegetable outlets in Belo Horizonte, finding that establishments were unequally distributed with more favorable access in socioeconomically advantaged areas. Similarly, Grilo, Menezes, and Duran [19] geocoded food outlets in Campinas, identifying five of the city's eighteen regional administrations as "food swamps." These areas consistently combined greater social vulnerability with a higher relative availability of fast-food outlets. Furthermore, Borges et al. [14] audited 650 food retail establishments in Jundiaí, demonstrating that product availability, price, and promotional practices differ significantly by establishment type. Together, these studies form a consensus that consumer food environments can either expand or restrict opportunities for healthier purchasing.

However, the strength of this evidence is primarily observational. Because studies like Lopes et al. [18] used a cross-sectional and ecological design, they identify correlations and territorial inequalities but cannot establish a direct causal effect on individual dietary intake or weight loss. Qualitative evidence adds necessary context to these spatial findings; Yoon et al. [20], using photo-elicitation interviews in Seoul, found that adults perceive convenience, tempting food cues, and alcohol-related eating contexts as major influences on weight management. While this qualitative approach describes experiences rather than causal effects on body weight, it aligns consistently with the quantitative audits showing that environmental cues shape consumer choices.

INDIVIDUAL EFFORTS VS. ENVIRONMENTAL EXPOSURE

The synthesis of the literature indicates a clear interaction between individual motivation and environmental support. Konsor, Schneider, and Appelhans [21] examined 196 adults and found that meal planning and grocery-list use did not mediate the relationship between weight-loss attempts and household food availability. These findings strongly suggest that individual motivation and planning alone may be insufficient to modify the foods routinely available within the home environment.

Conversely, broader environmental support appears to facilitate individual success. Clynes et al. [22] analyzed 6,946 adults who reported successful weight-loss maintenance, finding that those living in healthier retail food environments maintained weight loss for approximately six months longer than those in less healthy environments. While inconsistent methodologies (e.g., cross-sectional designs) limit causal inferences, the synthesized evidence points to a consistent narrative: long-term weight management is significantly hindered in unsupportive food environments, regardless of individual planning.

METHODOLOGICAL SHIFTS: THE ROLE AND LIMITS OF GEOLOCATION

To better capture environmental exposure, the literature shows a methodological shift toward Geolocation and Geographic Information Systems (GIS). The World Health Organization [23] describes GIS as a vital resource for public-health planning, identifying underserved populations, and monitoring inequalities. Harnessing this geospatial data is increasingly recognized as a transformative approach for better health surveillance and targeted interventions [24].

Studies utilizing Global Positioning System (GPS) methods consistently argue that relying solely on residential addresses underestimates actual exposure. Burgoine and Monsivais [25] characterized exposure across neighborhoods, workplaces, and commuting routes, while Burgoine et al. [26] found that greater exposure to takeaway outlets across these diverse daily spaces was associated with higher consumption, higher BMI, and greater odds of obesity. Liu et al. [27] further reinforced this by showing that greater *time-weighted* exposure to fast-food outlets was associated with higher consumption, suggesting that exposure duration provides stronger evidence than simple proximity. Studies mapping daily activity spaces confirm that individuals are frequently exposed to food outlets located far from their residential neighborhoods [28,29].

Despite this methodological advancement, the evidence provided by GPS tracking contains notable inconsistencies and limitations. A systematic review by Siddiqui et al. [29] found that results depend heavily on methodological choices, including tracking duration, buffer size, and outlet classification. Tamura et al. [30] compared residential measures with GPS-defined activity spaces among low-income adults in New York City, revealing that associations differed according to geographic measures, showing that GPS does not automatically provide a superior estimate. Furthermore, the literature cautions that presence within an activity space does not necessarily equal entry, purchase, or consumption [29]. Additionally, Chaix et al. [31] highlighted severe privacy limitations, noting that GPS data requires explicit informed consent, data minimization, and de-identification due to its sensitive nature.

Furthermore, while geospatial methodologies offer advanced estimates of environmental exposure, the interpretation of these findings must rigorously account for confounding variables. Geospatial analyses frequently struggle to fully isolate the food environment from socioeconomic status, individual mobility constraints, and pre-existing dietary preferences. A critical methodological challenge in this field is residential self-selection, recognizing that the spatial distribution of individuals is not random. For instance, individuals with strong preferences for highly palatable, convenient foods may actively choose to reside in neighborhoods with a high density of fast-food outlets, just as health-conscious individuals might self-select into areas with greater access to fresh food markets. Consequently, while the synthesized studies demonstrate clear

associations between spatial exposure and dietary habits, it remains difficult to definitively determine whether the obesogenic environment is solely shaping the behavior, or if pre-existing behaviors, socio-demographic factors, and residential self-selection are simultaneously driving these spatial patterns.

GLOBAL POLICY LANDSCAPES AND IMPLEMENTATION GAPS

When synthesizing policy responses across different regions, the literature reveals distinct but complementary strengths, alongside a consistent gap between policy formulation and local implementation.

In Latin America, countries have progressed through mandatory measures. Chile stands out for its coordinated regulatory package (warning labels, marketing restrictions, school rules), which Taillie et al. [32] reported led to a significant reduction in purchases of regulated beverages. Mexico provides robust evidence for fiscal policies, with Colchero et al. [33] reporting notable decreases in household purchases of taxed sugar-sweetened beverages in 2014 and 2015.

In contrast, the WHO European Region, where 59% of adults live with overweight or obesity [34], has placed greater emphasis on regional surveillance, physical-activity policy, product reformulation, and integration of obesity management into health services [35]. Recognizing the severity of this burden, experts urge that obesity prevention and management must become a central pillar of public health strategies rather than a peripheral concern [36].

Brazil presents a comprehensive intersectoral framework, anchored by the National Food and Nutrition Policy (PNAN), the Dietary Guidelines emphasizing minimally processed foods, and mandatory front-of-package nutrition labeling [37,38]. The Pan American Health Organization emphasizes that the adoption of such front-of-package nutrition warnings is a crucial strategy to help decrease obesity, cardiovascular disease, type 2 diabetes, and certain cancers across the Americas [39]. However, the evidence consistently points to implementation failures. Germani and Immig [12] identified limitations in incorporating PNAN guidelines into municipal planning. Furthermore, Mariath and Martins [40] noted that legislative proposals addressing food-industry practices often fail to be enacted, and Recine et al. [41] classified most Brazilian actions as having low or medium implementation levels, particularly regarding retail and pricing. The synthesized evidence highlights that improving food environments requires not just national policy design, but municipal capacity and coordination.

While comparing policy frameworks across Brazil, other Latin American nations, and the WHO European Region provides valuable public health insights, these comparisons must be contextualized. The reviewed literature underscores that differences in healthcare systems, economic structures, dietary cultures, and policy implementation capabilities significantly influence the success of nutritional interventions. Consequently, not all regulatory or fiscal solutions are directly transferable between regions. For instance, a successful measure implemented in a European context with a robust primary care network and high municipal administrative capacity may face substantial implementation barriers in Latin American settings characterized by deeper socioeconomic inequalities and different commercial food dynamics. Therefore, while international examples highlight the importance of intersectoral action, they should serve as conceptual models rather than rigid templates, requiring careful economic and cultural adaptation to be effective at the local level.

GLOBAL PRIORITIES AND THE SUSTAINABLE DEVELOPMENT GOALS

Addressing the burden of noncommunicable diseases, which caused at least 43 million deaths globally in 2021 [42], requires universal but contextually adapted responses. The WHO consistently recommends comprehensive policies protecting children from food marketing [43], school nutrition standards [44], and fiscal measures combining taxes on unhealthy foods with subsidies for healthier options [45]. Implementing these

"smart food policies" is fundamental to modifying the commercial and environmental drivers of poor diets and effectively preventing obesity [46].

The synthesized findings of this review align directly with the Sustainable Development Goals (SDGs). Improving the affordability of nutritious foods (SDG 2), preventing premature mortality from NCDs (SDG 3), addressing territorial inequalities in food environments (SDG 10), improving urban planning (SDG 11), and promoting sustainable public food purchasing (SDG 12) all require intersectoral approaches. The overarching consensus in the reviewed literature is that obesity prevention demands coordinated action across health systems, food systems, and urban planning, rather than interventions relying solely on individual education or willpower.

CONCLUSION

This narrative review reinforces that obesity cannot be explained solely by individual choices or willpower. While the broad food environment encompasses all settings of food acquisition, specific obesogenic environments, shaped by food availability, affordability, retail patterns, household conditions, institutional settings, and territorial inequalities, actively drive excessive energy consumption and hinder healthy decisions.

Geolocation technologies strengthen this perspective by allowing environmental exposure to be assessed beyond residential neighborhoods. Geographic Information Systems can identify food deserts, food swamps, inequalities in access to nutritious foods, and territories where social vulnerability overlaps with limited health-promoting resources. GPS-based methods can characterize exposure across workplaces, commuting routes, and broader activity spaces. However, these approaches require careful methodological interpretation, particularly regarding confounding factors such as residential self-selection, socioeconomic status, and individual mobility, alongside strong protection of sensitive mobility data.

Brazil has developed an important normative framework through the National Food and Nutrition Policy, the Dietary Guidelines for the Brazilian Population, school food standards, public food purchasing, and front-of-package nutrition labeling. Nevertheless, implementation varies across institutions and regions, and important gaps remain in local planning, pricing, food retail, regulatory enforcement, and evaluation.

The comparison with other Latin American countries and the WHO European Region shows that policy strengths differ. Crucially, because healthcare systems, economic structures, dietary cultures, and implementation capabilities vary significantly across these regions, international solutions are not directly transferable and demand contextual adaptation. Chile has implemented a coordinated package involving warning labels and school food regulation, while Mexico has applied and evaluated fiscal measures targeting sugar-sweetened beverages. The European response has placed greater emphasis on regional surveillance, physical-activity policy, product reformulation, and integration with health services.

Global action should remain universal but adapt technical and financial support according to disease burden, social inequality, health-system capacity, and policy implementation. Priority actions include improving access to nutritious foods, strengthening healthier institutional and community food environments, protecting children, expanding equitable obesity care, and using geospatial surveillance to identify populations and territories facing the greatest barriers.

Overall, effective obesity prevention requires coordinated action across food systems, health systems, social policy, and urban planning. Individual education remains important, but it cannot compensate for environments in which healthier options are less available, less affordable, or more difficult to access.

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