



Narrative Review of Obesogenic Environments

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ABSTRACT

The rising prevalence of obesity reflects the influence of obesogenic environments settings that promote excessive calorie intake and discourage physical activity across both urban and rural contexts. Urban areas, where over half the global population resides, shape opportunities for physical activity, dietary habits, and social interaction through urban design, green spaces, traffic patterns, and food accessibility. In contrast, rural regions face challenges such as limited access to recreational facilities and healthy food options, compounded by socioeconomic disparities and cultural factors that shape eating behaviors. Current research highlights inconsistencies due to methodological variations, inadequate differentiation between perceived and objective environmental measures, and insufficient focus on diverse global contexts. Future research must integrate behavioral and environmental determinants at multiple levels to clarify causal pathways and inform community-based interventions. The implications for public health are profound, requiring multi-level strategies that mitigate obesogenic conditions, reduce individual vulnerability, and foster health-promoting environments. Emerging approaches such as community engagement through participatory interventions, technological innovations, smart-city initiatives, and mobile health applications present promising opportunities to reshape both urban and rural settings toward healthier living. Collectively, these insights underscore the urgent need for interdisciplinary action, data-driven urban design, and technological integration to counteract obesity and enhance global health outcomes.

Keywords: Obesogenic Environments, Urban Design and Health, Community Engagement, Smart City Initiatives and Mobile Health Applications (MHAs).

INTRODUCTION

Obesity is on the rise in developed countries, creating a serious public health problem around the world. Obesity is associated with higher mortality rates, cardiovascular disease, diabetes, and several other health problems. Some of the environmental factors that have been reported to contribute to obesity include access to supermarkets, fast food outlets, and exercise facilities; land use; public transport; and street connectivity [1]. Studies have shown that these factors affect physical activity and diet, which are behaviors that directly influence body weight [2]. The fact that the built environment influences physical activity and diet is creating interest in the possibility of changing current environments to promote physical activity and healthy eating. Efforts to achieve this goal would allow communities to promote health and limit the need for treatment through simple changes throughout the community [6]. Regional planning, neighborhood design, housing, transportation, and distribution of services are all aspects of the built environment that are linked to health outcomes [3]. Investigators have sought interest in this link, which is the result of long-term commitments of resources by research foundations to encourage initial investigation of the area. Funding programs support the creation of measurement tools that reflect both the social and physical aspects of the environment and provide analytical approaches to evaluate the complex relationships found and additional research that begins to clarify the role of residential context in health [4].

Definition of Obesogenic Environments

Obesogenic environments are those that contribute to weight gain and hinder weight control efforts [2]. The environment includes physical, economic, policy, and socio-cultural factors that affect an individual's food intake and physical activity [3]. Food environments influence the type and location of food outlets, the cost of food, advertising exposure, and both social and cultural norms around food. Urban design factors such as walkability,

access to public transport, green spaces, and availability of recreational facilities also affect energy expenditure and physical activity levels [2, 3]. Socio-cultural factors encompass social models, cultural meanings, and socio-economic status, with individuals from lower socio-economic backgrounds and those with greater vulnerability such as reduced mobility, learning disabilities, or lower environmental awareness being more prone to obesogenic environments [4].

Historical Context

Following significant post-war advances in nutritional and hormonal sciences, it was quickly realized that these internal approaches would not provide a sufficient explanation for the widespread prevalence of obesity [2]. Instead of focusing exclusively on individuals with obesity or how obesity emerges in a population, critical attention turned in the direction of how obesity is produced and how obesity spreads through social groups. Public health practitioners on obesity moved away from individual level behaviour change towards understanding obesity at a societal scale and on spatial scales of community and neighbourhoods [3]. These social and spatial nexuses of external drivers of obesity necessarily contain environmental variables associated with obesity viewed within the context of specific urban forms of social organization [3]. In public health research, obesogenic environments constitute “an environment that promotes gaining weight and one that is not conducive to weight loss within the home or workplace” [4]. Explicit mentions of obesogenic environments in the health literature can be traced back to the early 1990s, when chroniclers of the global epidemic of obesity began to question the traditional focus on individual behaviours such as physical activity, diet, and lifestyle [5]. Obesogenic environments emerged as a concept in the early 1990s in reference to “the sum of influences that the surroundings, opportunities, or conditions of life have on promoting obesity in individuals or populations,” marking a pivot from individual characteristics to broader contextual ones [7]. World Health Organization (WHO) recommendations incorporate a focus on structural environmental changes to facilitate access to healthy choices. Broader concerns with the particular spatial organization of resources, activities, or services eventually led to the more geographic notion of obesogenic environments: the degree to which a “particular places do or do not promote increased food intake, non-healthy eating behaviours, and physical activity” [5].

Key Components of Obesogenic Environments

Obesogenic environments are those that promote obesity among individuals and populations [6]. Factors in the physical environment, such as design for motorized transport rather than walking, lack of recreational or exercise facilities, and poor access to affordable healthy foods, are major contributors creating such environments [13, 16]. High population density and provision of public parks increase walkability and access to recreational facilities [8]. Entry of supermarkets into rural areas leads to the availability of healthy foods. Cultural, socioeconomic or environmental factors are also related to obesity [7]. Low income and lack of knowledge about nutrition increases the susceptibility of people to become obese. Cultural factors determine what people eat, thereby influencing their diet habits [5]. The concept of obesogenic environments can be traced back to 1995 when Swinburn and colleagues considered physical, biological, economic and cultural aspects of members of society that changed their behaviors and patterns, resulting in obesity [2, 18]. Milstein and colleagues observed that just like communicable diseases, obesity clusters geographically, therefore, variations in geographic or built environments may be associated with variations in the risk of obesity in populations of those environments [25, 28]. It is also clear that, although the risk of obesity is related to individual behavior and underlying biological factors such as genetics, the potential causes of obesity at a population level need to be investigated in the context of environment and policies. The present paper explores the role of environment in obesity [24, 26].

Physical Environment

Obesity is often conceptualized as “a condition of life within environments that promote increased food intake, nonhealthy foods, and physical inactivity”, with ‘environments’ defined broadly as the opportunities or conditions exogenous to the individual that influence obesity-related decisions and behaviors [8]. An obesogenic environment is therefore one “that promotes obesogenic (i.e., weight gain producing) behaviors” [7]. These behaviours include limited physical activity and high-calorie dietary intake; prominent components of obesogenic environments are the physical, social-cultural and political environments, which collectively create the living, working and leisure conditions that influence energy balance [6]. One key element of the physical environment concerns urban design and land use, including the availability of recreational facilities and the walkability of neighborhoods [6]. Higher public transport access and larger park area close to residential locations are associated with small decreases in BMI [5]. The relationship of car access with weight status is less clear and may depend on whether the vehicle is used as a convenience or facilitates greater opportunity for physical activity; the strength of any association between physical environmental characteristics and obesity is moderated by the manner in which those characteristics are measured [5]. Travel behaviour acts as an important mediator [4]. In a related observation, large urban populations benefit from aspects of scale in setting the physical conditions for physical activity and healthy food availability [2].

Social Environment

Obesity is influenced by the social environment, which acts as a mediator of obesity production by affecting how the body is experienced and how the physical and food environments are negotiated [28]. Social environments can foster behaviors and exposure to social norms that protect against or promote weight gain [27]. A greater number of social contacts appear to have a protective influence, reducing obesity risk, a pattern most apparent across younger populations [14]. Observing obesity as a social phenomenon frames it as a complex, socially networked condition that remains influential beyond specific spatial contexts [23]. For example, cigarette smoking similarly reflects social phenomena mediated by environmental and psychological factors. Socially mediated behaviors and responses relevant to obesity include patterns of physical activity, levels of stress, and food selection [17]. Both food and activity choices are influenced by social processes and networks that, with other elements of the social environment, influence behavior and psychological responses that determine nutritional outcomes and body size [2].

Economic Environment

In the past years, changes in the worldwide economic environment have affected income, education and food prices influencing individual energy consumption; at the same time, urban developments, as well as trade agreements, have an impact on food availability and costs [1]. Economic factors influence not only how obesogenic environments are shaped, but also affect individuals' capacity to avoid them [24]. Low-income groups tend to spend larger proportions of their income on energy-dense foods, as well as maxing out their credit cards; additionally, they usually cannot afford gym memberships, have less free time to exercise, and schools in their neighborhoods may limit access to physical activity programs [26]. Welfare and social benefits provide low-income families with access to energy-dense food, while educational limitations constrain awareness about healthy food choices [25]. As a result, members of these socioeconomic groups are more likely to live in obesogenic environments.

Impact of Urban Design on Obesity

Neighborhood walkability is strongly associated with physical activity among adults [5]. Recreational facility access is more consistently related to physical activity among youth and lower-income adults than the general adult population. High walkability is associated with lower odds of obesity in adults [5]. Availability of green spaces is potentially related to moderate to vigorous physical activity in adults, but findings are inconsistent. A more nuanced understanding of the impact of urban design on obesity at different stages of the lifecycle is necessary. Physical aspects of urban design relate to the built environment, referring to planned or constructed features of the larger physical environment [2]. Characteristics of the built environment that are particularly influential include neighborhood design and transportation infrastructure [2]. In general, high-density urban centers that promote walking, cycling, and public transportation relate inversely to obesity and BMI [1]. Polycentric urban development is rapidly emerging as the dominant form of urban settlement worldwide, with large urban populations benefiting from aspects of scale in setting the physical conditions for physical activity and healthy food availability [1, 6].

Walkability

Urban design can create an environment that encourages or discourages physical activity [11]. The availability of public parks or recreational facilities such as swimming pools, sport stadiums, walking and jogging trails might encourage the population to participate in such activities and thus control their weight or diminish their weight gain [7]. In contrast, the lack of such recreational facilities discourages physical activity and contributes to higher rates of overweight and obesity [8]. Studies reveal that there is a strong negative association between urban design walkability and overweight and obesity [9]. Data revealed, for example, that for every point increase in walkability index, odds of being overweight or obese were reduced by 10%. Another study found an increased risk of obesity of 2.5 times in both men and women for the lowest versus the highest walkability index [11]. A study in Germany showed an 8-point increase in walkability score (scale 0–100) was associated with a decrease of and Body-mass Index and Waist-to-height Ratio [13]. Research in Canadian metropolitan areas showed that residents of less walkable neighbourhoods (lowest quartile of Walk Score®) had 70% greater odds of obesity compared to residents of highly walkable neighbourhoods in the highest quartile [17].

Access to Recreational Facilities

Access to recreational facilities is considered one of the physical environment factors influencing obesity. Numerous cross-sectional and longitudinal studies have assessed the relationship between urban design characterized by neighborhood walkability and street connectivity and body mass index (BMI). These studies employ GPS and GIS technologies to quantify distances from individuals' homes to the nearest recreational facilities [6]. Lee, Lee, and Macfarlane [7] concluded that the features of neighborhood recreational facilities play a significant role in promoting youth physical activity [8]. The provision of community exercise space validates the necessity of recreational infrastructure within neighborhood environments. However, given that the presence

of such facilities does not prevent widespread weight gain or inactivity [8], urban design alone does not fully account for the obesity epidemic. Examining the availability of facilities in conjunction with current physical activity behaviors may help to clarify this complex association.

Food Environment and Accessibility

The availability of food is a key aspect of the food environment [9]. The food environment has a considerable influence on dietary intake and obesity-related outcomes [10]. The absence of healthy food sources in residential areas and reliance on convenience stores is a significant concern [11]. Such areas with limited access to fresh and healthy food are often designated as “food deserts”.

Availability of Healthy Foods

Obesity has become a global concern over the past four decades, and experts seek conditions that either promote or fail to protect against excess weight gain [12]. The term “obesogenic environment,” introduced by researchers at the University of Glasgow and popularized by Swinburn et al. (1999), refers to the sum of influences that surroundings, opportunities, or life conditions exert on an individual’s diet and physical activity [13]. Excess body fat remains a leading risk factor for cardiovascular disease, diabetes, and several other chronic conditions. The concept has been embraced by fields ranging from psychology to business and urban planning. Scientific literature has adopted a comprehensive definition viewing obesogenic environments as the collective physical, economic, political, and sociocultural elements that encourage obesity in individuals or populations [12, 13]. Urban planning affects community connections and the choice to drive over more active options, creating obesogenic settings through street layouts, transportation efficiency, and distance to work or retail centers. Social and cultural environments, shaped by societal norms around body shape, eating, and activity, can promote weight gain. Economic factors constrain choices through transportation costs, housing costs, and safe recreational spaces [14]. Availability of healthy foods remains the most studied obesogenic factor. Diet quality correlates with overall health and the ability to maintain a healthy weight [17]. Food deserts limit access to fruits, vegetables, and other products needed for a balanced diet. Without these provisions, individuals rely on energy-dense processed items, increasing weight, malnutrition, and diabetes. Policies targeting zoning and retail environments aim to increase the availability of healthy options [18].

Food Deserts

Food deserts are commonly defined as areas with poor access to healthy and affordable food [14]. Food deserts exist mainly in underserved communities, exacerbating health disparities across the United States [15]. Improving food access requires a community effort, leadership from government officials, and long-term policies. Ongoing research is essential to evaluate and adapt strategies. Additionally, neighborhood clinics can increase health awareness and strengthen connections to primary care, contributing to better health outcomes [14, 15].

Socioeconomic Factors

A socioeconomic gradient affects the likelihood of becoming obese and illustrates how physical, social, and economic factors produce obesogenic environments [15, 16]. Low-income areas tend to have fewer grocery stores selling healthy and affordable foods, while an overdose of calorie-dense and nutrient-poor products is available in corner shops and convenience stores [16]. Greater financial resources and education make it easier to acquire foods requiring frequent renovation and to know which foods are healthy. Furthermore, living in economic hardship can lead to overspending and consuming junk food and beverages with a higher calorie intake [15]. These findings confirm that low income can be a major obstacle to a healthy diet and contribute to socioeconomic inequalities in the food environment around the world [16]. Higher socioeconomic status (SES) also promotes autonomy, self-efficacy, and a better appreciation of and attention to one’s appearance [2]. At the economic level, high and rising prices act as a major obstacle to the provision of fresh fruits and vegetables to poor sections of the community [14].

Income Levels

High income levels are inversely related to obesity. In developed regions that attract migrant workers with low education levels and low incomes, individuals may lack knowledge about healthy eating or access to amenities supporting healthier behaviors and thus become particularly vulnerable to obesogenic environments [17]. In Saudi Arabia migrant workers constitute about 29% of the total population, and many live in crowded compounds where opportunities for food storage and preparation are limited [17]. Consequently they often consume high-calorie fast foods, take-away meals, and snacks that are readily available, cheap, and served in large portions [18]. Furthermore, they generally have low physical activity levels due to limited opportunities to participate in alternative recreational activities [17, 18].

Education and Awareness

Education and awareness may serve as protective factors against obesogenic environments. Food literacy pertains to the theoretical and practical knowledge of food and its implications for health and well-being [24]. Low levels of food literacy can increase risk factors for obesity, such as poor diet quality and food insecurity [3]. A

longitudinal cohort study demonstrates how better practice of four food literacy domains plan and manage, select, prepare, and eat [19] was significantly associated with healthier dietary behaviours among adolescents who experienced the environmental change of changing schools [19]. This approach highlights the importance of integrating strategies into public health interventions that support at-risk groups to develop better food literacy in order to mitigate obesogenic environments [18].

Cultural Influences on Eating Habits

Culture refers to the characteristics and knowledge of a particular group of people, encompassing language, religion, cuisine, social habits, music, and arts, which create an identity and condition behavior [9]. Culture is one of the factors that determine the type of food people consume and their eating patterns [1]. Different cultures lead to different food usages and habits [8]. Historically, the geographical location of a country and the natural conditions of a particular place dictated eating habits that were also related to its culture. Therefore, the diversity of eating habits stems from the differences in natural and geographical conditions [10, 11]. In the modern world, globalization trends have caused regional and local situations to lose their effectiveness on the decision-making and consumption behaviors of consumers [30]. However, local cultures still have a profound effect on the food habits of people. Consumers' eating habits are influenced by many factors such as income, nutritional awareness, price levels, cultural attitudes, nutritional habits, geographic and climatic factors, and traditions, as well as social and cultural factors [29]. The modern-day awareness of individuals about living healthy and consciously has increased. Accordingly, individuals pay more attention to the construction of their body and structure and the development of their lives. It is observed that individuals are more eager to pursue a program to be healthy and eat regularly and timely [12]. A role is assigned to advertising in defining the message created by the consumer about the product or service. Today, advertisements promote desired buying and consuming acts but also help develop unwanted false needs [13]. However, unfortunately, the message directly experienced is not true, and this can create psychological dissatisfaction in the consumer's mind [12].

Policy Interventions

At the urban design scale, zoning and land-use regulations can maintain a balance of retail establishments conducive to health [20]. These regulations have potential to limit the density of fast-food establishments, thereby reducing exposure to obesogenic food environments and promoting healthier dietary intake [20]. Population-level reforms targeting food outlets and their products constitute a rapidly emerging field [21]. Mandatory nutrition labelling provides a low-cost, wide-reaching, and relatively hands-off mechanism for dietary reform. Alongside spatial and compositional interventions, pricing strategies are considered a promising strategy for orchestrating large-scale change [20, 21].

Zoning Laws

Zoning laws can reduce the density and prevalence of fast-food restaurants, as well as help encourage recreational land uses in residential neighborhoods and ensure the community-wide availability of a restaurant menu labeling program [22]. Starting in 1977, the San Francisco Bay Area Air Quality Management District implemented California's first Regional Transit Priority Project (RTPP) to assist BART and AC transit in improving their service frequencies and speeds throughout the Bay Area to services where transit service was known or predicted to be resilient, even in the face of rising fares [22].

Nutrition Labeling Regulations

After a city's zoning laws restricting access to fast food outlets, policymakers can employ restaurant nutrition-labeling laws. Some researchers have argued that menu-labeling policies shave 4% off the calories in food-away-from-home orders [23]. Prospective pizza purchases from a carryout chain that introduced per-ingredient calorie information during the Great Recession decreased by approximately 443 calories per transaction (one large pizza corresponds to roughly 2,000 calories) [23]. An investigation into the impacts of New York City's 2008 calorie-labeling initiative discovered that the total calories purchased decreased more in restaurants that independently predicted relatively low compliance [23]. Nutrition-labeling regulations have important implications for public health and consumer awareness [21]. Various investigations have examined consumer understanding and use of nutrition labels across countries in the Global South. Consumer response to different food labels, including front-of-package (FOP) labeling, influences dietary choices and obesity-prevention patterns. A global review reveals trends toward standardization of nutrition-label standards and claims [24]. The effect of legislation is apparent in the mode of presentation and consumer perceptions, with a focus on FOP nutritional-labeling systems and claims. Awareness and use of food labeling differ considerably among populations, which in turn influences the ability to select more healthful options [6]. Effective communication of nutritional information is key to promoting healthy diets, thereby reducing vulnerabilities to non-communicable diseases [23].

Role of Media and Advertising

Several media platforms, including television, Internet, cinema, radio, games, music, magazines, and billboards, frequently showcase behavior that forms part of the obesogenic environment, contributing to the spread of obesity

[25]. The promotion of fast foods, soft drinks, processed foods, confectionery, snacks, and alcohol is widespread, and the public, especially children, are exposed to a large variety of media messages containing these stimuli [25]. Moreover, the constant presentation of these behaviors can contribute to a misperception of the characteristics of the social environment and facilitate the acceptance of these behaviors [25].

Psychological Factors

Obesogenic environments are those often constructed unintentionally and embedded within everyday settings [1]. People inhabiting these environments often unconsciously adopt patterns of behavior that predispose them to weight gain [2]. Furthermore, individuals with preexisting psychological vulnerabilities may be particularly susceptible to weight gain within such settings [2].

Behavioral Patterns

Behavioral patterns offer a reliable means for understanding the complex interactions leading to overweight and obesity, particularly among children [26]. Combining existing knowledge from diverse fields fosters the development of behavioral patterns grounded in a unifying conceptual framework [10]. Several patterns have been identified, including clusters within activity behavior and dietary intake, as well as across these categories [20]. These patterns relate to overweight development and associate with parental and child background characteristics, especially in children of lower socioeconomic status or higher parental body mass index [21]. Boys and girls exhibit substantially different behavioral patterns with varying relations to overweight, implying the need for tailored preventive approaches for each gender [25]. Future prevention efforts may benefit from addressing diet- and activity-related behaviours simultaneously, emphasizing not only enhanced physical activity but also reduced sedentary time [22]. Clustering of determinants, such as parenting practices and cognitive factors like attitude and perceived control, occurs and may indicate a broader obesogenic family context [26]. Modifying one behaviour or related determinant can induce positive effects in others, a mechanism exploitable in effective prevention strategies [28].

Mental Health Considerations

Psychological processes that are important components of obesogenic environments include behavioural patterns and mental health considerations [27]. Behavioural patterns are affected by habits and environmental cues which influence food intake, food choice and the level of physical activity that is undertaken. Mental health issues such as stress, anxiety and depression increase the likelihood of obesity because they can trigger unhealthy behaviour or lead to the release of cortisol [25]. Obesity is also associated with mental health disorders such as anxiety and depression which can lead to a cycle of overeating and increased weight gain [28].

Global Perspectives on Obesogenic Environments

The relative impact of a country's obesity burden partly depends on its context. Countries like Pakistan, independently ranked 71 out of 163 in 2007, are prone to rapid increases because they pass through the demographic transition before economic growth has shifted diets to high calorie or high fat options [2]. The environments that facilitate maintaining energy balance are also dependent on the stage of the nutrition transition. Countries in stage IV, the degenerate or lifestyle disease phase frequently have an urban bias in food distribution since the agriculture manufacturing services transition produces more and better food for the cities than rural households [5]. These urban environments tend to be more obesogenic since food supplies are mostly from supermarkets and restaurants while rural populations retain more traditional diets [7].

Comparative Studies

Central to the debate on climate change is the design and operation of large-scale economic and technological systems such as energy supply, industry, transport, and wide-area agriculture and forestry [2]. In response to a wide range of greenhouse gas emission (GHGE) reduction targets, considerable efforts have been made to identify low-carbon substitutes and alternatives to existing systems [24]. Consequently, many technological options have been developed and vetted against performance criteria involving cost, potential feedstock availability, and the scale of emissions reduction [26]. Here, the emphasis lies on limited solutions with technical maturity and near-term deployment potential. However, there has been little consideration of how the underlying system designs might be reconfigured to better fit such options and lower overall emissions [23]. Whole-system design approaches that address this gap are more promising because of their transparent articulation of the impact of alternative targets and assumptions on the feasibility of a "best" option, and the critical role of constraints, including infrastructure, system boundaries, and distribution between direct and indirect emissions [1]. It is crucial to investigate these whole-system designs and their influence on GHGE reduction targets during the option selection process [3]. Crucially, while there is scope to reduce sector-wide emissions by reconfiguring the functions, locations, and patterns embedded in current systems, there are strong previous indications that these design changes only yield such benefits at an order of magnitude less than those attainable from technology substitution and improvement [22].

Cultural Variations

Obesogenic environments vary across cultural contexts and geographical locations, with implications for obesity prevalence [21]. These environments are urban or rural areas that promote unhealthy diet and physical inactivity, but not all cultures or places respond in the same way [29]. Local customs and ethnic backgrounds influence perceptions of overweight, while the physical and social components of obesogenic environments affect behavior differently across settings [8]. Mexican settings retain cultural referents dictating adequate body size and eating patterns, and the availability of unhealthy food is lower in rural than in urban settings [7]. Consequently, certain urban and rural obesogenic environmental characteristics seem to contribute to obesity development through culturally conditioned behavioral responses [3]. Culture strongly influences associations between food and emotions, as well as the ability to recognize feelings of stress or hunger [4]. Family and food are central cultural factors in urban and rural Mexico, and food environments are shaped by culture through attitudes, beliefs, and access. Eating with family, particularly when dining out, is considered a way to bond. Decisions, behaviors, and perceptions related to feeding practices often persist after migration [4]. The maternal role traditionally involves providing healthy food and caring for the family, but conflicts arise due to domestic workload and employment. Family, friends, and neighbors play a significant role in childhood feeding: extended family can enable healthy changes among Mexican families living in the U.S., while immediate and extended family members can pose barriers to a healthy lifestyle among those living in Mexico [25].

Case Studies

Cities in developing nations encompass underprivileged populations living in slums. For instance, in Lagos, a housing shortage has precipitated a rise in people residing in formal settlements, which is associated with increased obesity rates [2]. The interplay of rural–urban migration and environmental deterioration may give rise to obesogenic environments in peri-urban slums [30]. In South Africa, the high and fast urbanisation rate has not been matched by adequate policies and effective governance. An increase in access to ultra-processed foods is observed, mainly in informal settlements [1], and the accompanying food systems now offer choices which are susceptible to widespread changes in social, economic and cultural factors [6]. The global outbreak of the COVID-19 pandemic created an environment where governance responded by restricting movement of people and access to essential services to control the virus spread, while livelihoods and socioeconomic well-being plummeted [15]. While such restrictions were essential to control virus spread, the measures have contributed to an increase in the obesogenic environment in some cases [16]. A limitation to most obesogenic environment studies is the assumption that people reside and shop in the same neighborhood without factoring in mobility [17]. Further, measuring exposure to food environments within a predefined buffer may not reflect the true extent of exposure that occurs outside the environment and within other locations such as place of work or education [18]. Collaboration with urban planners enables testing of additional infrastructure while meeting energy expenditure in a different way. Community participation enables the community to work with authorities to examine local problems such as prohibitively expensive cost of healthy food during a pandemic and availability of walking and cycling lanes in an urban environment [1, 30]. Within Asia, smart cities are preferred by many countries and their implementation within the focus regions can provide useful information on smart monitoring of obesogenic factors, movement of people, and even remote diagnosis and management of obesity [30, 31]. Within the country context, mobile-health applications can be developed to collect locally-relevant information.

Urban Areas

Urban environments provide the contexts where over half the world's population live, work and recreate [11]. As a consequence, avenues for physical activity and access to recreation and health facilities crucially depend on urban design and the spatial distribution of associated services and facilities [13]. Urban living also determines access to and consumption of a nutritious diet and the way people are able to interact socially and culturally with others in the community [10]. Urban design also influences multiple factors related directly to well-being where the quality and accessibility of green space, traffic volume and air quality and social cohesion must all be considered [9]. Among the various environmental influences on obesity, the composition of the urban physical environment has been emphasized [13]. Walkability is a behavioural indicator that characterises urban environments in terms of their suitability for walking, with a walkable community defined as one in which walking is 'an easy, safe, and pleasant experience where residents can satisfy some or all of their daily needs without use of a car' [2]. Vegetation in the built environment is also beneficial to increasing walking [6]. The availability, accessibility and the perceived quality of recreational facilities are also commonly measured within the obesogenic environment literature [9]. Food environments include local food outlets such as convenience stores and takeaway restaurants that promote unhealthy food consumption and therefore encourage obesity [14]. Analyses show that the presence of healthier food outlets, including grocers and supermarkets, is associated with a reduced risk of being obese, consistent with their role providing fresh, nutrient-rich foods that align with dietary guidelines [1].

Rural Areas

Obesogenic environments encompass many physical component characteristics, such as low walkability or recreational facility access [11]. When considering these environmental restrictions beyond urban areas, they are also relevant in rural settings and can determine children's weight status. The influence of unhealthy food accessibility in the rural environment may exacerbate these effects on BMI, extra weight, and obesity [13]. In this regard, „retail food deserts,“ areas characterized by low geographic access to supermarkets and grocery stores as well as limited access to healthy food options, pose similarly complex health risks to urban and rural populations [12]. Socioeconomic factors continue to be important, with lower income and education shaping individual awareness of physical activity and nutritional needs, thereby fueling susceptibility to obesity in an unhealthy environment. Cultural aspects also bear relevance [30]. Individuals develop specific eating habits according to their cultural background [5, 9]. This explains the lack of clearly significant correlations between accessibility to unhealthy food and BMI, extra weight, or childhood obesity, an effect probably mediated by psychological factors related to attitude and behavior. The absence of a clear association suggests that unhealthy food availability does not invariably lead to unhealthy eating habits in children and teenagers [14]. Similarly, research indicates that eating behavior is approved or disapproved by the mass media, which, despite not being a direct obesogenic environment component, decisively influences healthy or unhealthy children's behaviors [18].

Future Research Directions

Emerging perspectives on the pathways driving obesity have suggested the need for approaches that integrate environmental and behavioural determinants at multiple levels [2]. Obesogenic environments are central to public-health-mediated and community-based intervention, regulation and empowerment strategies that are moving to the forefront of research on prevention [3]. Unpacking the pathways linking environment effects is currently a key area for future work, and research may also address the limits in understanding the properties of such environments [7]. Over the past decade, there has been a limited appreciation of the actual properties of the environment that are obesogenic and what methodologies are appropriate for assessing the causality of environmental effects [13]. For example, a central assumption in obesogenic environment research is that built environments to be obesogenic suppress physical activity and enhance calorie consumption, yet associations between obesity and objectively measured physical activity are extremely limited [17]. Currently, the challenge lies in the assessment of the properties of obesogenic environments and in addressing the necessary qualifications and limits of community-based intervention [19].

Limitations of Current Research

Key limitations of current research into obesogenic environments challenge the ability to identify the most influential environmental factors on obesity development [21]. Numerous physical environmental correlates such as access to recreation areas, proximity to fast food outlets, and availability of walking and cycling infrastructure potentially influence weight status through their effects on food intake and physical activity [3]. Variation in study methods, measures, and situational factors has produced inconsistent findings [22]. A review of reviews underscores insufficient literature quality and a lack of methodological quality assessments for primary studies, alongside inadequate differentiation between objective and perceived measures of the environment [4]. Studies that employ causal inference methods concentrate on selective aspects of the food environment, overlooking dietary exposures at home, workplaces, and schools [27]. Available data often remain aggregated and fail to capture individuals' comprehensive daily exposures, which probably contributes to weak associations with BMI. Only two studies assess the school food environment and none examine workplace surroundings, indicating a significant research gap in evaluating the multiple environments impacting individuals throughout the day [13]. Most investigations focus on Western countries, particularly the USA, thus limiting the worldwide generalizability of findings [32]. Additional limitations include reliance on incomplete or inaccurate datasets, overly generalized categorizations of food sources, and methodological issues in defining exposure for example, the use of administrative boundaries that may not correspond to actual access [10].

Implications for Public Health

The implications of obesogenic environments for public health are significant and warrant clear elucidation. Persistently high prevalence of overweight and obesity is an indication of enduring exposure to such environments, constituting a major public health concern, heightening motivation to reduce their ubiquity [2]. Because many obesogenic factors thus appear difficult to alter rapidly, public health takes three complementary avenues for dealing with the underlying causes of the obesity pandemic [12]. One seeks to mitigate or compensate for obesogenic features of the environment; another attempt to reduce individual vulnerability to such features; and the third involves the development of environments that promote health [18].

Community Engagement Strategies

Community engagement is proposed as a means to address the complex phenomenon of obesity, which requires collaborative efforts to create environments supportive of healthier lifestyles [30]. Many communities have been empowered to address these topics through participatory interventions, yet research remains scarce in deepening understanding on the potential effectiveness of mechanisms for direct involvement of city inhabitants [24]. One approach to generate urban policy recommendations is based on Photovoice, a participatory method that relies on citizens' photographs and narratives being displayed in exhibitions to reach policymakers, stakeholders and other groups of citizens [19, 23]. The methodology has been employed in a European city with the objective of implementing actions to enhance walking opportunities and access to healthy food. The process provided valuable insights into the community's needs, especially among disadvantaged populations [25]. Local authorities accepted most of the proposals, several of which have already been integrated into the urban agenda, while others are in preparation. The approach underlines the importance of empowerment and engagement in laying the groundwork for community-driven interventions to prevent obesity [26].

Technological Innovations

Urban design exercises critical influence over dynamics governing physical activity and dietary behavior in obesogenic environments [1]. Post-pandemic, myriad digital interventions are being developed to curtail infection transmission, sustain psychosocial well-being, and foster economic resilience; many of these also bear capacity to promote physical activity and modulate diet, thereby mitigating obesity risk [2]. Smart-city initiatives enable real-time monitoring of traffic volume, route congestion, pavement quality and accessibility, air quality, noise levels, urban heat island effects, and exploitment of green spaces, facilitating customized app-based recommendations aligned with user preferences and needs. Wearable applications can advise on caloric consumption vis-à-vis expenditure during a cycle [27].

Smart City Initiatives

Reflecting the transition from setting the physical conditions whereby neighborhoods or workplaces could promote physical activity to providing that same opportunity through connection with others, smart-city initiatives have the potential to transform both the urban environment and body weight [5]. Cities embracing such initiatives typically integrate information from multiple public and private sources including other cities, government services, users, businesses, social media, daily activities, and health metrics into a unified framework. This framework enables real-time intervention, allowing cities to address challenges related to mobility, socioeconomics, and sustainability while enhancing the quality of life [1]. Polycentric cities characterized by multiple centers of activity tend to exhibit lower obesity rates than monocentric or dispersed urban forms, and the prevalence of polycentric urban development is rising globally [2]. In large polycentric urban areas, smart-city strategies and the utilization of smart devices are expected to foster new modes of social interaction and influence health-related behaviors [28]. Whereas a polycentric urban form addresses obesity predominantly through macro-level planning, neighborhood-focused approaches concentrate more on shaping social norms. Moreover, the increasing platformization of society marked by the integration of digital platforms into daily life bears significant implications for how environments external to the body affect obesity. Changes in urban design coupled with the intensification of digital-physical hybrid sociality are reshaping these relationships [29].

Mobile Health Applications

In parallel with smart city innovations for obesity control, mobile health applications (MHAs) may offer a personal alternative to urban interventions [30]. MHAs have emerged as a prominent platform for weight management, which is a widely advocated target for curtailing the obesity trajectory [31]. Clinicians are frequently queried regarding the utility of MHAs, while many users have independently adopted apps to aid in weight control [32]. Recent studies report encouraging outcomes of app-based interventions in diverse populations, but conflicting data persist concerning the consistency and magnitude of effect [32]. According to existing evidence, MHAs are best suited as low-intensity or supplementary components of conventional strategies; insufficient rationale exists to endorse their adoption as solely or primarily intensive weight-loss methods. Further investigation is necessary to delineate the conditions under which MHAs maximize benefit, both as autonomous modalities and adjuncts to comprehensive programs [1]. While research on MHAs in primary and secondary care remains nascent, the preliminary consensus identifies considerable potential. Progress toward robust, standardized evaluation frameworks will enable systematic appraisal and optimization of MHAs via coordinated interventional studies [31]. Particular attention to the influence of embedded features psychological support, real-time feedback, adherence monitoring, reminders, and prescription integration is critical for understanding mechanisms and enhancing effectiveness. Consequently, MHAs promise significant facilitation of weight management services in medical settings pending validation of their durability and scalability at the population level. Improvements in mobile technology echo revolutionary health-care possibilities worldwide [32].

CONCLUSION

Obesogenic environments represent a complex interplay between social, physical, and technological factors that collectively influence obesity prevalence. In both urban and rural settings, environmental determinants such as walkability, food accessibility, socioeconomic status, and cultural behaviors significantly shape individuals' health outcomes. Despite the progress in identifying these factors, research remains fragmented due to methodological limitations and narrow geographic focus. The path forward requires an integrated approach that combines environmental restructuring, behavioral interventions, and technological innovation. Community engagement emerges as a crucial mechanism, empowering residents to participate actively in designing healthier environments. Furthermore, smart-city technologies and mobile health applications provide scalable, data-driven tools that can enhance monitoring, encourage active lifestyles, and personalize interventions. To ensure lasting impact, public health strategies must be inclusive, evidence-based, and adaptable to both urban and rural contexts. Ultimately, combating obesity demands a coordinated, multi-sectoral effort to transform obesogenic environments into enablers of physical, mental, and social well-being thereby safeguarding future generations against the global obesity epidemic.

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