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ACCESS TO HEALTHY FOOD AND ADULT OBESITY: A SECONDARY EVIDENCE SYNTHESIS WITH CLINICAL IMPLICATIONS FOR ENDOCRINOLOGY

ABSTRACT: Background: Obesity is highly prevalent and determined, in addition to individual factors, by characteristics of the food environment. Understanding how the availability of healthy foods affects obesity risk is important for endocrinology practice.

Objective: Summarize the relationship between access to healthy food and obesity in adults and highlight the clinical and public health implications.

Methods: Focused secondary synthesis based on contemporary systematic review and meta-analysis, supplemented by representative observational studies. Exposures are operationalized as proximity, density and composite indices (eg RFEI). Pooled odds ratios (ORs) with 95% confidence intervals were extracted; no new re-meta-analysis was performed. Quality and bias were considered within the framework of PRISMA and the ROBINS-I domain.

Results: Closer availability of fast food was consistently observed to be associated with higher odds of obesity (≈OR 1.15), while proximity to supermarkets and greater density of fresh food stores were associated with lower odds (≈OR 0.90 and ≈OR 0.93). Composite indices are more often close to the neutral effect. Heterogeneity depends on the definition of the exposure zone (signal clearer in wider

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buffers, eg 1.5–3 km) and socioeconomic conditions. Although the effects are moderate at the individual level, they may be clinically significant in the population.

Conclusion: The spatial availability of healthy food is measurably related to the risk of obesity. Endocrinological practice should combine individual counseling with "mapping" of local sources of fresh food and referral to realistically available resources. Public policies that reduce the dominance of unhealthy offerings AND encourage the opening/sustainability of healthier food outlets have the potential for significant population benefit. Standardization of exposure metrics and evaluation of interventions in a real environment is needed.

Key words: obesity; food environment; proximity; density; supermarkets; fast food; endocrinology; public health.

INTRODUCTION

Obesity is one of the leading metabolic risk factors for the global burden of disease; the sustained increase in exposure and burden in recent decades underscores the need for effective, multifaceted prevention and treatment strategies (1).

In addition to individual determinants, environmental structural factors are also receiving increasing attention, particularly access to healthy foods—the availability and spatial accessibility of stores with more nutritionally favorable choices versus the saturation of fast-food restaurants and ultra-processed food stores (2–5). The concepts of food deserts and food swamps point to two complementary dimensions: lack of physical and economic accessibility to fresh foods and overexposure to unhealthy options (3–6).

Community-level syntheses and empirical work describe a consistent pattern: greater proximity to supermarkets and fresh food stores is, on average, associated with a lower risk of obesity, while greater proximity and/or density of fast food establishments shows the opposite direction (6,7). Systematic reviews in the field of "built environment" and obesity emphasize that the perceptibility of effects depends on the way exposure is operationalized (proximity to residence, density per area, composite indices) and on the scale of observation (8). This paper provides a secondary evidence synthesis focusing on: (i) pooled effects by exposure type, (ii) comparison of exposure measures (proximity/density/composite), and (iii) representative studies that explain heterogeneity of findings and practical implications for endocrinology (2).

METHODS

Design and goal.A focused secondary synthesis was conducted: the quantitative basis is a contemporary systematic review and meta-analysis of the food environment and obesity (2). The reporting is designed in accordance with the PRISMA 2020 guidelines (9). The bias assessment plan was pre-defined according to the ROBINS-I tool (10). After that, to illustrate the methodological heterogeneity, representative observational studies were included (11–14).

PECO frame. Population: adults from the general population. Exposures: metric measures of the food environment (proximity/speed of access; density of facilities; composite indices). Comparators: more favorable versus less favorable exposure level or quantile category. Outcomes: obesity (BMI ≥30 kg/m²) or continuous BMI, according to sources (2).

Search and selection. The primary framework of findings is provided by a meta-analysis (2). Additionally, a targeted search (MEDLINE/PubMed; Web of Science) was conducted for key terms ("food environment", "proximity", "density", "supermarket", "fast-food", "obesity", "BMI"), and studies whose exposure measures and outcomes were most comparable to the target were included in the study (11–14). The selection was made by a two-stage procedure (titles/abstracts → full texts) in accordance with PRISMA principles (9).

Data extraction and outcomes. Pooled effect measures — odds ratio (OR) and 95% confidence interval (CI) — by type of exposure (proximity/density/composite; object type) were taken from the meta-analysis (2). Design, exposure measure, outcome(s), method, and key effects were extracted from representative studies (11–14). No new quantitative pooling or re-meta-analysis was done.

Assessment of risk of bias.ROBINS-I domains (confounding, selection, exposure classification, deviations, missing data, outcome measurement, selective reporting) were applied for additional studies, descriptively and without formal scoring (10); for the main meta-analysis we relied on the authors' estimates (2).

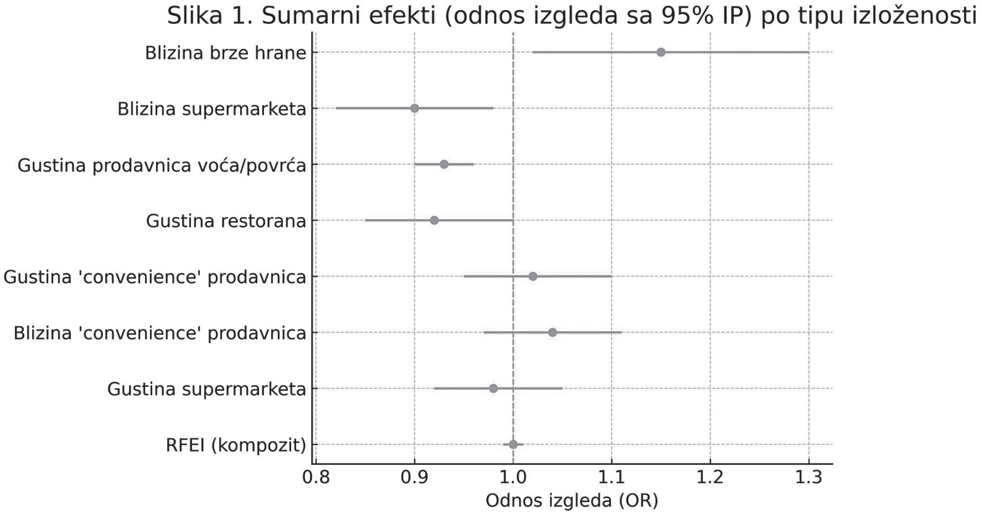
Ethics. The paper is a secondary analysis of already published results; ethics committee approval is not required. No individual or identifiable data was used.

RESULTS

The latest synthesis shows a consistent pattern: closer access to fast food is associated with higher odds of obesity, while closer access to supermarkets and higher density of fresh food stores are associated with lower odds; composite indices (eg

RFEI) are often neutral (2). The numerical summary is in Table 1. In this paragraph in the manuscript, call the graphic representation (forest-plot) (Figure 1).

Figure 1. Summary effects (odds ratio with 95% confidence interval) by exposure type.



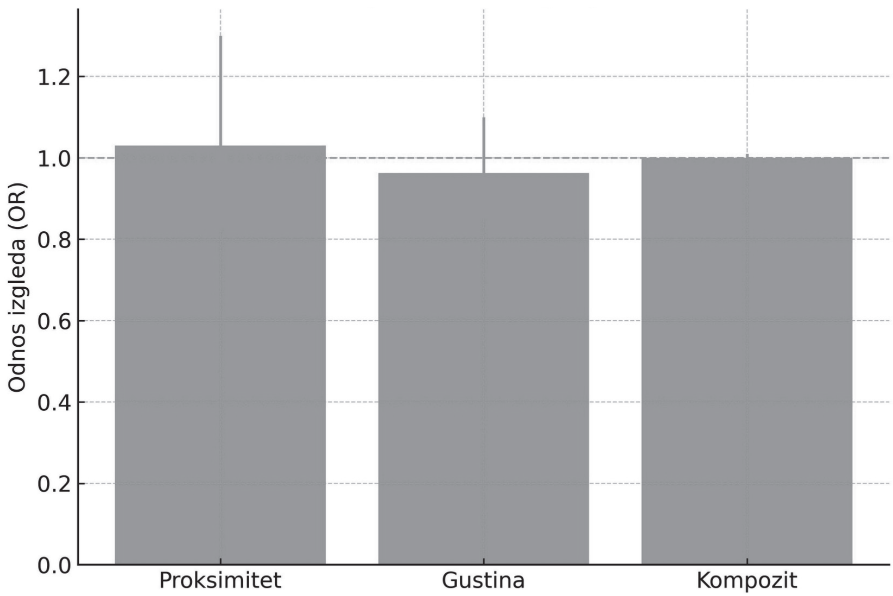
Dots show pooled odds ratios (ORs) by exposure type; horizontal lines are 95% confidence intervals. The dashed vertical line indicates a neutral effect (OR=1). Values of OR>1 indicate higher odds of obesity, OR<1 lower odds.

Table 1. Pooled estimates of the association between elements of the food environment and adult obesity (according to meta-analysis) (2)

Type of exposure (measure)	Outcome	Pooled OR (95% CI)	p
Fast food — nearby	Obesity	1.15 (1.02–1.30)	0.02
Supermarket — nearby	Obesity	0.90 (0.82–0.98)	0.02
Fruit/vegetable stores — density	Obesity	0.93 (0.90–0.96)	<0.001
Restaurants — density	Obesity	0.92 (0.85–1.00)	0.05
“Convenience” stores — density	Obesity	1.02 (0.95–1.10)	0.64
Convenience stores — proximity	Obesity	1.04 (0.97–1.11)	0.31
Supermarket — density	Obesity	0.98 (0.92–1.05)	0.53
RFEI (composite index)	Obesity	1.00 (0.99–1.01)	0.99

When effects are grouped by measure of exposure, proximity on average shows stronger and more consistent associations with obesity than mere density of facilities, while composite measures are often methodologically heterogeneous and approximately neutral (2). These differences depend on the operationalization of exposure and the scale of observation, which has been emphasized in epidemiological reviews of the "built environment" (8). For the sake of clear communication of the findings, a columnar representation of the average effects by groups of measures is recommended (Figure 2).

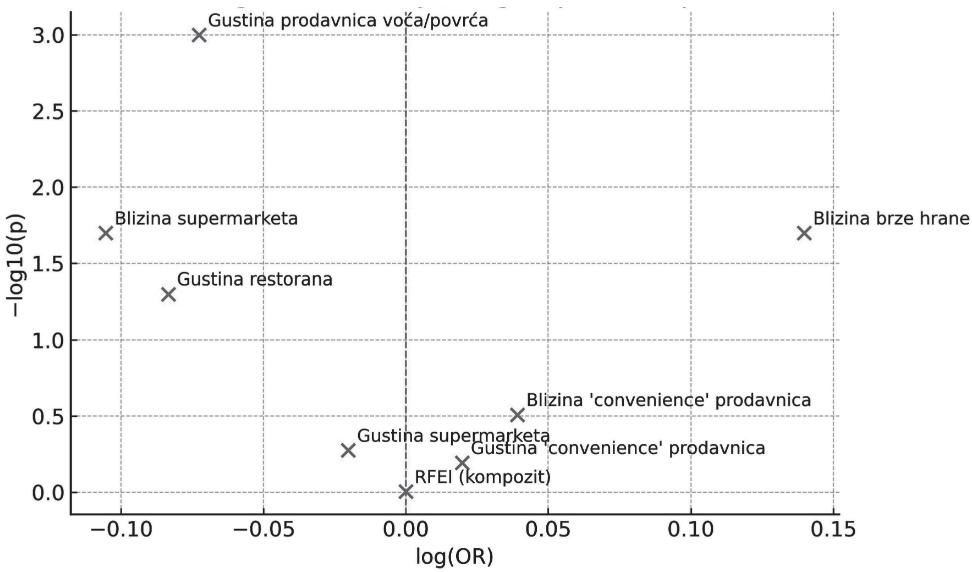
Figure 2. Average effect by measure of exposure (proximity, density, composite) with min–max range lines.



Average OR for the three groups of exposure measures (proximity, density, composite). Vertical range lines (min–max) show the lowest and highest estimate within each group; dashed line is OR=1. Note: this view does not show confidence intervals, but ranges of values.

The findings of the meta-analysis complement the studies that explain why the effects differ. In a study of older adults, a higher density of fast food establishments was associated with a higher likelihood of obesity (11). In a US national sample, better accessibility to supermarkets was associated with lower risk of obesity and higher fruit/vegetable intake (12). In a large sample from California, effects became apparent only in more broadly defined exposure zones (1.5–3 miles): greater availability of fast food was associated with less favorable dietary behavior and higher odds of elevated BMI, while greater number of supermarkets was associated with lower BMI (13). In an international context, a higher composite unhealthy:healthy index (RFEI) is associated with less favorable dietary patterns and higher BMI, especially in lower socioeconomic status (14). For orientation and visual synthesis, an additional graphic representation (evidence-map/forest with selected studies) is recommended (Figure 3).

Figure 3. Relationships between exposure measures and obesity in representative studies: effects on larger exposure zones and by facility type.



Dots represent exposure types; x-axis = log(OR) (direction and strength of effect), y-axis = −log10(p) (statistical significance). The vertical line at x=0 corresponds to OR=1. Larger y values indicate stronger statistical signal (smaller p).

Findings should be viewed through the prism of space and time: part of the contradiction in the literature stems from the question of whether the “neighborhood” or broader context better explains variation in outcomes (15). Natural experiments show that the introduction of supermarkets into a “food desert” changes dietary habits and perceptions of the environment, while the impact on BMI is often delayed and moderated by sociodemographic factors (16). Systematic reviews of methods remind us that the quality of exposure measurements has a decisive influence on effect size estimates (17). More broadly, an unfavorable food environment is also associated with downstream outcomes such as mortality from obesity-related cancers (18). Longitudinal data indicate that “exposure” to the food environment over time and life transitions contributes to changes in BMI and eating behavior (19–21), while the availability of fresh foods at the neighborhood level enables healthier choices and a lower risk of obesity (22–23). In a theoretical framework, the concepts of obesogenic environments and the politics of creating healthy food environments offer a path from geographic findings to practical interventions in the clinic and community—relevant to endocrinology practice and public health planning (24–25).

DISCUSSION

The results of this secondary synthesis indicate that the physical food environment is a critical determinant of obesity in adults, often exceeding individual dietary preferences. Evidence suggests that a higher density of health food stores and fresh food supermarkets correlates with a lower body mass index (BMI), while the dominance of fast food establishments creates an “obesity environment” that makes it difficult to maintain metabolic health.

The finding about the existence of “food deserts” and “food swamps” is particularly significant. In urban areas, these phenomena are not only a geographical problem, but also a socio-economic one, as low availability of healthy food directly correlates with lower incomes and increased risk of metabolic disorders (26). Recent longitudinal studies confirm that long-term exposure to an environment with limited healthy food choices leads to a progressive increase in BMI over time (27).

Clinical implications for endocrinology practice

Clinicians, and especially endocrinologists, must recognize that patients do not make dietary decisions in a vacuum. When setting goals for weight reduction, it is necessary to take into account the patient’s immediate environment. Counseling that focuses solely on calorie restriction without considering the realistic availability of healthy foods in the patient’s neighborhood often results in poor compliance. As modern trends emphasize, the nutritional transition towards ultra-processed food in urban areas represents a global pandemic challenge that requires a systemic response (28).

Additionally, the need to standardize the metrics used to assess the food environment has been identified. The diversity in the definition of “accessibility” (geographic vs. economic) makes direct comparison of studies difficult, which has been recognized as a methodological challenge in recent reviews (29). Future research should focus on the longitudinal effects of community interventions, such as subsidizing markets and limiting the density of fast food establishments near residential areas (30).

CONCLUSION

Access to healthy food is a fundamental determinant of adult obesity that requires an integrated approach in diagnosis and treatment. This synthesis of evidence confirms that the increased availability of health food stores and the decrease in the density of fast food establishments directly contribute to the reduction of the risk of metabolic diseases.

For clinical endocrinology, these findings suggest that therapeutic plans must be tailored to the patient's socio-ecological context. Success in the fight against the obesity epidemic depends on the synergy of public health policies that change the architecture of food choices and individual clinical practice that recognizes barriers in the environment.

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