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Review Article

Impact of Fast Food Consumption on Obesity and Overweight among Individuals Aged Ten Years and Above: A Systematic Review and Meta-Analysis

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Abstract

Background: The prevalence of obesity and overweight globally has increased to epidemic proportions, representing a substantial burden on health systems. The consumption of high-energy-density but low-nutritional-value food, known as fast food, has been linked to the obesity epidemic. This review aimed to quantify the association between fast food consumption and overweight/obesity in individuals aged ten years and above.

Methods: We followed the PRISMA-P 2020 guidelines. To identify studies, English databases, including PubMed, Web of Science, Scopus, Science Direct, and DOAJ, were searched. The search strategy focused on terms and inclusion criteria. After quality assessment, data were analyzed using SPSS software.

Results: Thirteen studies out of 665 screened indicate a significant positive association between fast food consumption and obesity or overweight (OR 2.979 [1.748-5.078]). Heterogeneity analysis revealed substantial variability across studies ($Q = 119.497$, $P < 0.0001$; $I^2 = 92.47\%$), suggesting true differences beyond chance with the random-effects model showed a stronger association compared to the fixed-effects model (OR 2.979 vs. OR 1.929). Sensitivity analysis demonstrated variations based on sample size. Publication bias of the included studies was done using Egger's and Begg's tests.

Conclusion: The analysis revealed the effect of fast food consumption on weight status varied among demographic subpopulations. The review also provides further justification for interventions to encourage healthier dietary choices and reductions in consumption of fast food, both of which, in turn, are aimed at tackling the obesity epidemic.

Keywords: Fast food consumption; Obesity; Overweight; Junk food; Meta-analysis

Introduction

Obesity and overweight have emerged as major global public health challenges due to their complex etiology, which involves genetic, environmental, and socio-economic factors influencing

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behavioral patterns (1). Among these factors, dietary habits play a significant role in weight gain and metabolic disorders (1). Global estimates show that nearly 3.3 billion adults could be affected by high body mass index (BMI) by 2035, compared to 2.2 billion in 2020. This signifies an increase in prevalence from 42% of adults in 2020 to over 54% by 2035. This trend highlights the urgency of addressing dietary behaviors that contribute to weight gain and associated health risks (2).

Individuals who regularly consume fast food have a 20% to 129% increased risk of obesity compared to non-consumers (3). Fast food, a type of ultra-processed food, is characterized by its industrial formulations, low nutritional quality, and high energy density (4, 5). It is widely consumed due to its affordability, convenience, and aggressive marketing strategies, particularly targeting children and adolescents (6). The rapid expansion of the fast food industry, driven by urbanization and globalization, has led to increased consumption in both high-income and developing countries (6). According to studies, nearly one-third of adults in the United States consume fast food daily (7-9), with similar rising trends observed in Saudi Arabia (10), India (11), and Greece (12). The growing accessibility of fast food outlets has been linked to dietary inequalities and increased obesity rates (11, 13).

The health consequences of fast food consumption are well documented. Frequent intake of these foods, which are high in calories, saturated fats, sodium, and added sugars but low in essential nutrients (14, 15) has been associated with obesity, central adiposity, metabolic disturbances, cardiovascular disease, systemic inflammation, and oxidative stress (16, 17). Despite extensive research on this topic, the strength of the association between fast food consumption and overweight/obesity remains an important area of investigation.

Therefore, we aimed to quantify the association between fast food consumption and overweight/obesity in individuals aged ten years and above. Using available evidence, the study seeks to provide a clearer understanding of the impact of fast food consumption on weight status. The findings will offer valuable insights for policymakers and public health interventions aimed at obesity prevention.

Materials and Methods

The review was conducted under PRISMA-P 2020 guidelines and registered on PROSPERO with registration number CRD42024551720 (18). By using structured data extraction and synthesis techniques, the quantitative approach was used to provide valuable insights into the relationship between fast food consumption and overweight/obesity (19) (Table 1, Fig. 1).

Search strategies

A systematic search was conducted in PubMed using the Medical Subject Heading (MeSH) and the results of this search were used to refine the search strategy for a comprehensive literature search in five electronic databases: PubMed, Scopus, Web of Science, Science Direct, and the Directory of Open Access Journals (DOAJ). Key terms and synonyms for the search terms for each database were explored. The retrieval strategy of the broad search of the databases was as follows: ("Fast Foods" OR "Junk Food" OR "Processed Food" OR "Convenience Foods OR "Ready-Prepared Foods" OR "Ready-To-Eat Meals") AND ("Obesity" OR "Overweight" OR "Body Mass Index" OR "Adiposity" OR "Metabolic Syndrome" OR "Weight Gain" AND ("Adolescent" OR "Young Adult" OR "Adult"). The literature published in the English language was retrieved from January 1, 2014 to December 31, 2023. The search was restricted to studies published from 2014 onward to reflect the recent increase in the prevalence of obesity. The results of the comprehensive searches were imported into EndNote (Endnote Online Classic) for duplication.

Selection of Studies

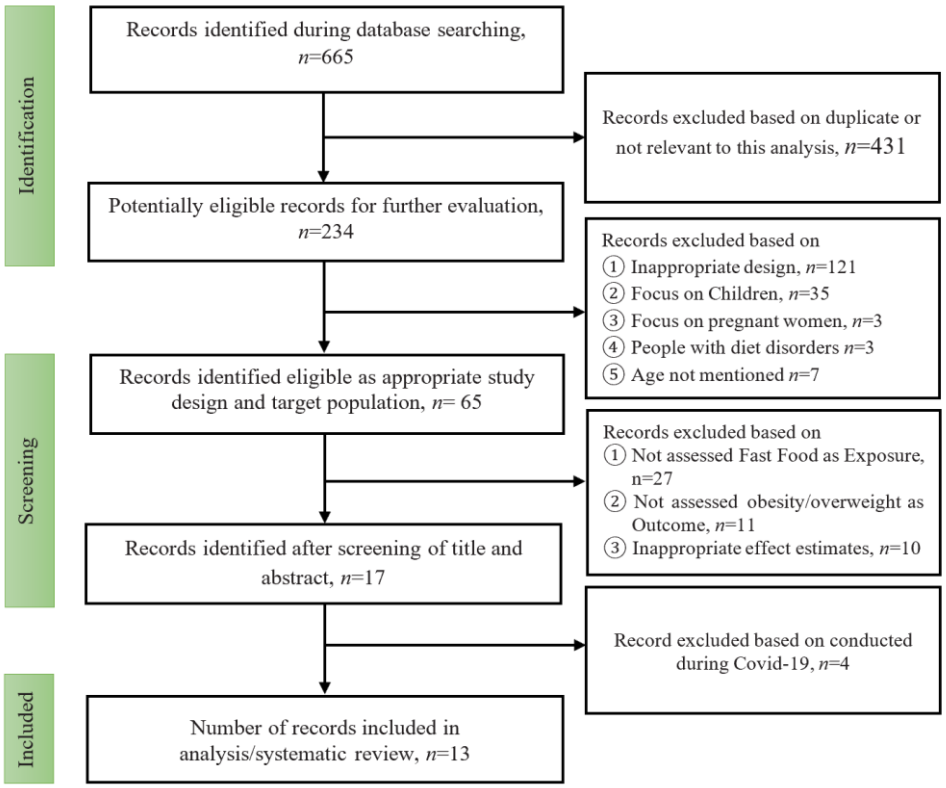

Fig. 1: PRISMA Flow Diagram Showing the Process of Study Selection

Table 1: Inclusion and Exclusion Criteria

Variable	Inclusion Criteria	Exclusion Criteria
Population	Studies focused on 10-year-old adolescents and above, where age-specific data could be extracted.	Studies were conducted among children aged below ten years. Studies focused on special populations (e.g., pregnant women, individuals with specific medical conditions)
Exposure	Study as an exposure to fast food, convenience foods, ready-prepared foods, ready-to-eat meals, and ready-to-eat meals.	Studies that do not specifically investigate Fast Food consumption or do not provide precise methods for assessing fast food intake.
Context	The review was not limited to a certain geographical region.	The review was not limited to a certain geographical region.
Outcome	Studies reporting outcomes related to obesity, such as BMI, waist circumference, or obesity prevalence, adiposity, metabolic syndrome or weight gain	Studies that measured overweight and obesity as an outcome among ten years old and above individuals, but did not measure any associations with the consumption of fast food
Study design	Observational studies (Cross-sectional or cohort study)	Case studies, case series, case-control studies, clinical trials, systematic, scoping, or narrative reviews, grey literature, conference abstracts, papers without full text, and non-English language publications.

Assessment of Study Quality

Study quality was subject to independent evaluation and later confirmed by three authors (SSK, DL, JM) according to the Joanna Briggs Institute (JBI) critical appraisal checklists customized for cross-sectional studies and cohort studies (20). The JBI checklist for cross-sectional studies examines the quality of a study along eight criteria that focus on bias and confounding and how well these have been addressed by focusing on exposure or outcome measures, validation considerations, and robust analytical methods. In contrast, the cohort studies checklist evaluates quality with eleven key criteria, including study objective and design, population characteristics, exposure and outcome information, confounding adjustment measures considered in analyses, statistical analysis appropriateness, follow-up adequacy, and clarity of presentation. We assigned 1 point for each criterion, and the maximum number of attainable points was scored at 8 (representing high evidence quality in cross-sectional studies). The review classified these into high quality, medium-quality, and low-quality studies according to scores 8-6, 3-5, and 0-2, respectively. For cohort studies, high-quality evidence was supported by scores of 8-11, medium quality of 5-7, and low-quality level scores of 0-4.

Data Extraction

SSK utilized a structured data extraction form to gather essential information, a process subsequently validated by a second reviewer, DL. Extracted details encompassed various aspects, including authorship, publication year, DOI, study design, geographic location, participant demographics (age and gender), instruments employed for data collection, sample size, duration of follow-up (for cohort studies), exposure variables, outcome measures, key findings, methodological adjustments, and quality assessment.

Statistical method

We opted for a random effects model, recognizing the inherent variability among the included studies' populations and outcomes. To assess the degree of heterogeneity among the studies, both the Q Statistic Test and the I^2 statistic were employed. Additionally, the analysis included a sensitivity assessment to validate the robustness of the findings. This involved calculating odds ratios (ORs) for different subsets of studies based on sample sizes, which highlighted variations in the strength of associations. The credibility of the results was further strengthened by evaluating publication bias with funnel plots and statistical tests such as Egger's test and Begg's nonparametric correlation test. The level of significance was set at $P<0.05$.

Results

Characteristics of the included studies

Tables 2 and 3 present a comprehensive summary and results of studies with diverse geographic locations, participant demographics, and sample sizes.

Table 2: Characteristics and study quality of studies included in the review

Reference	Study Design	Country	Age (yr)	Sex	Sample Size
AlTamimi (21)	[1]CS	Saudi Arabia	36 to 59	Male only	1800
Tareq (22)	[1]CS	Bangladesh	17 to 30	Male and Female	440
Sultana (23)	[1]CS	Bangladesh	Different age groups (including 10 to 23)	Male and Female	654

Table 2: Continued…

Doupis (12)	[2]FS	Greece	>18	Male and Female	284
Thike (24)	[1]CS	Myanmar	18 to 60	Male and Female	400
Yoon (25)	[1]CS	Korea	20 to 39	Male and Female	1726
Samphors (26)	CS	Cambodia	18 to 59	Male and Female	749
Jamil (27)	[1]CS	Gulf Countries	17 to 25	Male and Female	251
Mohammad Beigi (28)	[1]CS	Iran	Adults	Male and Female	300
Laxy (13)	[1]CS	United States	21 to 74	Male and Female	1570
Trushna (29)	[1]CS	India	University Medical Students	Male and Female	138
Whitton (30)	[1]CS	Singapore	18 to 69	Male and Female	1627
Al-Otaibi (31)	[1]CS	Saudi Arabia	18 to 25	Female only	276

Table 3: Summary of findings included studies in the systematic review and meta-analysis

Reference	Exposure	Outcome	Summary of Results	Adjustment
AlTamimi (21)	Fast Food Consumption	Obesity	Increasing fast food consumption is associated with obesity among study participants. Daily consumption (OR = 1.93 (1.34–2.78)), Weekly consumption (OR =5.83(2.84–11.96))	Sociodemographic factors and weight status
Tareq (22)	Fast Food Consumption	Obesity	Increasing fast food consumption was significantly associated with increasing obesity/overweight *P*-value = 0.003, with males shown to be more obese than females, *P*-value <0.001.	Gender, Physical Exercise, soft drinks, and sleeping patterns
Sultana (23)	Risk factors and status of fast-food consumption	Overweight and Obesity	A positive association was observed for fast-food consumption more than three times and less than three times per week (OR and 95% CI: 11.13 [7.52–16.47], *P*-value < 0.001), fast food preference and other foods (OR and 95% CI: 1.55 [1.11–2.15], *P*-value = 0.009), and sedentary and heavily active lifestyle (OR and 95% CI: 5.71 [2.02–16.10], *P*-value = 0.001)	Gender, economic status, and physical activities
Doupis (12)	Fast Food Consumption	BMI (Kg/m^2)	Frequent fast food consumption was significantly linked with increased BMI in young naval active personnel. With measurement weekly (OR =2.56 (95% CI: 1.10–5.96)), More than two times in a week (OR= 3.41 (95% CI: 1.05–11.03)).	Physical activity, other dietary habits
Thike (24)	Ready-to-eat food consumption	BMI (Kg/m^2)	Frequent consumers of Ready to Eat (RTE) food and less physically active sedentary staff were more likely to be overweight and obese. Preference for RTE food was found to be positively associated with overweight and obesity (AOR = 8.93, 95% CI 2.54–31.37)	Smoking, alcohol drinking, physical exercise, leisure activity, distance from home
Yoon (25)	Fast Food Consumption	Obesity and Dyslipidemia	Frequent fast food consumers (≥ 1 time/week) have a higher risk of obesity. The risk for obesity (BMI ≥ 25 kg/m2) was higher in those consuming Fast Foods 3–4 times/month OR = 2.064 (95% CI, 1.124–3.790) and ≥ 1 time/week (OR = 2.043 (95% CI, 1.091–3.825)) compared with people consuming Fast Food	Age, sex, alcohol drinking, smoking, household income, education levels, physical activity, and breakfast intake frequency

Table 3: Continued…

			< 1 time/month.	
Jamil (27)	Fast Food Consumption	Overweight and Obesity	The finding suggests that students with more knowledge about the calories in fast food meals had a higher prevalence of overweight or obesity (*P*-value = 0.002). Overweight or obese participants who checked the number of calories in fast food meals had a higher prevalence of overweight or obesity (*P*-value < 0.05).	Physical activity, other dietary habits
Samphors (26)	Fast Food Consumption	Overweight and Obesity	Fast food consumption and over-nutrition are significant problems in Cambodia. The majority of adults aged 31-59 years are overweight as well as obese. Fast food consumption was significantly associated with overweight and obesity (OR adj.=2.00; 95% CI: 1.39-2.88; *P*-value <0.001).	Income, expenditure, smoking, alcohol consumption, vegetables, fruits and exercise, sleeping patterns
MohammadBeigi (28)	Fast food consumption	Overweight and Obesity	The obesity prevalence based on BMI and WHR was 21.3 % (18.2% in females vs 26.3% in males) and 33.2% (40.1% in females vs 21.9% in males), respectively. Fast food consumption was associated with only WHR (OR: 1.46, 95% CI: 1.11, 2.26). Sandwich consumption was associated with obesity/ overweight based on a BMI of 35%, fried chicken of 40%, and pizza of more than 80%.	Demographic characteristics
Laxy (13)	Neighborhood economic hardship, the retail food environment, fast food intake	Obesity	Participants reporting two or more fast food meals per week had 35% higher odds of obesity than those consuming fast food meals less than twice per week (OR= 1.35 (95% CI: 0.99, 1.84).	Gender, age, race/ethnicity, education, income, physical activity and urbanicity
Al-Otaibi (31)	fast-food consumption	Obesity/Overweight	A significant correlation exists between BMI and fast food consumption (r = 0.125; *P*-value = 0.05). Logistic regression found obesity/overweight is significantly associated with the frequency of fast food consumption (OR=3.072, 95% CI 1.107-8.523)	Age, marital status, household income, living status,
Trushna (29)	Fast Food Consumption	Overweight and Obesity	The significant relationship between BMI and frequency of fast food consumption (X^2 =37.93, *P*-value =0.000001), less physical activity (X^2 =18.13, *P*-value =0.0004), evening or nighttime eating (X^2 =13.77, *P*-value = 0.03) and soft drink intake (X^2 = 11.48, *P*-value = 0.009) was found.	Eating sugar-added soft drinks and vegetables
Whitton (30)	Fast-food consumption	Demographic profile, diet quality and weight status	Fast-food consumers were likelier to exceed the RDA for energy, fat, and saturated fat and were less likely to meet wholegrain and fruit recommendations. Occasional consumers (OR=51.19, 95% CI 1.04, 1.37) and regular consumers (OR=0.76, 95% CI 0.64, 0.91) were more likely to have increased abdominal obesity compared to occasional consumers (OR 51.52; 95% CI 1.32, 1.77).	Age (as a continuous variable), ethnicity, household income group, and education level group

Table 4 provides a comprehensive meta-analysis of various studies, the analysis reports the odds ratio, significance effect, and weight of each study included. While the cumulative analysis demonstrates a significant overall effect, the variability among studies suggests that the impact of fast food consumption may not be uniform across different contexts.

Table 4: Effect Size of the study included

Reference	OR (95% CI)	Cumulative Effect size (95%CI)	Weight (%)	P-value	I2(%)
Whitton (30)	1.520 (1.312, 1.761)	1.520 (1.312,1.761)	12.018	$z = 5.583$, $P = 0.000$	-
Al-Otaibi (31)	3.070 (1.106, 8.524)	1.788 (0.041,77.163)	7.683	$z = 1.961$, $P = 0.300$	43.930
Laxy (13)	1.350 (0.990, 1.840)	1.504 (1.009, 2.241)	11.544	$z = 4.401$, $P = 0.048$	15.356
MohammedBeigi (28)	1.460 (1.088, 1.959)	1.498 (1.258, 1.783)	11.603	$z = 7.368$, $P = 0.005$	0.000
Samphors (26)	2.000 (1.389, 2.880)	1.549 (1.274,1.883)	11.322	$z = 6.216$, $P = 0.003$	12.648
Doupis (12)	5.820 (3.018, 11.222)	1.869 (1.117, 3.127)	9.800	$z = 3.125$, $P = 0.026$	74.820
Thike (24)	4.770 (1.437, 15.829)	1.968 (1.213, 3.193)	6.739	$z = 3.423$, $P = 0.014$	73.923
Yoon (25)	2.650 (1.130, 6.216)	2.007 (1.316,3.060)	8.647	$z = 3.905$, $P = 0.006$	71.164
Sultana (23)	11.110 (7.522, 16.410)	2.775 (1.558, 4.945)	11.210	$z = 4.075$, $P = 0.004$	92.745
AlTamimi (21)	5.810 (2.830, 11.928)	2.979 (1.748,5.078)	9.433	$z = 4.631$, $P = 0.001$	92.468
Total	2.979 (1.748, 5.078)	-	100	-	-

The forest plot also presents overall findings from a heterogeneity test conducted to assess the combined effect of multiple studies (Fig. 2). The Q Statistic Test provides insight into the variability among these studies, with a resulting Q statistic value of 119.497 and an associated *P*-value of <0.0001, indicating significant heterogeneity. This suggests that the observed differences in effect sizes are unlikely to be due solely to random sampling variation.

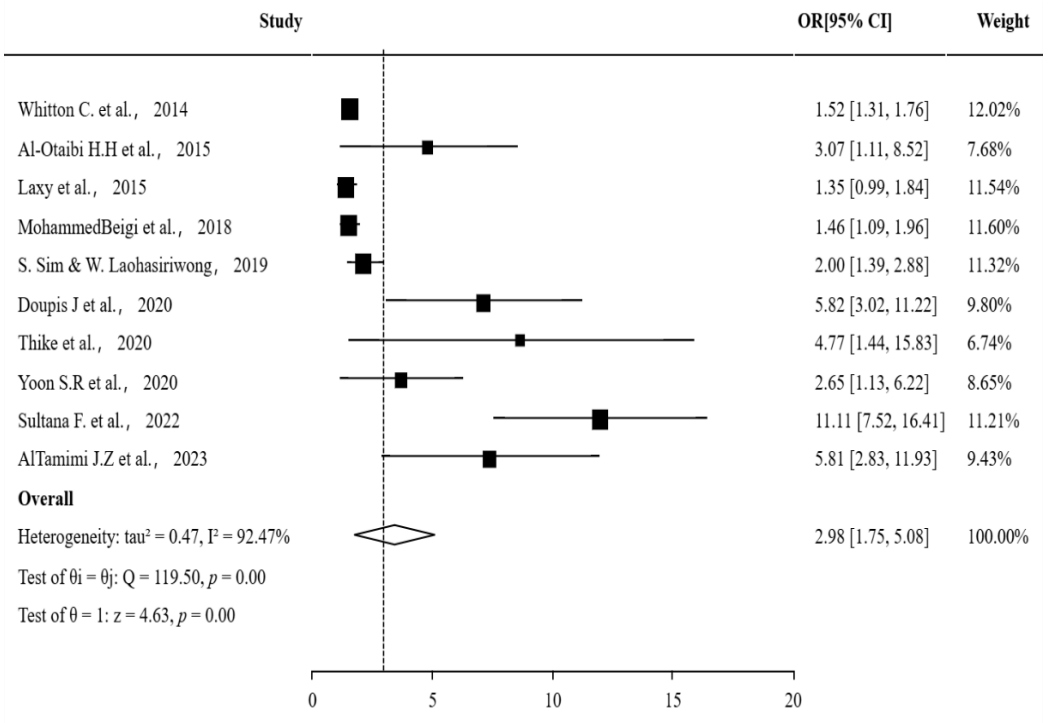

Fig. 2: Forest plot of the association between fast food consumption and overweight/obesity using a random effects model

Sensitivity analysis

The sensitivity analysis demonstrates varying levels of association depending on different factors. When examining the sample size, studies with less than 1000 participants (12, 23, 24, 26, 28, 31) show a strong association with an odds ratio (OR) of 3.692 (95% CI [1.638, 8.323]), indicating that smaller studies tend to report a higher risk. Conversely, studies with more than 1000 participants (13, 21, 25, 30) report an OR of 2.052 (95% CI [0.753, 5.591]), which suggests a weaker association. The wider confidence interval in the larger sample size studies indicates less precision and potential non-significance, highlighting the need for cautious interpretation of these results. The fixed-effect model yields an OR of 1.929 (95% CI [1.736, 2.144]), implying a consistent effect across the included studies with minimal variability. In contrast, the random-effects model shows a higher OR of 2.979 (95% CI [1.748, 5.078]), suggesting a stronger association when accounting for heterogeneity among the studies.

Excluding a study with a high risk of bias result (23) in an OR of 2.290 (95% CI [1.461, 3.588]), indicating that the significant association between fast food consumption and obesity/overweight persists even when potentially biased studies are removed. Additionally, when excluding the cohort study (12), the OR is 2.765 (95% CI [1.552, 4.926]), demonstrating that the association remains strong and significant without relying on this particular study design. The sensitivity analysis confirms that the association between fast food consumption and obesity/overweight is generally robust across different sample sizes, analytical models, and study quality assessments.

Publication bias

Fig. 3 indicates asymmetry in the funnel plot and the presence of an outlier, which suggests the possibility of publication bias or other biases affecting the results of this meta-analysis.

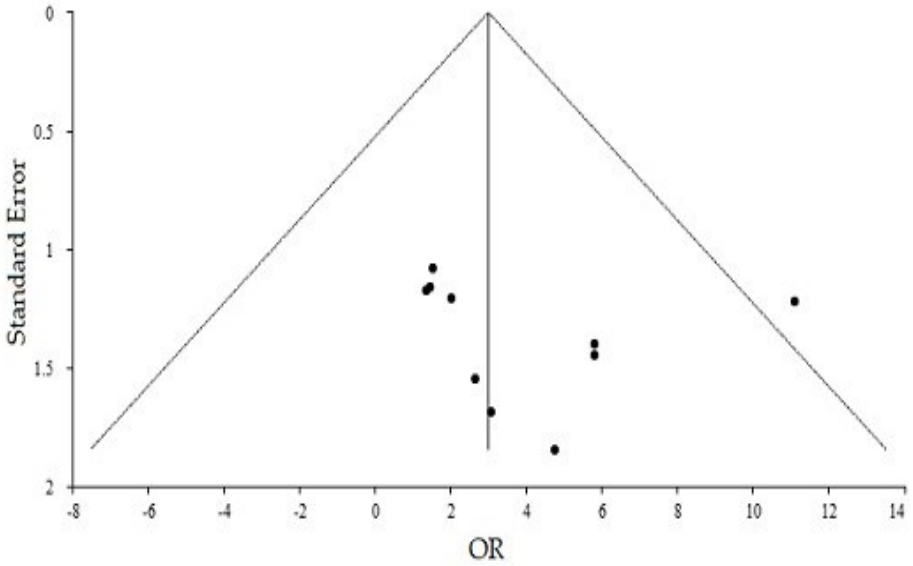

Fig. 3: Funnel Plot

Furthermore, the Egger Test (regression-based) revealed a beta coefficient of 3.436 with a standard error of 1.775, yielding a *t*-value of 1.936 with 8 degrees of freedom and a *P*-value of 0.089. Concurrently, Begg's Test produced Kendall's score of 19.000 with a standard error of 11.180, resulting in a z-value of 1.699 and a *P*-value of 0.089. Both tests provide consistent results, indicating an absence of significant publication bias in the analyzed data.

Discussion

Multiple studies consistently show a significant association between frequent fast food consumption and increased BMI, overweight, and obesity. This trend is evident across various research studies. The consistency in findings highlights the robust relationship between fast food intake and weight gain, emphasizing the importance of dietary habits in managing body weight. These findings are supported by research indicating that obese individuals have a higher likelihood of consuming fast food regularly whereby fast food intake has been identified as a significant modifiable risk factor for excess weight gain (32). Moreover, fast food outlets play a crucial role in the positive relationship between high-calorie food consumption and obesity (33).

The association between fast food consumption and weight gain is further emphasized by the impact of dietary habits on body weight management (34). Furthermore, Studies have shown that increased consumption of sugary drinks, fried foods, and snacks, along with decreased physical activity, are linked to higher odds of weight gain (35). Additionally, research highlights that irregular meal patterns are associated with both increased food intake and weight gain (36). The consistent findings across various studies between fast food consumption and weight gain, highlight the critical role of dietary habits in managing body weight and addressing the global concern of overweight and obesity. However, Jakobsen et al found different results, noting no clear association between access to fast-food restaurants and overweight/obesity when using BMI-related continuous measures (37). Similarly, a study by Zhao et al did not find significant associations between fast food consumption and health outcomes in children (16).

Frequent fast food intake strongly predicts higher BMI and obesity, with significant odds ratios reported in several studies. For instance, some studies indicated odds ratios as high as 5.82 for frequent consumers. This strong association underlines the significant effect of fast food consumption on weight gain and the development of obesity. It is indicated that the excess energy from fast food is converted into triglycerides, leading to the expansion of adipose tissue depots and subsequent weight gain (38). Studies have also shown that excess visceral adiposity, often associated with obesity, is an independent risk factor for poor cardiovascular outcomes (39). However, Steele et al observed no correlation between dietary choices and body weight in rats exposed to high-fat and high-sugar diets, possibly because the dietary exposure did not result in obesity (40). Additionally, certain dietary patterns, such as the Dietary Approaches to Stop Hypertension (DASH) diet, have been identified to correlate with lower BMI, visceral fat, and body fat mass (41).

The results of this study indicate the impact of fast food consumption varies based on demographics, lifestyle factors, and regional dietary habits. Differences in study populations, such as age, gender, and cultural backgrounds, contribute to the variability in results. This highlights the importance of considering contextual factors when addressing the effects of fast food on obesity. Factors like age, gender, and cultural background play a crucial role in determining the relationship between fast food intake and obesity (42). For instance, research has highlighted that fast food consumption is particularly high among teenagers, with implications for obesity rates (43). Additionally, the frequency of fast food consumption has been found to correlate with higher body mass index (BMI) in various age groups, indicating a consistent pattern across different populations (44). Furthermore, the context in which fast food is consumed plays a significant role in its impact on obesity. Factors such as socioeconomic status, educational background, and cultural norms influence the relationship between fast food consumption and obesity (45). Studies have highlighted the need to consider these contextual factors when designing interventions to address the effects of fast food on obesity (33). Additionally, research suggests that promoting healthy eating habits and lifestyle behaviors, along with reducing the availability of fast food

outlets, may help combat obesity rates (46). The consistent association between fast food consumption and negative weight outcomes highlights the critical need for public health interventions aimed at reducing fast food intake and promoting healthier eating habits to address the escalating obesity crisis (47). This concludes that frequent fast food consumption is strongly associated with increased BMI, overweight, and obesity.

Strengths and Limitations

This review offers a global perspective on the association between fast food consumption and obesity/overweight. Using the Joanna Briggs Institute (JBI) checklist ensures study quality and enhances reliability. Another strength of this review is its comprehensive search using multiple electronic databases over a wide range of time. However, limitations include a lack of grey literature searches due to the lack of access to such documents. Therefore, we suggest other review studies should be conducted where access to such documents is possible.

Conclusion

Frequent fast food consumption is strongly associated with increased BMI, overweight, and obesity. Public health interventions, including stricter marketing regulations, improved access to healthier food, and education on balanced diets, are essential to combat the issue. Addressing these factors through policy and behavioral changes is crucial in mitigating the rising obesity epidemic.

Journalism Ethics considerations

Ethical issues (Including plagiarism, informed consent, misconduct, data fabrication and/or falsification, double publication and/or submission, redundancy, etc.) have been completely observed by the authors.

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Competing interests

The authors declare that they have no competing interests.

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