REVIEW ARTICLE

Ultra-processed food consumption and childhood obesity: a scoping review of recent evidence and research gaps (2021–2025)

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Abstract

Background and Objective: Childhood obesity is a global public health concern, and increasing consumption of ultra-processed foods (UPFs) may contribute to excess adiposity among children and adolescents. However, evidence varies in study design, dietary assessment, and outcomes. This scoping review aimed to map evidence on the association between UPF consumption and childhood obesity and to identify the dietary exposure measures and outcomes reported in studies.
Methods and Materials: We conducted a scoping review following PRISMA-ScR. We searched PubMed and Scopus for studies published from January 2021 to December 2025. Studies involving children and adolescents assessing UPF consumption and reporting at least one obesity-related outcome were eligible. In total, 11 studies met the eligibility criteria. Data were synthesized descriptively across study characteristics, exposures, and outcomes.
Results: The 11 studies represented settings in Europe, Latin America, the Middle East, and East Asia. Seven were cross-sectional, and four were cohort or longitudinal studies. UPF consumption was assessed using food diaries, food frequency questionnaires, and 24-hour dietary recalls, with NOVA classification used in most studies. BMI was the most frequently reported outcome (n=9), followed by BMI-for-age Z-score (n=5), fat mass index (n=3), body fat percentage (n=3), and waist circumference (n=2). Most studies reported positive associations between UPF consumption and adiposity, although some showed null, mixed, or inverse findings.
Conclusion: Higher UPF consumption was predominantly associated with adverse obesity-related outcomes, while evidence from LMICs remains limited. Longitudinal studies using standardized measures are needed to strengthen evidence and guide childhood obesity prevention.
Keywords: Ultra-Processed Foods; Pediatric Obesity; Adiposity; Diet; Child; Adolescent; Scoping Review.

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Introduction

Over the past three decades, the global food supply has undergone a profound structural transformation, characterized by the accelerating displacement of traditional, minimally processed diets by industrially manufactured food products (1). Ultra-processed foods (UPFs), as classified under the NOVA framework, represent the fourth and most industrially processed tier of the food classification system, encompassing products formulated predominantly from substances extracted or derived from foods, including refined starches, hydrogenated oils, protein isolates, and an array of cosmetic and preservative additives rather than from intact food ingredients (2). However, UPF consumption poses a risk of malnutrition, particularly in socioeconomically disadvantaged groups or in low- and middle-income urban communities.

Childhood obesity is one of the most serious public health challenges of the 21st century. Rising UPF consumption has been implicated as a contributing factor in this trend across both high-income and low- and middle-income settings.

In the United States, UPFs account for approximately 67% of total dietary energy intake among children, while longitudinal data indicate that toddlers and school-aged children derive 47% and 59.4% of daily caloric intake from UPFs, respectively (3,4). Comparable trends have been documented in European cohorts; a cross-sectional analysis in the United Kingdom found that UPFs contributed over 60% of total energy intake among children aged 7–10 years (5).

Drawing on data from the Demographic and Health Surveys and nationally representative nutritional surveillance systems spanning more than 20 countries, Popkin and Laar (2012) reported that UPFs account for approximately 25% of caloric intake in toddler diets globally, with consumption escalating sharply among preschool-aged children. These data collectively indicate that UPF intake is now a defining and measurable characteristic of contemporary pediatric dietary behavior across both high-income and transitional economies.

The biological and behavioral mechanisms underpinning the association between UPF consumption and childhood obesity are multifaceted. In an experimental randomized controlled inpatient trial among adults, Hall et al. (6) demonstrated that participants consuming an ultra-processed diet consumed approximately 500 kcal/day more than those consuming an unprocessed diet and gained significantly more weight over the two-week intervention period. These findings suggest that characteristics of UPFs, including high palatability and effects on satiety, may promote excess energy intake. However, whether these mechanisms translate into similar associations with adiposity among children and adolescents remains uncertain.

Childhood obesity not only tracks into adulthood but is associated with a clustering of cardiometabolic risk factors, including insulin resistance, dyslipidemia, and hypertension, that substantially increase lifetime risk of type 2 diabetes, cardiovascular disease, and certain cancers (7).

Recent observational studies have investigated the association between UPF consumption and a range of obesity-related outcomes among children and adolescents, including body mass index (BMI), BMI-for-age Z-score, fat mass index, body fat percentage, waist circumference, overweight, and obesity. However, the available evidence is heterogeneous. Studies differ in their study designs, populations, geographical settings, methods used to assess dietary intake, approaches to classify UPFs, and metrics used to quantify UPF consumption. In addition, obesity-related outcomes have been assessed using different anthropometric and body-composition measures. Such methodological variation makes it difficult to

directly compare findings across studies and to determine whether the observed associations are consistent across different populations and outcome measures (7,8).

Although previous reviews have examined UPF consumption in relation to obesity and adiposity, there remains a need to map the characteristics and breadth of the recent evidence specifically among children and adolescents. In particular, it is important to understand which study designs have been used, which populations and geographical settings have been studied, how UPF consumption has been assessed and quantified, which obesity-related outcomes have been measured, and whether the reported associations are consistent across different approaches. Because the available evidence varies substantially in study design, exposure assessment, outcome measurement, and population characteristics, a scoping review provides an appropriate approach for systematically mapping this heterogeneous body of literature rather than focusing on a single pooled effect estimate (3,4,5,7,8).

Therefore, this scoping review aimed to map the existing evidence on the association between ultra-processed food consumption and obesity-related outcomes among children and adolescents. Specifically, the review sought to describe the characteristics and geographical distribution of available studies; identify the methods used to assess and quantify UPF consumption; examine the obesity-related and adiposity outcomes evaluated; summarize the direction of reported associations, and identify methodological and geographical gaps in the existing evidence to inform future research and childhood obesity prevention strategies.

Methods and Materials

Scoping review design and guiding framework

This scoping review was conducted in adherence to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR) guidelines (9). Scoping reviews are used to systematically map the available evidence on a particular topic, describe the characteristics and methodologies of existing studies, identify patterns in the evidence, and highlight gaps in the current literature. This approach was considered appropriate for the present review because the association between ultra-processed food (UPF) consumption and childhood obesity has been investigated across diverse populations, settings, study designs, and measures of UPF consumption and obesity-related outcomes.

The scoping review approach therefore enabled a broad examination of the existing evidence without restricting the review to a specific study design or outcome measure. The review was not prospectively registered but followed the systematic stages outlined in the PRISMA-ScR checklist: (1) defining the research question and eligibility criteria, (2) identifying relevant studies, (3) selecting studies for inclusion, (4) extracting and charting relevant data, and (5) collating, summarizing, and reporting the findings.

Population, concept and context (PCC) framework

Population: Studies involving children and/or adolescents aged between 2 and 19 years were included. Studies exclusively recruiting adult populations (aged ≥20 years) were excluded.

Concept: The primary concept of interest was the relationship between dietary habits, specifically ultra-processed food (UPF) intake and obesity-related outcomes. Outcomes of interest included BMI, BMI-for-age z-score, fat mass index (FMI), waist circumference, body fat percentage, and risk of overweight or obesity. Studies examining dietary exposure without any obesity-related outcome were excluded.

Context: Studies conducted in any country or geographic setting and published in peer-reviewed journals between 2021 and 2025 were considered. School-based, community-based, clinic-based, and population-based studies were all eligible.

Search Strategy

A comprehensive literature search was conducted using two electronic databases, PubMed and Scopus, to identify studies examining the association between ultra-processed food consumption and childhood obesity. The search strategy was developed using a combination of controlled vocabulary (MeSH terms in PubMed) and free-text keywords related to the population, ultra-processed food consumption, and overweight/obesity outcomes. The search strategy was adapted to the specific requirements of each database. PubMed and Scopus were selected because, together, they provide broad coverage of the biomedical, nutrition, and public health literature relevant to this topic, including substantial overlap with Embase- and Web of Science-indexed journals; supplementary reference-list screening was used to further mitigate the risk of missing eligible studies.

A comprehensive search was conducted in PubMed using three concept blocks: population, ultra-processed food consumption, and overweight/obesity. Terms related to children and adolescents were combined with terms related to ultra-processed foods, and these were subsequently combined with terms related to overweight and obesity using the Boolean operator "AND." Within each concept block, related terms were combined using "OR."

The PubMed search was conducted using the following strategy: ((Child OR childhood OR adolescent OR school-aged OR schoolchild OR youth) AND (ultra-processed food OR ultra-processed food OR UPF OR highly processed food OR ultra-processed diet OR processed food) AND (obesity OR overweight OR weight status OR body mass index OR BMI OR adiposity)).

A comprehensive search was conducted in Scopus using the same three concept blocks: population, ultra-processed food consumption, and overweight/obesity. Terms related to children and adolescents were combined using "OR," as were terms related to ultra-processed food consumption and obesity outcomes. The three concept blocks were then combined using "AND" to identify studies examining the association between ultra-processed food consumption and overweight or obesity among children and adolescents.

The search was conducted using the TITLE-ABS-KEY fields in Scopus, with the following strategy:

TITLE-ABS-KEY ((child OR childhood OR adolescent OR school-aged OR schoolchild OR youth) AND (ultra-processed food OR ultra-processed food OR UPF OR highly processed food OR ultra-processed diet OR processed food) AND (obesity OR overweight OR weight status OR body mass index OR BMI OR adiposity)) AND PUBYEAR > 2020 AND PUBYEAR < 2026 AND (LIMIT-TO (LANGUAGE, "English")).

The search was limited to studies published between January 2021 and December 2025 to capture recent evidence on the relationship between ultra-processed food consumption and childhood overweight and obesity. Additional studies were identified through hand-searching the reference lists of included studies and relevant systematic or scoping reviews to identify potentially eligible articles that may not have been retrieved through the electronic database searches.

Eligibility criteria

Inclusion criteria

Studies were considered eligible if they were peer-reviewed research articles that systematically assessed the consumption of ultra-processed foods and its association with overweight or obesity among children and

adolescents. The population comprised children and adolescents aged between 2 and 19 years, including school-aged children, consistent with the PCC framework. Eligible studies were required to report data on ultra-processed food consumption and at least one obesity-related outcome, such as overweight, obesity, body mass index (BMI), adiposity, or weight status. Observational studies, including cross-sectional, cohort, and case-control studies, were considered eligible to capture the available evidence on the association between ultra-processed food consumption and childhood obesity. Studies published in the English language between January 2021 and December 2025 were included.

Exclusion criteria

Studies were excluded if they did not include children or adolescents, such as studies conducted exclusively among adults or other age groups. Studies that did not assess ultra-processed food consumption or did not report an obesity-related outcome were excluded. Studies focusing exclusively on general dietary patterns, individual nutrients, or food groups without assessing ultra-processed food consumption were also excluded. Interventional studies, reviews, systematic reviews, scoping reviews, meta-analyses, editorials, commentaries, conference abstracts, letters, case reports, and protocols were excluded. Studies published in languages other than English and articles published outside the period from January 2021 to December 2025 were also excluded.

Study Selection Process

All records identified through the electronic database searches were imported into Rayyan for screening and management. Duplicate records were identified and removed before the screening process. Titles and abstracts were screened independently by the reviewers against the predefined eligibility criteria to identify potentially relevant studies. Full-text articles were subsequently retrieved and assessed for eligibility. Studies that did not meet the inclusion criteria at the full-text stage were excluded, with reasons for exclusion documented. Any disagreements between reviewers were resolved through discussion and consensus, and a third reviewer was consulted when consensus could not be reached. The overall study identification, screening, eligibility assessment, and inclusion process was presented using a PRISMA flow diagram.

Data extraction and charting

A standardized data extraction form was developed and piloted to ensure consistency, completeness, and relevance to the review objectives. The following information was extracted from each included study: bibliographic details (first author and year of publication), country, study design, study setting, sample size, participant characteristics, dietary exposure, obesity-related outcomes, measurement methods, statistical analysis, effect estimates with 95% confidence intervals (CI), p-values where reported, and the direction of association.

Dietary exposures were categorized according to the type of food or dietary pattern investigated, including ultra-processed foods (UPF), ultra-processed beverages or sugar-sweetened foods/drinks, fast foods, and overall dietary quality. UPF exposure was reported using different measures across studies, including intake categories, tertiles or quintiles, frequency of consumption, and dietary assessment methods based on food classification systems such as NOVA. To facilitate comparison across studies, dietary exposures and outcome measures were retained in their original reported formats while being grouped into common exposure categories.

The included studies demonstrated considerable heterogeneity in study populations, exposure assessment, outcome definitions, and statistical methods. Therefore, findings were descriptively

charted rather than statistically pooled. For interpretation, associations were classified according to their reported direction as positive, negative, or no association. A positive association indicated that higher consumption of UPF or related dietary exposures was associated with higher BMI, adiposity, overweight/obesity, or other obesity-related outcomes. A negative association indicated an inverse relationship, while results whose confidence intervals included the null value or were reported as statistically non-significant were classified as having no statistically significant association.

The extracted findings were organized into tables presenting study characteristics, dietary exposure categories, obesity-related outcomes, effect measures, confidence intervals, and direction of association. Across the included evidence, UPF consumption was most frequently associated with higher BMI, overweight/obesity, adiposity, body fat measures, and related metabolic outcomes, although some studies reported no significant association for specific outcomes.

Data Synthesis

Given the heterogeneity in study designs, dietary exposure measures, obesity outcome definitions, and population characteristics across included studies, a meta-analysis was not appropriate. Data were therefore synthesized using a descriptive narrative approach, consistent with standard scoping review methodology.

Included studies were organized and presented according to study characteristics (design, country, sample size), dietary exposures examined, and obesity-related outcomes reported. Findings were grouped thematically, with particular emphasis on: (1) the association between UPF consumption and adiposity indicators; (2) the role of other dietary habits (sugar-sweetened beverages, fast food intake, dietary quality scores); and (3) metabolic and behavioral correlates of obesity risk.

Structured summary tables were developed to present the characteristics of included studies (Table 1), the dietary exposures examined (Table 2), and the direction and magnitude of associations reported between dietary habits and childhood obesity outcomes (Table 3). The PRISMA-ScR flow diagram (Figure 1) was created using appropriate diagramming software to document the study selection process, including records identified, screened, assessed for eligibility, and included in the final review.

Quality Appraisal

Consistent with the methodological guidance for scoping reviews, a formal critical appraisal of the methodological quality or risk of bias of the included studies was not undertaken. The primary objective of this scoping review was to map and describe the breadth and characteristics of the available evidence on the association between ultra-processed food consumption and childhood overweight and obesity, rather than to assess the methodological quality or certainty of the evidence. However, key methodological characteristics and limitations of the included studies were descriptively summarized to support the interpretation of the findings. Particular attention was given to study design, methods used to assess ultra-processed food consumption, measurement of overweight and obesity, and potential limitations such as self-reported dietary intake and variability in anthropometric assessment methods.

Results

Study Selection and Characteristics

The systematic search and screening process identified 11 studies that met the eligibility criteria for this scoping review (Figure 1). A total of 434 records were identified through database searching. After removal of 84 duplicate records, 350 records were screened based on their titles and abstracts, of which 314 records were excluded as they did not

meet the predefined eligibility criteria. Subsequently, 36 full-text articles were assessed for eligibility. Of these, 25 full-text articles were excluded: 4 because the primary focus was not on ultra-processed foods, 2 because they did not measure the exposure of interest, and 19 for other predefined reasons (including ineligible population, study design, or absence of an obesity-related outcome), with the specific reason for each exclusion documented in the study screening records. Finally, 11 studies were included in the scoping review.

The included studies were published between 2021 and 2025 and examined the association between ultra-processed food consumption and overweight or obesity among children and adolescents. The included studies employed predominantly observational study designs, including cross-sectional, cohort, and longitudinal designs. The studies varied in sample size, population characteristics, geographical settings, methods used to assess ultra-processed food consumption, and measures of obesity-related outcomes.

A total of 434 records were identified. After removal of 84 duplicates, 350 records were screened; 314 were excluded at title/abstract stage. Of 36 full-text articles assessed for eligibility, 25 were excluded for predefined reasons. Eleven studies met inclusion criteria and were included in the review.

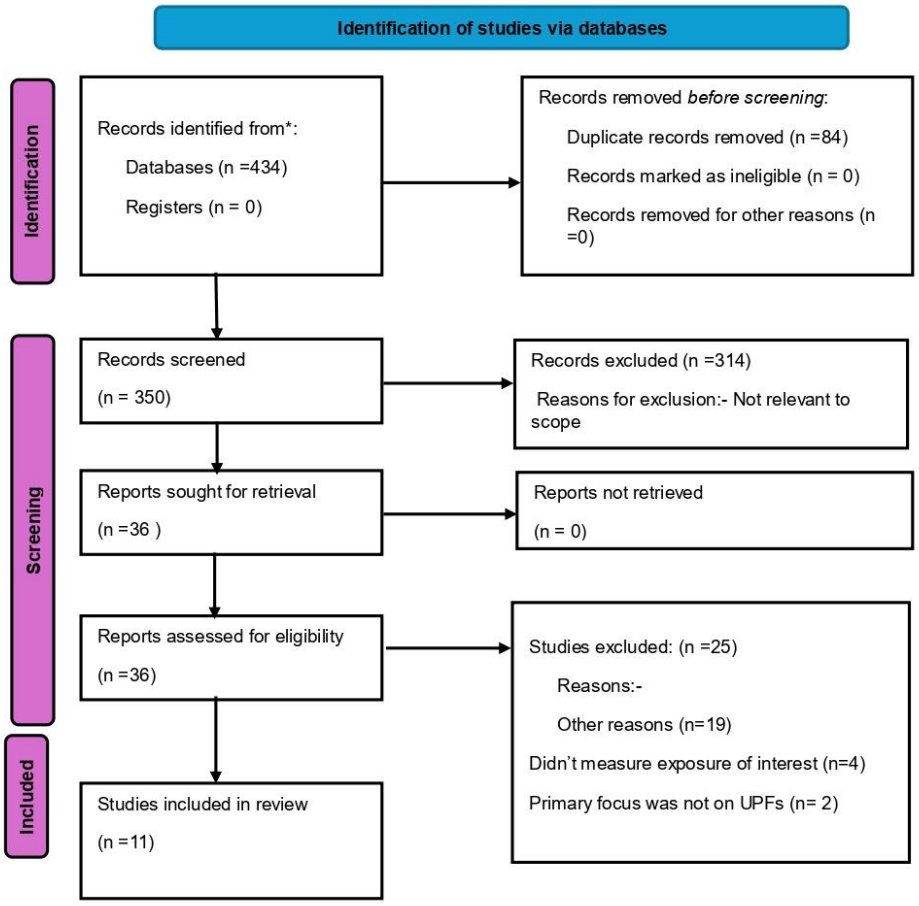


Figure 1. PRISMA 2020 flow diagram illustrating the study selection process

Table 1. Characteristics of Included Studies (N=11)

No.	First Author, Year	Country	Sample Size	Study Design	Obesity measure
1	(Handakas et al., 2022) (10)	United Kingdom	4528	Cross-sectional study	Mean BMI: 25.6 kg/m²
2	(Gketsios et al., 2023) (11)	Greece	1,718 preadolescents	Cross-sectional study (School-based)	Mean BMI: 19.2 ± 3.4 kg/m²
3	(Rosi et al., 2025) (8)	5 Mediterranean countries	2,011 children / adolescents (parent-reported survey)	Cross-sectional survey study	BMI assessed (values not specified in the extraction sheet)
4	(Gketsios et al., 2023)(12)	Greece	1,728 preadolescents	Cross-sectional school-based epidemiological study	BMI assessed (values not specified in the extraction sheet)
5	(Chang et al., 2021) (13)	United Kingdom	9,025 children	Prospective birth cohort study	BMI assessed (values not specified in the extraction sheet)
6	(Petridi et al., 2025a) (14)	Greece	443 children & adolescents	Cross-sectional nutrition survey analysis	BMI-for-age Z score: Overall 0.568 ± 1.35; Females 0.501 ± 1.22; Males 0.625 ± 1.46
7	(AI Hourani et al., 2025) (15)	Jordan	617 children & adolescents (aged 8–19 years)	Cross-sectional population-based study	BMI among overweight/obese: 22.6 ± 4.2 kg/m²
8	(Fedde et al., 2025) (16)	Germany	182 children	Longitudinal study follow-up study	Mean BMI for age Z score 0.055 ± 0.844 (normal BMI range); 13% overweight > +1SD, 1% obese (>+2SD)
9	(Zancheta et al., 2024) (17)	Chile	962 preschoolers	Cohort study	BMI-for-age Z score: 1.1 ± 1.3; Waist circumference: 59.5 ± 5.3 cm
10	(Lee et al., 2024) (18)	Korea	149 children	Prospective study	BMI assessed (values not specified in the extraction sheet)
11	(Costa et al., 2021) (19)	Brazil	6 years-3129, 11 years-3454	Observational study	Fat Mass Index (kg/m²): Age 6 (Boys 3.9±2.1, Girls 4.5±2.3) Age 11 – Boys 5.4 ± 3.3, Girls 5.5 ± 3.2

BMI: Body mass index; UPF: Ultra-processed foods. Note: Data are presented as reported in the individual studies. Sample size refers to the number of participants included in each study. Study design and obesity measures are reported according to the original study descriptions.

The 11 included studies demonstrated substantial heterogeneity in study populations, designs, and measures used to assess childhood adiposity. Most studies used BMI or standardized BMI measures as the primary indicator of obesity/adiposity, while some studies additionally used BMI-for-age Z-scores, waist circumference, and fat mass index (FMI). The reported anthropometric measures also varied considerably across studies, with some reporting mean BMI values, whereas others reported standardized scores or body-composition measures. Among studies reporting mean values, BMI ranged from approximately 19.2 ± 3.4 kg/m² among Greek preadolescents to 25.6 kg/m² in the UK study population, while standardized BMI measures indicated generally normal BMI in the (Fedde et al., 2025) (16) study, although 13% of participants were

overweight and 1% were obese. The (Zancheta et al., 2024) (17) study reported a mean BMI-for-age Z-score of 1.1 ± 1.3 and mean waist circumference of 59.5 ± 5.3 cm, whereas Costa et al. 2021) (19) demonstrated an increase in FMI between ages 6 and 11 years. Overall, the variation in anthropometric indicators highlights the heterogeneity in the operationalization and measurement of childhood obesity across the included studies, which should be considered when interpreting and comparing findings (Table 1).

Table 2. Dietary exposures examined and their associations with Childhood obesity.

Dietary Exposure	Number of studies (n)	Studies (Author, Year)	Association (Outcome)
Ultra-processed Foods	11	(Rosi et al., 2025), (Handakas et al., 2022) (Gketsios et al., 2023) (Chang et al., 2021) (Petridi et al., 2025a) (AI Hourani et al., 2025) (Fedde et al., 2025) (Zancheta et al., 2024) (Lee et al., 2024) (Costa et al., 2021) (8,10,11,13–19)	Increased BMI, Overweight/obesity, waist circumference
Sugar-Sweetened Foods	4	(Al Hourani et al., 2025; Chang et al., 2021; Gketsios et al., 2023; Petridi et al., 2025a)	Increased BMI, Overweight/obesity, waist circumference and secondary outcome is increased metabolic abnormalities
Fast Foods	1	(Petridi et al., 2025a)(14)	Obesity indicators and increased BMI and increased MASLD risk
Overall Dietary Quality	2	(Fedde et al., 2025) (Zancheta et al., 2024) (16,17)	Increased MASLD risk and metabolic abnormalities, increased BMI.

UPF: Ultra-processed foods; UPB: ultra-processed beverages; BMI: Body mass index.

The included studies also assessed multiple/additional dietary exposures, with ultra-processed foods (UPF) being the most frequently studied exposure (n=11) (8,10,11,13–19) . Other exposures included sugar-sweetened foods (n=4), fast foods (n=1) (14), and overall dietary quality (n=2) (16,17). Overall, these dietary exposures were associated with higher BMI, overweight/obesity, waist circumference, and metabolic abnormalities, although the strength and direction of associations varied across studies (Table 2).

Table 3. Dietary Exposure and Measurement Methods

Study	Exposure	Assessment method	Classification / metric
(Handakas et al., 2022) (10)	UPF	3-day food diary	NOVA; % energy
(Gketsios et al., 2023) (11)	UPB	Validated FFQ	Frequency score low/moderate/high
(Rosi et al., 2025) (8)	UPF / unhealthy UPF	13-item FFQ	NOVA-4; frequency
(Gketsios et al., 2023) (12)	UPB + snacks	FFQ	Low vs moderate/high
(Chang et al., 2021) (13)	UPF	3-day food diary	NOVA; quintiles

(Petridi et al., 2025a)(14)	UPF	24-h dietary recalls	NOVA-4; %energy; tertiles
(AI Hourani et al., 2025)(15)	UPF	24-h dietary recall	NOVA; % energy/kcal
(Fedde et al., 2025) (16)	UPF	Dietary assessment	NOVA; score/energy; tertiles
(Zancheta et al., 2024) (17)	UPF	24-h dietary recalls	NOVA; kcal/day and g/day
(Lee et al., 2024) (18)	UPF	Food diaries	NOVA; % grams and % energy; tertiles
(Costa et al., 2021) (19)	UPF	FFQ	NOVA; g, kcal, % grams, % energy

UPF: ultra-processed foods; UPB: ultra-processed beverages; FFQ: food frequency questionnaire.

The included studies used three main methods for assessing dietary exposure: food diaries, food frequency questionnaires (FFQs), and 24-hour dietary recalls. Most studies used the NOVA classification to identify ultra-processed foods, with NOVA-4 specifically reported in some studies. Dietary exposure was quantified using different metrics, including percentage of total energy intake, grams/day, kcal/day, frequency of consumption, tertiles, and quintiles. Overall, there was considerable variation in both the dietary assessment methods and exposure metrics used across the included studies. This heterogeneity should be considered when comparing dietary exposure and obesity-related findings across studies (Table 3).

Table 4. Association Between Dietary Exposures and Childhood Obesity outcomes / Adiposity outcomes in included studies

Author (Year)	Dietary exposure	Exposure comparison / metric	Obesity / adiposity outcome	Effect estimate / statistical result	Direction
(Handakas et al., 2022) (10)	UPF consumption	UPF relative intake (% of energy)	Adiposity-related outcome	Not reported but it primarily concerned metabolic traits and nutrient composition	Associations with obesity-related metabolic profiles were reported; specific anthropometric outcomes were not the primary focus
(Gketsios et al., 2023) (11)	Ultra-processed beverages (UPB)	High vs low; high vs. moderate; moderate vs. low UPB	BMI / obesity-related outcome	$\beta = 0.89 \pm 0.37$, $p = 0.020$; $\beta = 0.69 \pm 0.32$, $p = 0.030$; $\beta = -0.09 \pm 0.29$, $p = 0.740$	Positive; positive; No association
(Rosi et al., 2025) (8)	UPF-related eating behaviors and	Frequent / high consumption	Obesity vs. normal weight	OR = 1.97 (95% CI 1.39–2.80), OR = 2.02 (1.09–3.72), OR=2.69 (2.18–3.72), and OR = 1.95 (1.02–3.71)	Positive

	UPF consumption				
(Gketsios et al., 2023) (12)	Soft drinks and snacks	Moderate consumption among obese participants	Obesity	Soft drinks: OR = 1.99 (95% CI 1.31–3.04); snacks: OR = 2.36 (95% CI 1.51–3.69)	Positive
(Chang et al., 2021) (13)	UPF consumption	Highest vs. lowest quintile (Q5 vs Q1)	BMI, FMI, body fat %, weight and waist circumference trajectories	BMI trajectory: β=0.06/year (95% CI 0.04–0.08); FMI trajectory: β=0.03/year (0.01–0.05); weight trajectory: β = 0.20 kg/year (0.11–0.28); waist trajectory: β=0.17 cm/year (0.11–0.22).	Positive
(Petridi et al., 2025a)(14)	UPF (NOVA 4)	2nd vs 1st tertile; 3rd vs. 1st tertile	Overweight/obesity vs normal weight	OR = 1.60 (95% CI 0.92–2.84); OR = 1.00 (0.56–1.91); adjusted for sex, energy intake, age category and screen time	No significant association
(AI Hourani et al., 2025)(15)	UPF	Quartiles of % total energy from UPF	BMI-for-age Z-score, overweight, obesity, abdominal obesity / WHtR	No significant difference in BMI Z-score across quartiles; no significant correlation with BMI or Waist hip ratio.	No significant association with BMI and weak positive association with waist-hip ratio.
(Fedde et al., 2025) (16)	UPF score	UPF score during childhood / adolescence; sex-specific analysis	BMI-SDS and FMI	BMI-SDS: males r = −0.301, p = 0.01; females r = −0.315, p < 0.001. FMI: males r = −0.376, p = 0.001; females r = −0.282, p = 0.003.	Sex-specific: Positive in males; inverse in females
(Zancheta et al., 2024) (17)	UPF	Per 100 kcal and per 100 g of UPF	BMI Z-score, waist circumference, fat mass	BMI Z-score β = 0.24 (95% CI 0.16–0.33) and β = 0.21 (0.10–0.31) ; WC β = 0.89 cm (0.41–1.37) and β = 0.86 cm (0.32–1.40) per 100 g; fat mass β = 0.06 (0.03–0.09) per 100 kcal and β = 0.04 (0.01–0.07) per 100 g.	Positive
(Lee et al., 2024) (18)	UPF consumption	Highest tertile (T3)	Body fat mass, lean mass, FMI and insulin	Body fat mass β = 0.003 (95% CI −0.028–0.035); lean mass β = 0.009 (−0.005–0.023); FMI β = 0.004 (−0.027–0.035); insulin β = 0.133 (0.005–0.262).	No association; positive; no association; positive
(Costa et al., 2021) (19)	UPF consumption	Increase of 100 g in UPF contribution from 6 to 11 years	Fat mass index	Gain of 0.14 kg/m² in FMI (full adjusted analysis). Mediation analysis: 58.2% of the total effect was mediated by calorie content; 41.8% represented the direct effect/other unmeasured pathways.	Positive

UPF: ultra-processed foods; UPB: ultra-processed beverages; BMI: Body mass index; WC: waist circumference; FMI: fat mass index; SDS: standard deviation score; CI: confidence interval; OR: odds ratio.

The included studies showed considerable variation in the associations between dietary exposures and obesity/adiposity outcomes. Most studies reported a positive association between higher consumption of ultra-processed foods or related products and increased adiposity, including higher BMI, BMI trajectories, fat mass index, waist circumference, and obesity risk. Positive associations were reported by Gketsios et al. (11), Rosi et al. (8), Chang et al. (13), Zancheta et al. (17), and Costa et al. (19). In contrast, Petridi et al. (14) found no significant association between UPF consumption and overweight/obesity, while Al Hourani et al. (15) reported no significant association with BMI but a weak positive association with waist-hip ratio. Fedde et al. (16) reported sex-specific associations, with positive associations among males and inverse associations among females. Lee et al. (18) showed mixed findings, with no significant associations for body fat mass and FMI but positive associations for lean mass and insulin.

Overall, the findings suggest a predominantly positive but heterogeneous relationship between UPF-related dietary exposure and childhood adiposity, with differences across studies in exposure definitions, outcome measures, and effect estimates (Table 4).

Table 5: Obesity-related outcome measures reported across included studies

Outcome Measure	Studies Using it
BMI	9
BMI-Z score	5
Waist circumference	2
Fat mass index	3
Body fat %	3

BMI was the most commonly used obesity/adiposity measure, reported in 9 studies, followed by BMI-Z score (n=5). Other measures included fat mass index (n=3), body fat percentage (n=3), and waist circumference (n=2). This indicates that BMI-based measures were predominantly used to assess childhood obesity, while several studies also incorporated standardized BMI and body-composition measures to provide a broader assessment of adiposity (Table 5).

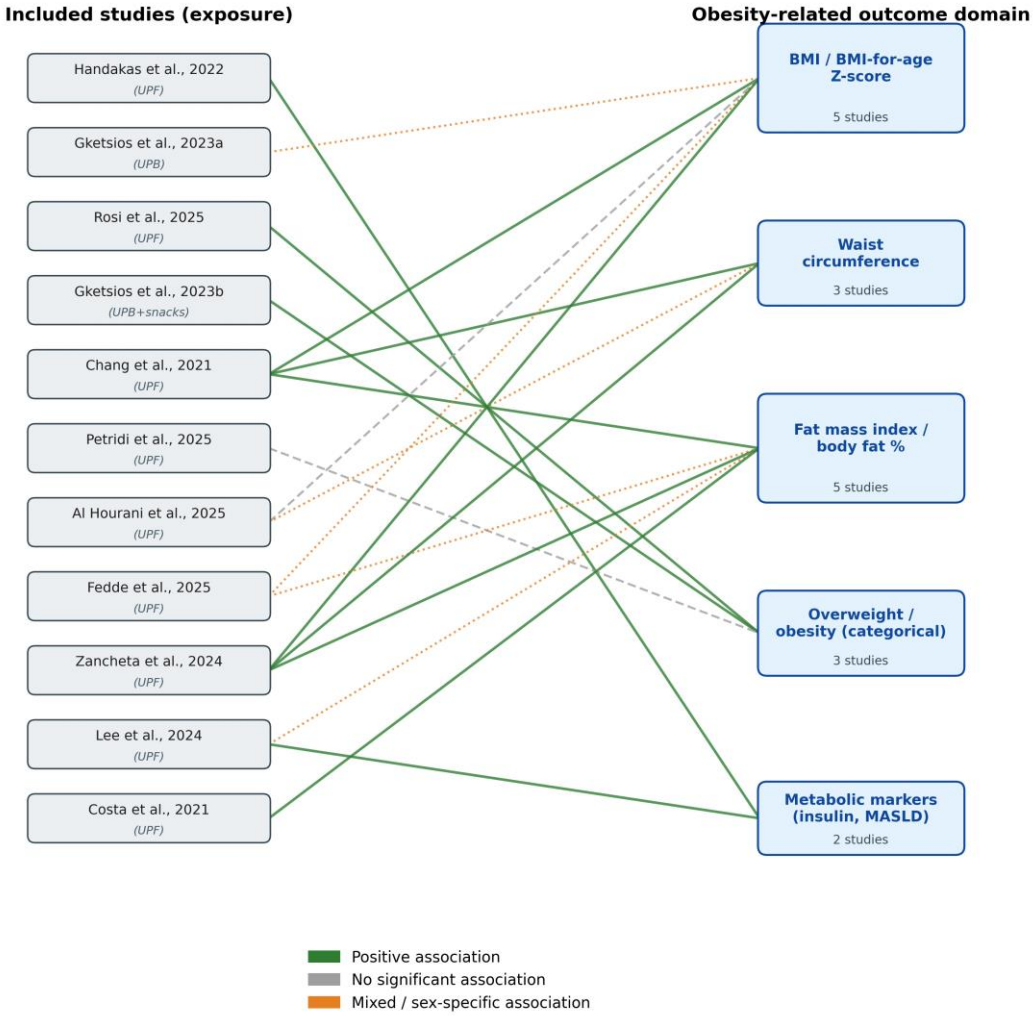


Figure 2. Evidence maps of dietary exposure–outcome associations across the 11 included studies (18 study-outcome links).

As shown in Figure 2, the solid green lines indicate a positive association, dashed grey lines indicate no significant association, and dotted orange lines indicate a mixed or sex-specific association; outcome-domain box size reflects the number of studies linked to that domain.

Figure 2 also consolidates the exposure–outcome linkages reported across Tables 2–5 into a single evidence map. BMI/BMI-for-age Z-score and fat mass index/body fat percentage were the most frequently examined outcome domains (five studies each), followed by waist circumference and overweight/obesity as a categorical outcome (three studies each), while metabolic markers such as insulin and MASLD risk were assessed least often (two studies). Of the 18 study-outcome links mapped, most (n=11) reflected a positive association between higher ultra-processed food or beverage consumption and adverse obesity-related outcomes, while five reflected mixed or sex-specific findings and two indicated no significant association. Critically, the mixed and null findings were not confined to any single outcome domain: they appeared for BMI-based measures, waist circumference, and body-composition measures alike. This pattern reinforces the review's central conclusion that the association between UPF consumption and childhood adiposity, while predominantly positive, is not uniform across

outcome domains and is likely shaped by differences in dietary assessment method, population characteristics, and sex, at least in one study.

Discussion

This scoping review mapped the recent evidence on the association between ultra-processed food (UPF) consumption and obesity-related outcomes among children and adolescents. Across the 11 included studies, the findings showed a predominantly positive association between higher UPF consumption and greater adiposity, including higher BMI, BMI-for-age Z-score, fat mass index, body fat percentage, waist circumference, and overweight/obesity. However, the evidence was not entirely consistent, with some studies reporting null, mixed, or inverse associations. This heterogeneity may be related to differences in study design, duration of follow-up, dietary assessment methods, UPF exposure metrics, population characteristics, and the anthropometric outcomes used.

The predominantly positive findings in the present review are broadly consistent with the systematic review by De Amicis et al. (21) which examined observational studies investigating the association between UPF consumption and obesity or adiposity among children and adolescents. Their review included ten studies, comprising five longitudinal and five cross-sectional studies, and reported that four longitudinal studies with follow-up periods longer than four years demonstrated positive associations between UPF consumption and obesity or adiposity parameters, whereas cross-sectional studies generally did not demonstrate significant associations. Similarly, in the present review, several longitudinal or prospective studies reported positive associations between UPF consumption and BMI trajectories, fat mass index, waist circumference, or other adiposity measures, while some cross-sectional studies reported null or mixed findings. These observations suggest that longer-term assessment of dietary exposure may provide greater insight into changes in adiposity than measurements obtained at a single time point. However, because the evidence included in the present review was observational, these findings should not be interpreted as establishing a causal relationship (21).

Considerable heterogeneity was observed in the assessment of UPF consumption across the included studies. Food diaries, food frequency questionnaires, and 24-hour dietary recalls were used, while UPF exposure was quantified using different metrics, including percentage of total energy intake, grams or kilocalories per day, frequency of consumption, and tertiles or quintiles. Although the NOVA classification was used in most studies, differences in dietary assessment methods and exposure definitions may contribute to variation in the observed associations. Marino et al. (22), in a systematic review of worldwide UPF consumption, similarly highlighted substantial variation in dietary assessment methods, with 24-hour dietary recalls being the most frequently used method among the studies reviewed. The authors also discussed ongoing debate regarding the application and appropriateness of the NOVA classification. These methodological differences may reduce comparability across studies and should therefore be considered when interpreting the heterogeneous findings observed in the present review (22).

The use of different obesity-related outcomes also contributed to heterogeneity. BMI was the most frequently reported outcome in the present review, while several studies additionally assessed BMI-for-age Z-score, fat mass index, body fat percentage, and waist circumference. Although BMI is widely used because of its feasibility in population-based studies, it does not distinguish between fat mass and lean mass. The inclusion of body-composition measures and indicators of central adiposity in some studies therefore provides complementary

information regarding the relationship between UPF consumption and adiposity. The longitudinal findings reporting increases in BMI, fat mass index, weight, and waist circumference trajectories further suggest that the association may extend beyond BMI alone. However, differences in anthropometric measures and age-specific reference standards may limit direct comparison across studies.

The geographical distribution of evidence represents another important research gap. The included studies were conducted across Europe, Latin America, the Middle East, and East Asia, whereas evidence from low- and middle-income countries, particularly South Asia and India, was limited. Differences in food environments, dietary patterns, socioeconomic conditions, food availability, and cultural practices may influence both UPF consumption and childhood obesity. Therefore, findings generated predominantly in high-income settings may not be directly generalizable to children and adolescents in countries such as India. Future research should include more diverse populations and examine the broader food and socioeconomic environments in which UPF consumption occurs.

The behavioral and environmental context of UPF consumption is also relevant to interpreting the findings. UPFs are generally described as convenient, readily available, affordable, and highly palatable foods, characteristics that may contribute to their frequent consumption. McCausland et al. (23) highlighted continuing uncertainty among the public and experts regarding the identification and classification of UPFs and discussed the implications of these uncertainties for nutrition education. Such issues may be particularly relevant in childhood and adolescence, when food choices are influenced by family, school, peers, and the wider food environment (23).

Psychological factors may also influence food-related behaviors. Smith et al. (24) examined the influence of COVID-19-related stress on food motivation and reported that stress was associated with alterations in food-related motivation, including motivation toward highly palatable food categories. However, this study was conducted among adults and did not specifically examine UPF consumption or childhood obesity. Therefore, its findings should be interpreted only as contextual evidence suggesting that psychological factors may influence food-related behavior rather than as direct evidence explaining the associations observed among children and adolescents in the present review (24). Future pediatric research could examine whether psychological stress, emotional eating, and food motivation modify the relationship between UPF consumption and obesity-related outcomes.

The present review also highlights the importance of distinguishing association from causation. Although most included studies reported positive associations between higher UPF consumption and adiposity-related outcomes, UPF consumption may coexist with other behavioral, dietary, and socioeconomic factors that influence obesity risk. Physical activity, sedentary behavior, total energy intake, sleep, socioeconomic circumstances, parental characteristics, and overall dietary quality may act as confounding or modifying factors. Future longitudinal studies should therefore use validated dietary assessment methods and appropriately account for relevant confounding variables when examining the relationship between UPF consumption and childhood adiposity.

The findings have implications for childhood obesity prevention. Given the predominantly positive association observed in this review, reducing excessive consumption of UPFs may form part of broader strategies to promote healthier dietary patterns among children and adolescents. However, interventions should not focus exclusively on individual food choices. School-based

nutrition education, supportive family environments, improved availability of minimally processed foods, and policies addressing the wider food environment may represent complementary approaches. Clear and consistent communication regarding UPFs may also be important because uncertainty surrounding food classification can make dietary guidance difficult to implement (23).

Strengths and limitations

This scoping review followed PRISMA-ScR guidance and used predefined eligibility criteria, a structured PCC framework, and a standardized and piloted data-extraction form. The review mapped evidence across diverse populations, geographical settings, dietary exposure measures, and obesity-related outcomes, while appropriately using descriptive synthesis because of substantial methodological heterogeneity. However, the findings should be interpreted in light of several limitations. Only 11 studies were included, with most being cross-sectional, limiting causal inference. Considerable heterogeneity existed in UPF assessment, NOVA classification, exposure metrics, obesity definitions, and statistical methods. Differences in BMI reference standards and the use of self- or parent-reported dietary assessments may have introduced measurement and reporting bias. Evidence from LMICs, particularly South Asia and India, was limited. Furthermore, no formal risk-of-bias assessment was undertaken, consistent with the scoping review methodology.

Conclusion

This scoping review identified a predominantly positive association between ultra-processed food consumption and obesity-related outcomes among children and adolescents, including BMI, BMI-for-age Z-score, fat mass index, body fat percentage, and waist circumference. However, some studies reported null, mixed, or inverse associations, reflecting considerable heterogeneity in study designs, dietary assessment methods, UPF classification, exposure measures, and obesity-related outcomes. The predominance of cross-sectional studies also limits causal interpretation.

Further longitudinal studies using standardized and validated dietary and anthropometric measures are needed to strengthen the evidence, particularly in low- and middle-income countries and underrepresented settings such as India and South Asia. These findings highlight the importance of promoting healthier dietary patterns and reducing excessive consumption of ultra-processed foods as part of childhood obesity prevention strategies.

Author contributions (CRediT)

A. Vyshnavi: Conceptualization, Methodology, Literature search, Investigation, Data curation, Writing - original draft, and Interpretation of findings. V. S. Amirtha Varshini: Investigation, Data curation, Formal analysis, Writing -review & editing. Karthik N: Methodology, Formal analysis, Interpretation of findings, and Writing-review & editing. Sony Sequeira: Data curation, Visualisation, and Writing-review & editing. Hari Prakash G: Data synthesis, Formal analysis, Interpretation of findings, and Writing-review & editing. Tejaswini B. D: Supervision, Methodology, Validation, and Writing-review & editing. All authors: Read and approved the final version of the manuscript.

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