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# Examining the effectiveness of food literacy interventions in improving food literacy behavior and healthy eating among adults belonging to different socioeconomic groups—a systematic scoping review

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## Abstract

**Background** In high-income countries, significant diet-related health inequalities exist between people of different socioeconomic backgrounds. Individuals who face socioeconomic challenges are less likely to meet dietary guidelines, leading to increased incidence and prevalence of morbidity and mortality associated with dietary risk factors. To promote healthy eating, strategies may focus on individual-level factors (e.g., knowledge, skills, and behavior) along with broader societal factors (e.g., social determinants of health). The concept of food literacy is considered an individual-level factor and has been framed as a skill set that individuals must possess to effectively navigate the complexities of the modern food system. Food literacy interventions can be a complementary but effective tool for encouraging healthy eating behavior among diverse populations, including those facing socioeconomic disadvantage. However, there is limited evidence to guide the design of food literacy intervention for vulnerable population groups. In the process of developing an ideal portfolio of solutions and strategies to promote food literacy and healthy eating for people experiencing socioeconomic disadvantage, this systematic scoping review aims to comprehensively examine the effects of food literacy interventions on promoting food literacy behavior and healthy eating in adults (18 years and above) from various socioeconomic groups (SEGs) in high-income countries.

**Methods** The review includes both qualitative and quantitative papers obtained from academic databases, including MEDLINE (via EBSCOhost), Embase, Web of Science, and Google Scholar. In addition to the electronic search, manual forward and backward citation searching will be conducted to identify additional relevant papers. Food literacy interventions will be evaluated across four domains: planning and management, selection, preparation, and consumption. Papers included in the review will be analyzed for process, impact, and outcome evaluation. The main outcome of a food literacy intervention is the modification in eating behavior, while the mechanism for this action will be through impact measure of food literacy behaviors. Implementation factors will be extracted for process evaluation. This review will also include a range of dietary behavior measures, such as diet quality index and dietary intake indicator. The screening process for all citations, full-text articles, and abstract data will be carried out by two

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reviewers independently. In case of any potential conflicts, they will be resolved through discussion. The quality of quantitative studies will be reviewed using the JBI critical appraisal checklist for analytical cross-sectional studies. The “Consolidated Criteria for Reporting Qualitative Studies (COREQ)” will be used to report on the quality of qualitative papers. Systematic review registration: <https://doi.org/10.17605/OSF.IO/TPNKU>

**Keywords** Food literacy, Intervention, Healthy eating, Socioeconomic position, Adults

## Introduction

In recent years, there has been an epidemiological shift on a global scale, characterized by the prevalence of non-communicable chronic diseases (NCDs), part of which can be attributed to unhealthy dietary patterns [39]. Globally, 42.0 million deaths were caused by non-communicable diseases (NCDs) in 2019. Among them, dietary risk factors were responsible for 7.9 million deaths and 187.7 million DALYs (disability-adjusted life years) [74]. In response, governments and policymakers worldwide are pushing for strong facilitation of healthy eating. Healthy eating comprises a healthy diet that is defined by the World Health Organization (WHO) as one that “protects against malnutrition in all its forms, as well as non-communicable diseases (NCDs), including diabetes, heart disease, stroke and cancer” (2020). However, facilitating healthy eating is complex. Eating, as a dynamic and complex health behavior [48, 56], is influenced by various factors that operate at individual, community, and societal levels [37, 44, 56, 61, 79]. Factors such as social context, economic conditions, and community and family factors heavily impact any health behavior, including eating [56, 59, 78]. These factors are collectively known as social determinants of health (SDHs). [78]. It is essential to acknowledge that social determinants play a crucial role in developing and maintaining healthy eating habits [22, 26, 58].

Out of all social determinants, socioeconomic position (SEP) has a significant impact on what people eat, leading to socioeconomic inequalities in healthy eating among different income groups. Education, income, occupation, gender, and ethnicity are examples of interlinked socioeconomic and sociodemographic factors that collectively can modulate eating [1, 45, 81]. Many high-income countries, including Australia, exhibit evidence of SEP-linked inequalities with regard to healthy eating [3, 4]. Individuals in higher income brackets, with advanced educational backgrounds, and residing in more affluent communities are more capable of consuming a well-balanced and nutritious diet, leading to better overall health outcomes. [38, 40]. Conversely, people facing social and economic disadvantage are less able to access and consume a healthy diet, resulting in a higher incidence and prevalence of morbidity and mortality rates from diet-related NCDs among this group [1, 12, 20, 24, 38, 43].

Poor diet and unhealthy eating habits are considered to be risk factors for chronic diet-related diseases worldwide, even in high-income countries. In most high-income countries, the negative effects of poor diets are disproportionately felt by lower socioeconomic populations, Indigenous Peoples, and those living in rural and remote areas [2, 20, 62]. Interestingly, what people consider to be healthy eating varies widely between countries and cultures too, along with other social determinants of health [14, 16, 49]. Moreover, there are significant disparities in the food environment between low- and high-income countries [69]. These differences in perceptions limit the generalizability of the findings and highlight the need to focus specifically on high-income countries when devising policies and strategies aimed at improving dietary patterns and nutrition-related outcomes.

Improving dietary habits is a complex issue that requires a multidisciplinary approach that takes into account the social context [57]. Among the different approaches or interventions aimed at influencing eating habits positively, food literacy has emerged as crucial in potentially enhancing diet quality as well as promoting good health [18]. Within policy and practice, interventions aimed at promoting healthy eating habits frequently focus on modifying personal behavior by influencing individual-level factors such as skills, knowledge, and beliefs while also addressing the underlying determinants that impact eating behavior [26, 41]. As outlined by (Velardo) in [71], food literacy focuses on enhancing individual knowledge that leads to the development of personal skills, such as critical decision-making, goal setting, and confidence in cooking. The importance of food literacy is that it recognizes that healthy eating is not just an individual responsibility but is also influenced by social structural factors [21, 64, 73].

Food literacy interventions are increasingly being developed and implemented. In accordance with the food literacy conceptual models, it is generally postulated that improvement in food literacy behavior has the potential to elicit favorable outcomes in terms of dietary intake and, as a consequence, overall health. This is essentially the underlying premise upon which all food literacy interventions or programs are running [7]. As proposed by Vidgen and Gallegos [73], the widely accepted food literacy model has four interconnected

domains, which are (1) planning and management, (2) selection, (3) preparation, and (4) eating. An ideal food literacy intervention should incorporate all four domains so that participants can achieve a comprehensive understanding of the interconnected knowledge, skills, and behavior essential to strengthen their connection with food and effectively adapt diet quality through changes, thus empowering people [13, 73]. Often many of these interventions are especially targeted at communities with less access to healthy diets, such as people living with socioeconomic disadvantage, where these interventions can make a real difference [7, 13, 76]. Evidence suggests that well-planned and implemented food literacy interventions can impact the healthy eating behavior of people facing socioeconomic disadvantage. For example, OZHarvest's NEST (Nutrition Education Skills Training) program is an intensive, 6-week, 15-h public health nutrition intervention in Australia designed to enhance the nutritional knowledge, food literacy, and cooking skills of Australian adults living with socioeconomic disadvantage [47, 76]. Attendees involved in OZHarvest's NEST Program showed improvements in their cooking skills, used healthier ingredients, applied proper cooking methods, made cost-effective ingredient substitutions, made informed choices when selecting food items, and managed to stay within their meal budgets [76].

Food literacy in the context of socioeconomic position is not well understood. There has been some limited exploration of the connection between social determinants of health and food literacy [21, 64, 73]. Also, investment in FL interventions by governments is based on the assumption that developing higher food literacy levels will positively impact dietary behavior. Various food literacy programs have been initiated to improve food literacy, especially among vulnerable population groups [8]. Studies have shown that food literacy interventions have promise in promoting healthy eating habits among adults from low socioeconomic backgrounds [7, 13, 76]. However, many interventions fail to report on their outcomes or conduct follow-up evaluations, which is contrary to best-practice recommendations [33]. Currently, there is a lack of comprehensive reviews available to verify the effectiveness of these interventions in enhancing food literacy behavior and encouraging healthy eating among vulnerable population groups [5]. This research gap can be addressed through a scoping review, which can identify available evidence, examine research methodologies, and determine whether food literacy interventions have been beneficial in promoting healthy eating and food literacy behavior among vulnerable population groups.

Upon initial exploration of several academic databases, including MEDLINE, Embase, and Google Scholar, it has become clear that there are currently existing systematic reviews (Kelly and Nash, 2021; Vaitkeviciute et al. 2015) as well as planned protocols (Doustmohammadian et al. 2020) that examine the effectiveness of food literacy. However, it should be noted that neither of these systematic reviews specifically target the adult population, nor do they incorporate socioeconomic position as a factor of interest in the analysis. Therefore, the aim of this review is to examine, through a systematic approach, food literacy interventions and their effectiveness in improving food literacy behavior and healthy eating among different socioeconomic groups in high-income countries.

### Study design

A protocol has been registered on the Open Science Framework Registries on July 17, 2023. This proposed systematic scoping review will be conducted using the JBI scoping review methodology outlined in "Chapter 11: Scoping reviews" [50, 51, 51]. The findings will be reported in compliance with the PRISMA extension for scoping reviews (PRISMA-ScR) [68].

### Objective and review questions to guide study design

The objective of this review is to systematically determine if food literacy interventions have an impact on improving food literacy and healthy eating behavior among different socioeconomic groups living in high-income countries.

The main review question for this inquiry has been formulated as follows:

#### Primary review question

*Are food literacy interventions effective in improving food literacy behavior and healthy eating across different socioeconomic groups?*

#### Secondary review questions

- i) Are food literacy interventions effective in improving food literacy behavior?
- ii) Are food literacy interventions effective in improving healthy eating behavior?
- iii) Which components within food literacy interventions are effective in improving food literacy behavior and healthy eating behavior?
- iv) Does the effectiveness of food literacy interventions vary across different socioeconomic groups?
- v) What are the characteristics of effective food literacy interventions?

## Inclusion criteria

**1. Participants** Studies conducted on adults (18 years and older) of any sex or gender residing in high-income countries will be included in the review.

**2. Concept** As this scoping review primarily focuses on the application (intervention) part of food literacy, the evidence of various food literacy interventions will be considered. Food literacy interventions can vary in design, approach, target population, time frame, outcome evaluation, theoretical model, and food literacy domains [72]). To select appropriate interventions, an established food literacy model will guide this review.

Food literacy has been defined in various ways by researchers attempting to give meaning to the emerging concept [19]. During the initial stage of conceptualizing the idea of FL, researchers perceived it as a compilation of nutritional knowledge and mechanical techniques for preparing food [36, 46]. Newer understandings of the subject have included the necessary knowledge, personal abilities, psychological traits (such as confidence, self-efficacy, and resilience), capabilities, and actions involved in the planning, selection, and preparation of food [10, 19, 21, 73]. It is worth mentioning, that among all definitions, the most cited definition is by [73], p. 54), according to a recent systematic review [66]. [73] defined FL as “the scaffolding that empowers individuals, households, communities or nations to protect diet quality through change and strengthen dietary resilience over time. It is composed of a collection of inter-related knowledge, skills and behaviours required to plan, manage, select, prepare and eat food to meet needs and determine intake”. The definition that has been presented lays the foundation for subsequent definitions that have sought to elaborate on the concept. It is worth noting that these subsequent definitions have not sought to challenge the central tenets of the original definition, but rather to build upon them. As such, this review will adopt and work within the framework of this original definition, which serves as a key reference point for further exploration of the concept.

Also, Vidgen and Gallegos [73], proposed a conceptual model for food literacy that goes beyond the basic definition. This model was developed based on primary research and the original definition. Its purpose is to illustrate their perspective on food literacy. The model consists of four domains: planning and management, selection, preparation, and consumption of food (Table 1). These domains comprise a total of eleven

food-related activities, referred to as “components” [73]. All interventions that align with the knowledge, skills, and behavior associated with these four domains will be included in this review. Table 1 below presents the four domains of the food literacy model.

**3. Context** Papers will include only interventions that have been implemented in high-income countries. Most high-income countries are also considered countries with the highest human development index (HDI) [80]. HDI, as defined by the United Nations Development Programme (UNDP), is a comprehensive indicator that assesses the overall attainment of human development in crucial areas such as standard of living, educational attainment, and life expectancy [70]. The importance of focusing on high-income countries cannot be overstated due to the differences in the way how healthy eating behaviors are perceived across various nations, as highlighted by [49]. Furthermore, there are significant disparities in the food environment between low and high-income countries [69]. Therefore, it is imperative to take into account these variations when considering policies and strategies aimed at improving dietary patterns and nutrition-related outcomes.

**4. Types of sources** This scoping review will include various types of studies published only in peer-reviewed journals, including quantitative, qualitative, and mixed-method designs. This may consist of systematic reviews, observational non-experimental studies, experimental studies, and case studies.

**5. Types of interventions** The main focus of this review will be on scholarly papers that explicitly and accurately discuss food literacy intervention, utilizing the terms “food literacy intervention” or “food literacy program”. By limiting the scope to articles that use these specific terms, is aimed to provide a more comprehensive and in-depth analysis of the research in this field.

## Method

### (1) Eligibility criteria

The emphasis of this review is largely placed on the intervention aspect of food literacy. Therefore, maximum data related to intervention will be extracted. In doing so, those studied will only be included which are (1) peer-reviewed, (2) studied on humans, (3) studied in high-income countries, (4) described a food literacy intervention implemented on adults aged 18 years or above, (6) published from 2001 to 2022 (7) published or translated in English.



**Table 1** Four domains and eleven components of food literacy, as proposed by Vidgen & Gallegos [73]

Domain	Components
1. Planning and management	1.1 Prioritize time and money for food.
	1.2 Plan food intake (formally and informally) so that food can be regularly accessed through some sources, irrespective of changes in circumstances or environment.
	1.3 Make feasible food decisions which balance food needs (e.g. nutrition, taste, hunger) with available resources (e.g. time, money, skills, equipment).
2. Selection	2.1 Access food through multiple sources and know the advantages and disadvantages of these sources.
	2.2 Determine what is in a food product, where it came from, how to store it and use it.
	2.3 Judge the quality of food.
3. Preparation	3.1 Make a good tasting meal from whatever food is available. This includes being able to prepare commonly available foods, efficiently use common pieces of cooking equipment and having a sufficient repertoire of skills to adapt recipes (written or unwritten) to experiment with food and ingredients.
	3.2 Apply basic principles of safe food hygiene and handling.
4. Eating	4.1 Understand food has an impact on personal wellbeing.
	4.2 Demonstrate self-awareness of the need to personally balance food intake. This includes knowing foods to include for good health, foods to restrict for good health, and appropriate portion size and frequency.
	4.3 Join in and eat in a social way.

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**(2) Search strategy**

To visualize the search plan, four main theoretical constructs related to the research question were identified first (presented in Fig. 1).

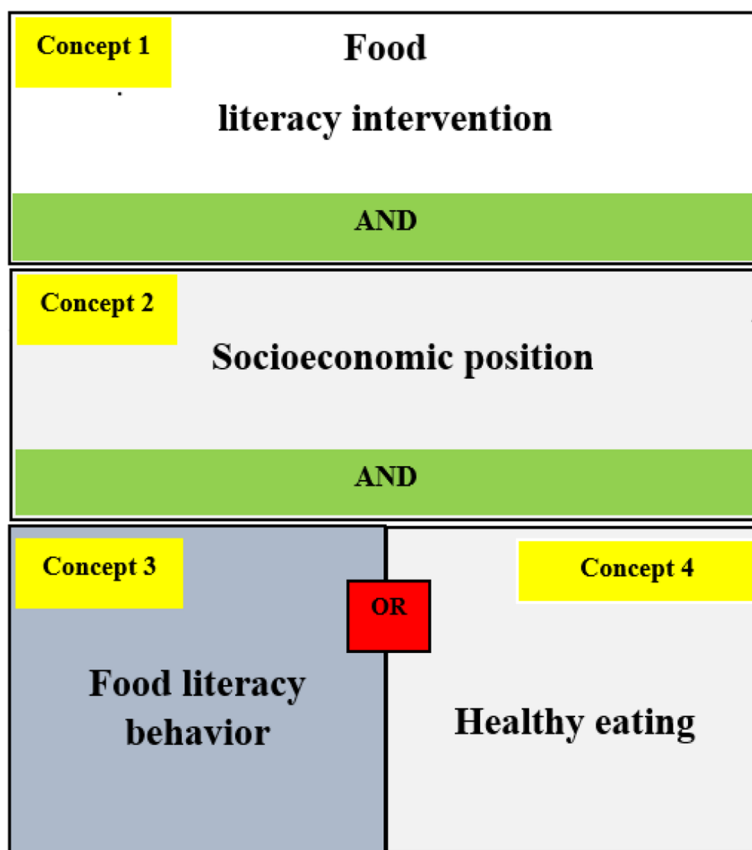
As recommended in all JBI types of reviews, a three-step search strategy was developed by all three authors, along with the consultation of an academic librarian.

**Step 1**

On July 5, 2023, an initial search was carried out on MEDLINE (via EBSCOhost), Cochrane Library, and OSFHOME (Open Science Framework) databases using

the keywords “food literacy,” “intervention,” “adults,” “healthy eating,” and “socioeconomic position. No systematic review was found to be registered on any platform that sufficiently addressed the research question of this study. However, the initial search also revealed significant limitations in the search strategy.

Many articles in the database used these search terms in a different context than intended. For example, the phrase “healthy eating” has multiple meanings and has been used in various contexts. In addition, no empirical study has explored the connection between food literacy and socioeconomic position till now. As a result, relying solely on the above-mentioned keywords either failed



**Fig. 1** Visual presentation of search adaptation

to yield related materials that did not explicitly use the search term or returned irrelevant materials.

**Step 2**

As such, the search strategy was adjusted to include only the keywords “food literacy” “intervention” and “adults”, along with the index terms used to describe these three constructs as identified in the titles/abstracts of articles from the initial search. The extraction of socioeconomic factors and any indication of healthy eating behavior (dietary behavior) will be carried out manually. A trial of search, using the preferred keywords and the index terms used in each database is shown in Appendix 1.

The second search using the modified search strategy will be run in three electronic databases (MEDLINE (via EBSCO-host), Scopus, and CINHAI) by AM in November 2023.

**Step 3**

To ensure the completeness of the search process, both forward and backward citation searches will be performed(QUT Library Guide, 2023).

After each search, all identified citations will be gathered and uploaded to the referencing software EndNote

20. Duplicates will then be removed before exporting the citations to Covidence, a screening and data extraction tool will be used in systematic reviews (<https://www.covidence.org/>).

**(3) Study selection**

***Integrating different types of studies***

The review will encompass diverse types of studies to gain a better understanding of multifaceted phenomena. These will include quantitative studies, which measure the effects of food literacy interventions, qualitative studies that focus on the experiences of those who attended any food literacy program, and mixed methods studies that combine both quantitative and qualitative approaches.

While reviewing quantitative studies, trials of food literacy programs/interventions that aimed to promote food literacy behavior and healthy eating will be looked at. The analysis for the trials will involve a thorough examination of the pre- and post-data on the outcomes that were reported, along with that of a comparable control or comparison group.

The aim of reviewing qualitative studies is to explore adults’ perspectives and experiences of attending food

literacy programs. The focus is on identifying what attendees have reported experiencing as a result of participating in these programs. Initial reviews of the available literature indicate that attendees of such programs have reported positive changes in their food habits, including eating more fruits and vegetables, gaining confidence in cooking, using healthier ingredients, adopting appropriate cooking methods, substituting ingredients with less expensive options, making informed decisions when selecting food items, and stretching their meal budgets [13, 76].

#### **Process of selection**

All authors (AM/HV/DG) will conduct a pilot test by screening the title and abstract of 10% of the articles randomly selected from the pool of the saved articles in Covidence against the inclusion criteria. Once a consensus is reached, the first author (AM) will screen the title and abstract of the remaining articles. The exact process will be followed for assessing articles in full text. After reaching an agreement, the first author will retrieve the full text of the primarily selected citations and assess them in detail against all the inclusion criteria, including language, participants, geography, and intervention. Another reviewer (HV) will repeat this process independently. Any disputes will be resolved by consensus or with the involvement of a third reviewer. Finally, the scoping review will include all the publications that meet the eligibility criteria.

#### **(4) Evaluation of food literacy intervention**

Although previous systematic reviews of food literacy interventions expose the inadequacy of the evaluation method, it is still crucial to assess the effectiveness of the interventions through post-program follow-up evaluations [9]. It is also important to select an appropriate evaluation design that corresponds to the level of development when assessing a program. This review will follow three main types of evaluation methods: process, outcome, and impact evaluation [32, 55].

The method of process evaluation is used to determine if program activities have been executed according to plan and if they have resulted in specific outputs [32]. The relationship between impact and outcome can be explained as follows: outcome is the goal of any project (intervention), while impact is the objective. To clarify, the outcome is characterized by the desired changes in targeted health behavior that are sustained over a long period of time. Impact evaluation provides information about the observed changes or “impacts” produced by the intervention [32]. For instance, when implementing a food literacy program for adults, the objective is to improve their food literacy behavior, resulting in a sustained improvement in their dietary behavior, which is the ultimate goal or outcome [5, 6]. As such, for this

scoping review, the impact is the modification in food literacy behavior, and the outcome is the modification in eating behavior. How the data for process, impact, and outcome evaluation will be extracted is described in the coming paragraphs.

Furthermore, the assessment method is consistent with Vidgen’s ([72], p. 75) “second model of food literacy”, which is illustrated in Fig. 2 below. This model not only illustrates the connection between food literacy and nutrition but also provides guidance for process, outcome, and impact evaluations in an ideal food literacy intervention. The insights gained from these evaluations can be applied to improve the development and execution of future interventions [72], p. 81). Hence, this model will guide the evaluation process.

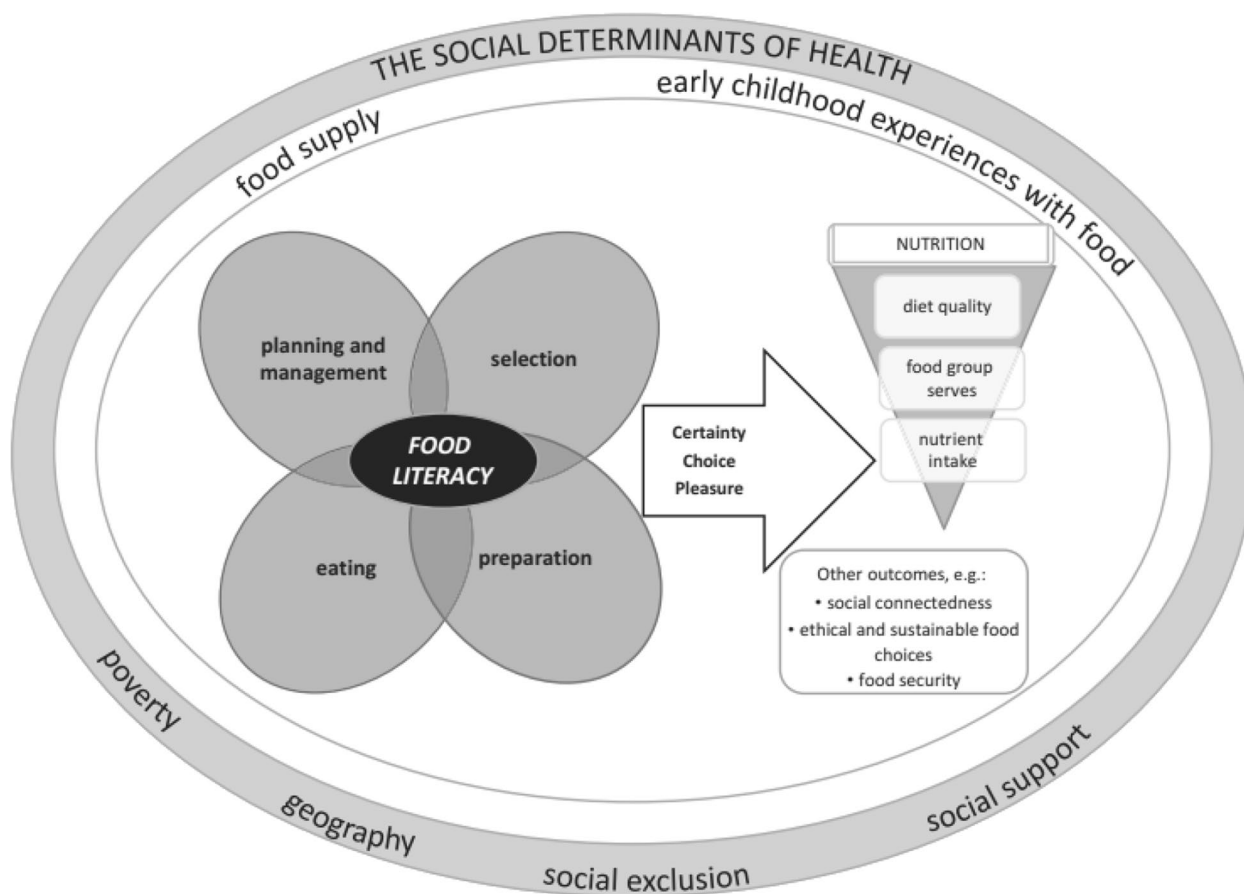
Below is an outline of how three types of evaluation will be implemented when reviewing various interventions.

#### **Process/implementation evaluation**

The 11 components of food literacy may serve as a framework for the process evaluation of a food literacy intervention, as suggested by [72], p. 81. Some of the constructs that will be investigated under the “process evaluation category” are which components of food literacy were addressed in the program, how the programs were designed, the percentage of adult participants, the records of their socioeconomic and sociodemographic characteristics, if the program’s effectiveness was measured according to attendee feedback, and what were the barriers/facilitators to implementation of program activities (Table 2).

#### **Impact evaluation**

To ensure food literacy is held accountable for driving healthy eating practices, it is essential to measure the impact of food literacy intervention on health outcomes [27]. In regard to that, Vidgen [72] proposed analyzing the constructs of “certainty”, “choice”, and “pleasure” (Fig. 2) is crucial in determining the impact of a food literacy intervention. For instance, a food literacy program can have a positive “impact” by increasing “pleasure” in cooking or by providing more “choices” in selecting healthy and affordable food from the local food environment. Therefore, to evaluate the impact of food literacy intervention, this paper will gather data on changes reported in various components of food literacy. These components include planning food intake (under the domain of planning, in component 1.1), reducing consumption of fast food and sugary drinks (under the domain of eating, in component 4.2), and increasing self-reported cooking skills (under the domain of preparation, in component 3.1).



**Fig. 2** Second model of food literacy, depicting the relation between food literacy and nutrition. Note: Adapted from Food Literacy: What Is It And Does It Influence What We Eat? by [72], p. 75

**Table 2** A list of framed questions will help in the process of evaluation

- Which components of food literacy were addressed in the program?
- How were the programs designed?
- How many adults participated?
- If the socioeconomic and sociodemographic characteristics of the attendee were recorded?
- If the program’s effectiveness was measured according to attendee feedback?
- What were the barriers/facilitators to the implementation of program activities?

These outcomes are indicative of the successful implementation of food literacy intervention and can guide future development [6] (Table 3).

**Outcome evaluation**

This review aims to determine any enduring effects on eating/dietary behavior after the delivery of a food literacy program as “outcome evaluation”. In a prior study [5], a comparable methodology was employed to assess the impact of food literacy by tracking modification in dietary behavior, which was deemed a critical metric for measuring outcomes of food literacy interventions. Next,

there is a discussion of what is meant by “eating behavior” and the method that will be utilized to track any changes in such behavior.

The concepts of “eating behavior” and its related terms, including “dietary behavior”, “dietary intake”, “eating habits”, “diet”, and “food choice”, are broad and ambiguous ideas, and these terms are used interchangeably in various academic fields [42]. In general, the term ‘eating behavior’ or “dietary behavior” is a conclusive idea that encompasses all the factors related to food consumption, including diet quality, food preferences and motives, eating patterns, and diet-related chronic diseases [37, 60].



**Table 3** A set of questionnaires, which will be used to extract data for impact evaluation

- 
- Was there any form of evaluation being carried out, such as an end-of-program or follow-up evaluation?
  - Did anyone report a change in food literacy behavior during the evaluation process?
  - What method was used to measure food literacy, such as a food literacy scale or self-reported measure?
  - What are the results?
- 

For this paper, the term “eating behavior” will be used consistently to refer to all the above-mentioned concepts.

There are different ways to measure different aspects of healthy eating behavior. In the field of dietary behavior research, self-reported measures, such as 24-h dietary recalls, food records/diaries, and food frequency questionnaires (FFQ), are commonly employed to collect data [53]. This is because it is generally not possible to objectively assess the usual dietary intake in community-dwelling individuals [35]. Hence, as measures for dietary behavior, this review will include previous studies that have reported dietary outcomes through self-reported measures along with other measures.

This review will rely on a range of measures, including the following:

- Measures of diet quality: Diet Quality Indices (DQIs) serves as tools for assessing an individual’s overall diet quality. These scores food and/or nutrition intakes and sometimes lifestyle factors based on how closely they align with dietary guidelines [77]. Examples of DQIs are the Healthy Eating Index (HEI), the Diet Quality Index (DQI), the Healthy Diet Indicator (HDI), the Mediterranean Diet Score (MDS [25, 75], and Single-item self-rated diet measure (SRD) [23].
- Dietary intake indicator: e.g., the Household Dietary Diversity Score (HDDS; measures food accessibility and socioeconomic status based on types and quantity of food consumed in 24 h [34] (Table 4).

#### (5) Data extraction

The lead researcher will extract the content of each study independently. The extracted findings then be shared with the supervisory team for approval. In the event of any conflicts, they will be resolved through discussion.

**Table 4** Some structured questions, that will help to extract data for outcome evaluation

- 
- Did they conduct an evaluation of dietary behavior after the program?
  - Which indicator was used to evaluate dietary behavior, such as measures of diet quality or dietary intake indicators?
  - What tool was used to collect data on the modification of dietary behavior? Was it FFQ or 24-h dietary recall data, or any other?
  - What were the results?
- 

The data extraction matrix will be revised and may be modified if required during the process.

Following the protocol, the data extraction matrix (an Excel sheet) will summarise the data under four main headings: (1) description of studies, (2) process evaluation, (3) impact evaluation, and (4) outcome evaluation. Under these four headings, all the single constructs will be assessed. Those constructs are listed below. An example of a data extraction matrix is attached in Appendix 3.

- **Study details:** (1) author, (2) study location, (3) sample size, (4) study design, (5) theoretical framework applied, (6) year of publication of the study results, (7) published in a journal
- **Population details :** (8) socioeconomic characteristics of the target group (high and low socioeconomic group, description of socioeconomic factors, such as income, education, occupation), (9) sociodemographic characteristics of the target group
- **Intervention details** (10) Name of the intervention (food literacy program), (11) components of the intervention (e.g., the components of food literacy addressed), (11) duration of the interventions, (12) measurement tool (e.g., food literacy scale, food literacy questionnaire, & FFQ),
- **Impact details:** (13) report of changes in food literacy behaviour, (14) measurement tool, (15) findings
- **Outcome details:** (16) report of changes in dietary behaviour, (17) measurement tool, (18) findings

#### (6) Assessment of risk bias: study appraisal

To evaluate the quantitative aspects of the articles, the JBI critical appraisal checklist for analytical cross-sectional studies, which is an eight-item questionnaire, will be employed (The Joanna Briggs [63]. Meanwhile, for the qualitative studies, the ‘Consolidated Criteria for Reporting Qualitative Studies (COREQ), which consists of 23 questions, will be used [67].

#### (7) Analyse and synthesize the evidence

*Synthesis of qualitative papers* After extracting the data, the information extracted from each paper, including study details, population details, intervention, impact, and outcome details, will be utilized to create evidence tables providing an overall description of the included studies.

Subsequently, two team members (AM and HV) will independently analyze the extracted data based on those predetermined categories.

Qualitative papers will be subjected to thematic analysis, as described by Braun and Clarke [11]. The thematic analysis aims to identify significant data patterns (“themes”) and establish a visual network and conceptual connections among these themes to address the primary and secondary research questions specific to this systematic review. During this process, both reviewers (AM and HV) will independently conduct line-by-line coding from the findings of the selected studies to identify recurring, unique, and contradictory content. These codes will then be utilized to form themes and a series of sub-themes [65]. The reviewers will utilize computer-assisted qualitative data analysis software (CAQDAS) such as NVivo to assist in this step. While the researcher creates the codes, NVivo can help with sorting, labeling, and organizing the codes (referred to as “nodes” in NVivo) and the data (Dhakai, 2022, NVivo, 2023). As thematic analysis is a comprehensive process, the reviewing team will convene for multiple meetings to arrive at consensus decisions. Investigator triangulation will be employed during this process, with two or more researchers involved, to mitigate personal bias and ensure the inclusion of diverse perspectives [15].

*Synthesis of quantitative papers* Due to the inherent nature of systematic reviews, it is anticipated that this systematic review will encompass a wide range of quantitative studies characterized by diversity in the intervention (including duration and delivery model), study design (e.g., cross-sectional and longitudinal cohort), study participants (e.g., physical condition, age, gender, and location), and the outcomes/effects (varied measurement methods and durations). This variability is commonly referred to as “heterogeneity” in research [17, 31]. As heterogeneity is expected, this review will use a meta-analytical method to combine study estimates and obtain a summary estimate (e.g., mean differences, standardized mean difference, and its 95% confidence interval) [54]. The most appropriate approach for the meta-analysis in this case is a random-effects meta-analysis, which will effectively assess the variations in the effects of different interventions [54]. In addition, Forest plots will be used for visual examination of heterogeneity [31]. To assess the degree of heterogeneity statistically, three measures will be employed: (1) Cochran’s  $Q$  to evaluate whether the proportion of successes is consistent across groups, (2) Higgin’s and Thompson’s  $I^2$  to assess the percentage of variability in effect sizes not caused by sampling error [30], and (3) Tau-squared to estimate the variance of the underlying distribution of true effect sizes [29].

The results from both the quantitative and qualitative synthesis will be integrated to produce the final synthesis that will help gain a comprehensive understanding of how different aspects of the research relate to one another. The qualitative papers will be analyzed to develop a set of recommendations for interventions that are in line with the perspectives of adult attendees. These recommendations will then be utilized to evaluate the interventions analyzed through quantitative synthesis to determine the level of alignment between the interventions and our recommendations [28, 52].

### **(8) Report the findings**

The findings of this review are intended for publication in a scholarly journal that focuses on public health or nutrition science. Additionally, the result may be shared through other networks, such as conferences. As a part of an effort to ensure data transparency and accessibility, all data resulting from this review will be uploaded to the Queensland University of Technology’s repository. The reviewers wish for the significant findings to be widely and readily available to those who can benefit from this research.

### **(9) Strengths and limitations**

- This will be the first review to synthesize evidence on the link between food literacy and socioeconomic position and healthy eating.
- The results will aid in comprehending whether previous food literacy interventions have effectively assisted individuals belonging to low-socioeconomic groups in adopting healthy eating habits.
- There is a lack of studies that have evaluated post-program analysis of food literacy intervention, specifically in relation to the food literacy domains or the three levels of food literacy outcome.
- It is possible that some interventions aimed at improving food literacy behavior may be missed due to the fact that not all studies use the term “food literacy” directly and instead focus on enhancing specific components related to it.
- It is important to note that the review will have some limitations regarding bias. Specifically, certain countries, papers written in languages other than English, and specific population groups were intentionally excluded. As a result, the selection process was significantly biased. The decisions have been taken to make sure that the review’s scope is narrowed down and relevant information is gathered. In the upcoming reviews, it would be advantageous to examine literature from low- to middle-income nations and also to involve children and elderly individuals who have firsthand experience with attending a food literacy program.

## Appendix 1

Table 5

**Table 5** Keywords for the search strategy used in each database

Database	Term 1: Food literacy	Term 2: Intervention	Term 3: Adults
MEDLINE (via EBSCOHost)	Keyword Food literacy	Keyword Intervention	Keyword Adults MH "Adults" MH "Young adults"
	Nutrition literacy	Program	
	MH "Health Literacy	Project	
	MH "Food"	Strategy	
		MH "Program Evaluation"	
		MH "Internet-based-intervention"	
		MH "Health Promotion	
	As above	Intervention	As above
CINHAL		Program	
		Project	
		MH "Program development"	
		MH Community program"	
		MH "Internet-based-intervention"	
		MH "Program Planning"	
		MH "Program implementation"	
		MH "Program evaluation"	

## Appendix 2

Table 6

**Table 6** MEDLINE database search strategy and number of results. Search conducted on the 13/November/2023

Search strategy	Results
S1 (MH "Health Literacy+") AND (MH "Food")	115
S2 (MH "Health Literacy+") AND "food literacy"	80
S3 ("food literacy" or (food w/3 literacy) ) OR nutrition literacy	633
S4 S1 OR S2 OR S3	705
S5 (MH "Program Evaluation+") AND (MH "Internet-Based Intervention") AND (MH "Health Promotion+") AND "Intervention or Program or Project or strategy"	8234138
S6 ( (MH "Adult+") OR (MH "Young Adult") OR "adults" ) OR young w/2 adults OR older w/2 adults	161,888
S7 ( S1 OR S2 OR S3 ) AND ( (MH "Program Evaluation+") AND (MH "Internet-Based Intervention") AND (MH "Health Promotion+") AND "Intervention or Program or Project or strategy" )	320
S8 ( S1 OR S2 OR S3 ) AND ( (MH "Program Evaluation+") AND (MH "Internet-Based Intervention") AND (MH "Health Promotion+") AND "Intervention or Program or Project or strategy" ) AND ( ( (MH "Adult+") OR (MH "Young Adult") OR "adults" ) OR young w/2 adults OR older w/2 adults )	123
S9 S6 AND S7	123
S10 S9 with Limiters - Date of Publication: 20010101 - 20231231 Expanders - Apply equivalent subjects- Narrow by Language: - English Search modes - Boolean/Phrase	<b>113</b>

### Appendix 3

Table 7

**Table 7** Partially filled up JBI template as a source of evidence details, characteristics, and results extraction instrument

Item	Scoping review details
Scoping review title:	Examining the effectiveness of food literacy interventions in improving food literacy behavior and healthy eating among adults belonging to different socioeconomic groups...a systematic scoping review
Review objective/s:	To systematically determine if food literacy intervention has an impact on improving food literacy behavior and thus promoting healthy eating among different socioeconomic groups.
Review question/s:	Are food literacy interventions effective in improving food literacy behavior and healthy eating across different socioeconomic groups...a systematic scoping review.
Inclusion/exclusion criteria	
Population	Adult (18 years and older)
Intervention	Food literacy intervention or food literacy program
Compare	Between socioeconomic groups (SEG) (high-SEG vs low-SEG)
Outcome	Primary outcome (outcome): Changes in healthy eating behavior Secondary outcome (impact): Changes in food literacy behavior
Types of evidence source	Peer-reviewed academic articles
Evidence source details and characteristics	To be filled up while conducting the review
Citation details (e.g., author/s, date, title, journal, volume, issue, pages)	
Country	Name of the countries with the highest human development index (HDI), also known as high-income countries:
Context	
Details/results extracted from the source of evidence (in relation to the concept of the scoping review	
E.g., quality of life domains assessed	





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### Authors' contributions

The study was conceptualized and designed by AM and HV, who also developed the search strategy. AM initially drafted the protocol, which was later revised by HV and DG. All authors carefully reviewed the final protocol and provided their approval.

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### Availability of data and materials

This article does not involve data sharing since no datasets were produced or examined in the present study.

### Declarations

#### Ethics approval and consent to participate

Not applicable.

#### Consent of publication

This article is freely available to everyone under the Creative Commons Attribution Non-Commercial (CC BY-NC 4.0) license. This means that others are allowed to share, modify, and build upon it non-commercially as long as they properly cite the original work, credit the author, indicate any changes made, and do not use it for commercial purposes.

#### Competing interests

The authors declare that there are no conflicts of interest.

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### References

- Alkerwi A, Vernier C, Sauvageot N, Crichton GE, Elias MF. Demographic and socioeconomic disparity in nutrition: application of a novel Cor-related Component Regression approach. *BMJ Open*. 2015;5(5):e006814–e006814. <https://doi.org/10.1136/bmjopen-2014-006814>.
- Australian Institute of Health. (2000). Australia's Health. Australian Government Pub. Service.
- Australian Institute of Health & Welfare. (2016). 4.1 Social determinants of health. Retrieved from <https://www.aihw.gov.au/getmedia/11ada76c-0572-4d01-93f4-d96ac6008a95/ah16-4-1-social-determinants-health.pdf.aspx>
- Australian Institute of Health & Welfare. (2022). Australia's children. Material deprivation. <https://www.aihw.gov.au/reports/children-youth/australias-children/contents/income-finance-and-employment/material-deprivation>
- Begley A, Gallegos D, Vidgen H. Effectiveness of Australian cooking skill interventions. *British Food Journal*. 2017;119(5):973–91. <https://doi.org/10.1108/bfj-10-2016-0451>.
- Begley, A., Paynter, E., Butcher, L., Bobongie, V., & Dhaliwal, S. S. (2020). Identifying who improves or maintains their food literacy behaviours after completing an adult program. *Int J Environ Res Public Health*, 17(12). <https://doi.org/10.3390/ijerph17124462>
- Begley, A., Paynter, E., Butcher, L. M., & Dhaliwal, S. S. (2019a). Effectiveness of an adult food literacy program. *Nutrients*, 11(4). <https://doi.org/10.3390/nu11040797>
- Begley, A., Paynter, E., Butcher, L. M., & Dhaliwal, S. S. (2019b). Examining the association between food literacy and food insecurity. *Nutrients*, 11(2). <https://doi.org/10.3390/nu11020445>
- Begley A, Paynter E, Dhaliwal S. Evaluation tool development for food literacy programs. *Nutrients*. 2018;10(11):1617. <https://doi.org/10.3390/nu10111617>.
- Benn, J. (2014). Food, nutrition or cooking literacy-a review of concepts and competencies regarding food education [Other Journal Article]. *International Journal of Home Economics*, 7(1), 13-35. <https://search.informit.org/doi/https://doi.org/10.3316/informit.511373079815906>
- Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology*, 3(2), 77-101. <https://doi.org/10.1191/1478088706qp0630a>
- Braveman, P., & Gottlieb, L. (2014). The Social Determinants of Health: It's Time to Consider the Causes of the Causes. *Public Health Reports*, 129(1\_suppl2), 19-31. <https://doi.org/10.1177/00333549141291s206>
- Butcher LM, Platts JR, Le N, McIntosh MM, Celenza CA, Foulkes-Taylor F. Can addressing food literacy across the life cycle improve the health of vulnerable populations? A case study approach. *Health Promotion Journal of Australia*. 2021;32(S1):5–16. <https://doi.org/10.1002/hpja.414>.
- Cardoso, A. P., Ferreira, V., Leal, M., Ferreira, M., Campos, S., & Guiné, R. P. F. (2020). Perceptions about healthy eating and emotional factors conditioning eating behaviour: a study involving Portugal, Brazil and Argentina. *Foods*, 9(9), 1236. <https://www.mdpi.com/2304-8158/9/9/1236>
- Carter, N. R. N. P., Bryant-Lukosius, D. R. N. P., DiCenso, A. R. N. P., Blythe, J. P., & Neville, A. J. M. M. F. (2014). The use of triangulation in qualitative research. *Oncology Nursing Forum*, 41(5), 545-547. <https://www.proquest.com/scholarly-journals/use-triangulation-qualitative-research/docview/1559261620/se-2?accountid=13380>. <https://libkey.io/libraries/772/openurl?genre=article&au=Carter%2C+Nancy%2C+RN%2C+PhD%3BBryant-Lukosius%2C+Denise%2C+RN%2C+PhD%3BDiCenso%2C+Alba%2C+RN%2C+PhD%3BBlythe%2C+Jennifer%2C+PhD%3BNeville%2C+Alan%2C+MBChB%2C+MEd%2C+MRCP%2C+FRCP%28c%29&aulast=Carter&issn=0190535X&isbn=&title=The+Use+of+Triangulation+in+Qualitative+Research&jtitle=Oncology+Nursing+Forum&pubname=Oncology+Nursing+Forum&bttitle=&atitle=The+Use+of+Triangulation+in+Qualitative+Research&volume=41&issue=5&spage=545&date=2014&doi=&sid=ProQuest>
- Chapman GE, Beagan B. Women's perspectives on nutrition, health, and breast cancer. *Journal of nutrition education and behavior*. 2003;35(3):135–41. [https://doi.org/10.1016/S1499-4046\(06\)60197-8](https://doi.org/10.1016/S1499-4046(06)60197-8).
- CochraneTraining. (2024). Handling heterogeneity in Cochrane reviews. <https://training.cochrane.org/msu-web-clinic-april-2023>
- Colatruglio, S., & Slater, J. (2014). Food literacy: bridging the gap between food, nutrition and well-being. *Sustainable well-being: Concepts, issues, and educational practices*, 37-55. [https://www.researchgate.net/profile/Joyce-Slater/publication/269394694\\_Food\\_Literacy\\_Bridging\\_the\\_Gap\\_between\\_Food\\_Nutrition\\_and\\_Well-Being/links/54889f910cf289302e30b685/Food-Literacy-Bridging-the-Gap-between-Food-Nutrition-and-Well-Being.pdf](https://www.researchgate.net/profile/Joyce-Slater/publication/269394694_Food_Literacy_Bridging_the_Gap_between_Food_Nutrition_and_Well-Being/links/54889f910cf289302e30b685/Food-Literacy-Bridging-the-Gap-between-Food-Nutrition-and-Well-Being.pdf)
- Cullen, T., Hatch, J., Martin, W., Higgins, J. W., & Sheppard, R. (2015). Food literacy: definition and framework for action. *Canadian Journal of Dietetic Practice and Research*, 76(3), 140-145. <https://doi.org/10.3148/cjdr-2015-010>
- Darmon N, Drewnowski A. Does social class predict diet quality? *The American journal of clinical nutrition*. 2008;87(5):1107–17.
- Desjardins, E., & Azevedo, E. (2013). "Making something out of nothing": food literacy among youth, young pregnant women and young parents who are at risk for poor health. Ontario Public Health Association. [https://foodsecurecanada.org/sites/foodsecurecanada.org/files/food\\_literacy\\_study\\_technical\\_report\\_web\\_final.pdf](https://foodsecurecanada.org/sites/foodsecurecanada.org/files/food_literacy_study_technical_report_web_final.pdf)
- Friel, S., Hattersley, L., Ford, L., & O'Rourke, K. (2015). Addressing inequities in healthy eating. *Health Promotion International*, 30(suppl\_2), ii77-ii88. <https://doi.org/10.1093/heapro/dav073>
- Gago CM, Lopez-Cepero A, O'Neill J, Tamez M, Tucker K, Orengo JFR, Mattei J. Association of a single-item self-rated diet construct with diet quality measured with the alternate healthy eating index. *Front Nutr*. 2021;8: 646694. <https://doi.org/10.3389/fnut.2021.646694>.
- Galobardes B, Morabia A, Bernstein MS. Diet and socioeconomic position: does the use of different indicators matter? *International Journal of Epidemiology*. 2001;30(2):334–40. <https://doi.org/10.1093/ije/30.2.334>.
- Gil Á, de Victoria EM, Olza J. Indicators for the evaluation of diet quality. *Nutricion hospitalaria*. 2015;31(3):128–44.

26. Gillies C, Super S, Te Molder H, De Graaf K, Wagemakers A. Healthy eating strategies for socioeconomically disadvantaged populations: a meta-ethnography. *International Journal of Qualitative Studies on Health and Well-being*. 2021;16(1):1942416. <https://doi.org/10.1080/17482631.2021.1942416>.
27. Gillis, D. E. (2016). Using a healthy literacy frame to conceptualize food literacy. In H. Vidgen (Ed.), *Food literacy. Key concepts for health and education* (pp. 85–101). Routledge. Taylor & Francis Group.
28. Gough D. Qualitative and mixed methods in systematic reviews. *Systematic Reviews*. 2015;4(1):181. <https://doi.org/10.1186/s13643-015-0151-y>.
29. Harrer, M., Cuijpers, P., Furukawa, T. A., & Ebert, D. D. (2021). *Doing meta-analysis with R: a hands-on guide* (1st ed.). Chapman & Hall/CRC Press. <https://www.routledge.com/ng-Meta-Analysis-with-R-A-Hands-On-Guide/Harrer-Cuijpers-Furukawa-Ebert/p/book/9780367610074>
30. Higgins JP, Thompson SG. Quantifying heterogeneity in a meta-analysis. *Statistics in medicine*. 2002;21(11):1539–58.
31. Higgins, J. P. T., & Li, T. (2022). Exploring heterogeneity. In *Systematic Reviews in Health Research* (pp. 185–203). <https://doi.org/10.1002/9781119099369.ch10>
32. Hughes, R. (2011). *Practical Public Health Nutrition*. John Wiley & Sons, Incorporated. <http://ebookcentral.proquest.com/lib/qut/detail.action?docID=624761>
33. Hutchinson J, Watt JF, Strachan EK, Cade JE. Evaluation of the effectiveness of the Ministry of Food cooking programme on self-reported food consumption and confidence with cooking. *Public Health Nutrition*. 2016;19(18):3417–27. <https://doi.org/10.1017/s1368980016001476>.
34. Kennedy, G., Ballard, T., & Dop, M. C. (2011). Guidelines for measuring household and individual dietary diversity. Food and Agriculture Organization of the United Nations. [https://www.fao.org/fileadmin/user\\_upload/wa\\_workshop/docs/FAO-guidelines-dietary-diversity2011.pdf](https://www.fao.org/fileadmin/user_upload/wa_workshop/docs/FAO-guidelines-dietary-diversity2011.pdf)
35. Kirkpatrick, S., & Raffoul, A. (2017). <https://www.nccor.org/tools-mruseguides/individual-diet/key-considerations-in-measuring-dietary-behavior-among-children/#box1Measures> registry user guide: individual diet. Washington DC: National Collaborative on Childhood Obesity Research.
36. Kolasa KM, Peery A, Harris NG, Shovelin K. Food literacy partners program: a strategy to increase community food literacy. *Topics in clinical nutrition*. 2001;16(4):1–10. <https://doi.org/10.1097/00008486-200116040-00002>.
37. Lacaillie, L., Patino-Fernandez, A. M., Monaco, J., Ding, D., Upchurch Sweeney, C. R., Butler, C. D., Soskolne, C. L., Gidron, Y., Gidron, Y., Turner, J. R., Turner, J. R., Butler, J., Burns, M. N., Mohr, D. C., Molton, I., Carroll, D., Critchley, H., Nagai, Y., Baumann, L. C., . . . Söderback, I. (2013). *Eating Behavior*. In (pp. 641–642). Springer New York. [https://doi.org/10.1007/978-1-4419-1005-9\\_1613](https://doi.org/10.1007/978-1-4419-1005-9_1613)
38. Lewis M, McNaughton SA, Rychetnik L, Chatfield MD, Lee AJ. Dietary intake, cost, and affordability by socioeconomic group in Australia. *International Journal of Environmental Research and Public Health*. 2021;18(24):13315. <https://doi.org/10.3390/ijerph182413315>.
39. Lim, S. S., Vos, T., Flaxman, A. D., Danaei, G., Shibuya, K., Adair-Rohani, H., Amann, M., Anderson, H. R., Andrews, K. G., Aryee, M., Atkinson, C., Bacchus, L. J., Bahalim, A. N., Balakrishnan, K., Balmes, J., Barker-Collo, S., Baxter, A., Bell, M. L., Blore, J. D., . . . Memish, Z. A. (2012). A comparative risk assessment of burden of disease and injury attributable to 67 risk factors and risk factor clusters in 21 regions, 1990–2010: a systematic analysis for the Global Burden of Disease Study 2010. *Lancet*, 380(9859), 2224–2260. [https://doi.org/10.1016/s0140-6736\(12\)61766-8](https://doi.org/10.1016/s0140-6736(12)61766-8)
40. Livingstone KM, Olstad DL, Leech RM, Ball K, Meertens B, Potter J, Cleanthous X, Reynolds R, McNaughton SA. Socioeconomic inequities in diet quality and nutrient intakes among Australian adults: findings from a nationally representative cross-sectional study. *Nutrients*. 2017;9(10):1092. <https://doi.org/10.3390/nu9101092>.
41. Macías, Y. F., & Glasauer, P. (2014). Guidelines for assessing nutrition-related knowledge, attitudes and practices. Food and Agriculture Organization of the United Nations (FAO).
42. Marijn Stok F, Renner B, Allan J, Boeing H, Ensenaer R, Issanchou S, Kiesswetter E, Lien N, Mazzocchi M, Monsivais P, Stelmach-Mardas M, Volkert D, Hoffmann S. Dietary behavior: an interdisciplinary conceptual analysis and taxonomy. *Front Psychol*. 2018;9:1689. <https://doi.org/10.3389/fpsyg.2018.01689>.
43. Martínez-Lacoba R, Pardo-García I, Amo-Saus E, Escribano-Sotos F. Social determinants of food group consumption based on Mediterranean diet pyramid: a cross-sectional study of university students. *PLOS ONE*. 2020;15(1):e0227620. <https://doi.org/10.1371/journal.pone.0227620>.
44. Martínez-Vargas L, Vermandere H, Bautista-Arredondo S, Colchero MA. The role of social determinants on unhealthy eating habits in an urban area in Mexico: a qualitative study in low-income mothers with a young child at home. *Appetite*. 2022;169: 105852. <https://doi.org/10.1016/j.appet.2021.105852>.
45. Nicholls R, Perry L, Duffield C, Gallagher R, Pierce H. Barriers and facilitators to healthy eating for nurses in the workplace: an integrative review. *J Adv Nurs*. 2017;73(5):1051–65. <https://doi.org/10.1111/jan.13185>.
46. Ontario Ministry of Health Promotion. (2010). *Healthy eating, physical activity & healthy weights guidance document*. Ontario: Ministry of Health Promotion Retrieved from [https://www.health.gov.on.ca/en/pro/programs/publichealth/oph\\_standards/docs/mhp/HealthyEating-PhysicalActivity-HealthyWeights.pdf](https://www.health.gov.on.ca/en/pro/programs/publichealth/oph_standards/docs/mhp/HealthyEating-PhysicalActivity-HealthyWeights.pdf)
47. OZHarvest. (2023). NEST. <https://www.ozharvest.org/education/nest/>
48. Pampel FC, Krueger PM, Denney JT. Socioeconomic disparities in health behaviors. *Annu Rev Sociol*. 2010;36:349–70. <https://doi.org/10.1146/annurev.soc.012809.102529>.
49. Paquette M-C. Perceptions de la saine alimentation: État actuel des connaissances et lacunes au niveau de la recherche. *Canadian Journal of Public Health*. 2005;96(53):S16–21. <https://doi.org/10.1007/bf03405196>.
50. Peters MD, Godfrey C, Mclnerney P, Munn Z, Tricco AC, Khalil H. Scoping reviews. *Joanna Briggs Institute reviewer's manual*. 2017;2015:1–24.
51. Peters, M. D., Godfrey, C., Mclnerney, P., Munn, Z., Tricco, A. C., & Khalil, H. (2020). Chapter 11: Scoping Reviews (2020 version). *JBIManual for Evidence Synthesis*, , 406-451. <https://jbi-global-wiki.refined.site/space/MANUAL/4687342/Chapter+11%3A+Scoping+reviews>
52. Petticrew M, Rehfuess E, Noyes J, Higgins JP, Mayhew A, Pantoja T, Shemilt I, Sowden A. Synthesizing evidence on complex interventions: how meta-analytical, qualitative, and mixed-method approaches can contribute. *Journal of clinical epidemiology*. 2013;66(11):1230–43.
53. Ravelli MN, Schoeller DA. Traditional self-reported dietary instruments are prone to inaccuracies and new approaches are needed. *Front Nutr*. 2020;7:90. <https://doi.org/10.3389/fnut.2020.00090>.
54. Riley RD, Higgins JPT, Deeks JJ. Interpretation of random effects meta-analyses. *BMJ*. 2011;342: d549. <https://doi.org/10.1136/bmj.d549>.
55. Salabarría-Peña, Y., Apt, B., & Walsh, C. (2007). Practical use of program evaluation among sexually transmitted disease (STD) programs. Atlanta, GA: Centers for Disease Control and Prevention. [https://www.cdc.gov/std/program/pupest/Step3\\_0215.pdf](https://www.cdc.gov/std/program/pupest/Step3_0215.pdf)
56. Short S, Mollborn S. Social determinants and health behaviors: conceptual frames and empirical advances. *Curr Opin Psychol*. 2015;5:78–84. <https://doi.org/10.1016/j.copsyc.2015.05.002>.
57. Sobal J, Bisogni CA. Constructing food choice decisions. *Ann Behav Med*. 2009;38(Suppl 1):S37–46. <https://doi.org/10.1007/s12160-009-9124-5>.
58. Sobal, J., Bisogni, C. A., & Jastran, M. (2014). Food choice is multifaceted, contextual, dynamic, multilevel, integrated, and diverse. *Mind, Brain, and Education*, 8(1), 6–12. <https://doi.org/10.1111/mbe.12044>
59. Solar O, Irwin A. A conceptual framework for action on the social determinants of health. In. Geneva: World Health Organization; 2010.
60. Stok, F. M., Hoffmann, S., Volkert, D., Boeing, H., Ensenaer, R., Stelmach-Mardas, M., Kiesswetter, E., Weber, A., Rohm, H., Lien, N., Brug, J., Holdsworth, M., & Renner, B. (2017). The DONE framework: Creation, evaluation, and updating of an interdisciplinary, dynamic framework 2.0 of determinants of nutrition and eating. *PLOS ONE*, 12(2), e0171077. <https://doi.org/10.1371/journal.pone.0171077>
61. Story M, Kaphingst KM, Robinson-O'Brien R, Glanz K. Creating Healthy Food and Eating Environments: Policy and Environmental Approaches. *Annual Review of Public Health*. 2008;29(1):253–72. <https://doi.org/10.1146/annurev.publhealth.29.020907.090926>.
62. Swinburn BA, Sacks G, Hall KD, McPherson K, Finegood DT, Moodie ML, Gortmaker SL. The global obesity pandemic: shaped by global drivers and local environments. *The lancet*. 2011;378(9793):804–14.
63. The Joanna Briggs Institute. (2017). *The Joanna Briggs Institute Critical Appraisal tools for use in JBI Systematic Reviews*. Checklist for Analytical Cross Sectional Studies. [https://jbi.global/sites/default/files/2019-05/JBI\\_Critical\\_Appraisal-Checklist\\_for\\_Analytical\\_Cross\\_Sectional\\_Studies2017\\_0.pdf](https://jbi.global/sites/default/files/2019-05/JBI_Critical_Appraisal-Checklist_for_Analytical_Cross_Sectional_Studies2017_0.pdf)
64. Thomas, H., Azevedo Perry, E., Slack, J., Samra, H. R., Manowicz, E., Petermann, L., Manafó, E., & Kirkpatrick, S. I. (2019). Complexities in conceptualizing and measuring food literacy. *Journal of the Academy of Nutrition and Dietetics*, 119(4), 563–573. <https://doi.org/10.1016/j.jand.2018.10.015>

65. Thomas J, Harden A. Methods for the thematic synthesis of qualitative research in systematic reviews. *BMC Medical Research Methodology*. 2008;8(1):45. <https://doi.org/10.1186/1471-2288-8-45>.
66. Thompson C, Adams J, Vidgen HA. Are we closer to international consensus on the term 'food literacy'? A systematic scoping review of its use in the academic literature (1998–2019). *Nutrients*. 2021;13(6):2006.
67. Tong A, Sainsbury P, Craig J. Consolidated criteria for reporting qualitative research (COREQ): a 32-item checklist for interviews and focus groups. *International Journal for Quality in Health Care*. 2007;19(6):349–57. <https://doi.org/10.1093/intqhc/mzm042>.
68. Tricco AC, Lillie E, Zarin W, O'Brien KK, Colquhoun H, Levac D, Moher D, Peters MD, Horsley T, Weeks L. PRISMA extension for scoping reviews (PRISMA-ScR): checklist and explanation. *Annals of Internal Medicine*. 2018;169(7):467–73.
69. Turner, C., Kalamatianou, S., Drewnowski, A., Kulkarni, B., Kinra, S., & Kadiyala, S. (2020). Food environment research in low- and middle-income countries: a systematic scoping review. *Advances in Nutrition*, 11(2), 387–397. <https://doi.org/10.1093/advances/nm2031>
70. United Nations Development Program. (2023). Human Development Index (HDI). <https://hdr.undp.org/data-center/human-development-index#/indicies/HDI>
71. Velardo SP. The nuances of health literacy, nutrition literacy, and food literacy. *Journal of nutrition education and behavior*. 2015;47(4):385–389. e381. <https://doi.org/10.1016/j.jneb.2015.04.328>.
72. Vidgen, H. (2016). *Food Literacy: Key concepts for health and education*. <https://www.routledge.com/Food-Literacy-Key-concepts-for-health-and-education/Vidgen/p/book/9781138898523>
73. Vidgen HA, Gallegos D. Defining food literacy and its components. *Appetite*. 2014;76:50–9. <https://doi.org/10.1016/j.appet.2014.01.010>.
74. Vos, T., Lim, S. S., Abbafati, C., Abbas, K. M., Abbasi, M., Abbasifard, M., Abbasi-Kangevari, M., Abbastabar, H., Abd-Allah, F., Abdelalim, A., Abdollahi, M., Abdollahpour, I., Abolhassani, H., Aboyans, V., Abrams, E. M., Abreu, L. G., Abrigo, M. R. M., Abu-Raddad, L. J., Abushouk, A. I., . . . Murray, C. J. L. (2020). Global burden of 369 diseases and injuries in 204 countries and territories, 1990–2019: a systematic analysis for the Global Burden of Disease Study 2019. *The Lancet*, 396(10258), 1204–1222. [https://doi.org/10.1016/s0140-6736\(20\)30925-9](https://doi.org/10.1016/s0140-6736(20)30925-9)
75. Waijers PMCM, Feskens EJM, Ocké MC. A critical review of predefined diet quality scores. *British Journal of Nutrition*. 2007;97(2):219–31. <https://doi.org/10.1017/s0007114507250421>.
76. West EG, Lindberg R, Ball K, McNaughton SA. The role of a food literacy intervention in promoting food security and food literacy—OzHarvest's NEST Program. *Nutrients*. 2020;12(8):2197. <https://doi.org/10.3390/nu12082197>.
77. Wirt A, Collins CE. Diet quality—what is it and does it matter? *Public Health Nutr*. 2009;12(12):2473–92. <https://doi.org/10.1017/s136898000900531x>.
78. World Health Organisation. (2023). Social determinants of health. [https://www.who.int/health-topics/social-determinants-of-health#tab=tab\\_1](https://www.who.int/health-topics/social-determinants-of-health#tab=tab_1)
79. World Health Organization. (2020). Healthy diet. <https://www.who.int/news-room/fact-sheets/detail/healthy-diet>
80. World Population Review. (2023). Human Development Index (HDI) by Country 2023. <https://worldpopulationreview.com/country-rankings/hdi-by-country>
81. Zorbas C, Palermo C, Chung A, Iguacel I, Peeters A, Bennett R, Backholer K. Factors perceived to influence healthy eating: a systematic review and meta-ethnographic synthesis of the literature. *Nutr Rev*. 2018;76(12):861–74. <https://doi.org/10.1093/nutrit/nuy043>.

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