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Impact of nutritional literacy on dietary habits: A systematic review

Sneha Maurya and Vandana Verma

Abstract
Nutrition literacy is crucial for individuals to comprehend and apply nutrition information, shaping their dietary habits and impacting health outcomes. This systematic review aims to assess how nutritional literacy influences dietary practices across various socioeconomic backgrounds and age groups. Multiple search engines and databases, including Google Scholar, PubMed, and Web of Science, were utilized to identify relevant studies published from January 2013 to December 2023. Studies examining the link between nutritional literacy and dietary habits in diverse populations were included, with data extraction performed using standardized methods. The discussion highlights how nutrition literacy affects dietary habits among children, adolescents, and adults, emphasizing the role of education. Parental literacy influences children's diets, while adolescents' choices are influenced by their own literacy levels. However, adults with higher literacy tend to adopt healthier eating habits. Interventions and cultural considerations are crucial for promoting nutrition literacy. In conclusion, this review underscores the significant impact of nutritional literacy on dietary habits across all age groups. Educational interventions, particularly online and through social media, are effective in enhancing literacy levels. Tailored approaches are essential to address gender and cultural disparities. Overall, improved nutrition literacy leads to healthier dietary habits and better health outcomes among diverse populations.

Keywords: Nutritional literacy, dietary habits, Socio-economic status, food, diet, healthy eating

Introduction

Food is essential for normal growth and development, as well as for improving overall quality of life, especially in terms of preventing chronic diseases. It is estimated that over half of all premature deaths globally are caused by chronic non-communicable diseases like cancer, heart disease, diabetes, or metabolic syndrome. These health issues are strongly associated with adopting faulty health behaviors and lifestyles [1]. Unhealthy, eating patterns are one of the major risk factors for chronic illnesses. Overnutrition, which occurs when a person consumes a lot of energy but receives insufficient amounts of certain nutrients, is connected to a rise in the prevalence of overweight people. One of the major threats to public health in the twenty-first century is obesity. Overweight and obesity have become the fifth leading cause of death globally in the last 20 years due to a significant increase in prevalence. Obesity increases the risk of depression, low self-esteem, and social discrimination in addition to physical and psychological disorders like type 2 diabetes, heart disease, liver disease, and other illnesses [2].

Dr. Dariush Mozaffarian and his team at Tufts University examined CDC's National Health and Nutrition Examination Survey (NHANES) and national disease-specific mortality data to better understand how diet affects disease risk. In relation to the mortality of heart disease, stroke, and type 2 diabetes, the study examined ten foods and nutrients. Individuals' age, sex, ethnicity, and education were also studied. The overindulgence in unhealthy foods and underindulgence in healthy foods was responsible for 318,656 (45%) of the 702,308 adult deaths in 2012 resulting from heart disease, stroke, and type 2 diabetes. Too much sodium causes caused 9.5% of cardiometabolic disease fatalities. An increased risk of death was associated with inadequate consumption of nuts and seeds (8.5%), seafood omega-3 fats (7.8%), vegetables (7.6%), fruits (7.5%), wholegrains (5.9%), and polyunsaturated fats (2.3%). Overconsumption of processed meat (8.2%), beverages with added sugar (7.4%), and unprocessed red meat (0.4%) was associated with an increased risk of heart attack, stroke, and type 2 diabetes. A diet heavy in fruits, vegetables, whole grains, and low in processed and red meats, alcohol, and excess calories is necessary to prevent these illnesses [3].

The understanding of nutrition has a significant impact on dietary practices. The promotion and maintenance of good eating behaviors now depend critically on nutrition literacy. Nutrition literacy is defined as 'the degree to which individuals have the capacity to obtain, process, and understand nutrition information and skills needed in order to make appropriate nutrition decisions (Matthew. K. Taylor. *et al*., 2019) [4].

WHO doesn't have specific guidelines tailored for different age groups within the Asian population. However, they do offer general recommendations for promoting nutritional literacy and healthy eating habits across all age groups.

1. Infants and young children (ages 0-2)
- Promote exclusive breastfeeding during the first six months of life, followed by the introduction of safe and nourishing complementary foods while continuing breastfeeding up to two years of age or beyond.
- Promote the timely introduction of diverse, locally available, and nutrient-rich foods to fulfil the dietary requirements of newborns and young children.

2. Children and adolescents (2-18 years old)

Emphasize the significance of eating a balanced diet that consists of foods from all the food groups, including whole grains, dairy products, fruits, vegetables, lean proteins, and so on. Limit the consumption of processed foods, sugary snacks, and beverages high in sugar and unhealthy fats. Promote regular physical activity and healthy lifestyle habits alongside dietary recommendations.

3. Adults (18+ years old)
- Advocate for a balanced diet that provides adequate nutrients while maintaining a healthy weight.
- Educate adults about portion control, mindful eating, and the importance of consuming a variety of nutrient-dense foods.
- Address specific nutritional needs related to different life stages (e.g., pregnancy, menopause) and health conditions (e.g., diabetes, hypertension).

4. Elderly population
- Emphasize the importance of eating a diet high in nutrients, such as fruits, vegetables, whole grains, and lean meats, in order to promote healthy aging and prevent chronic diseases.
- Provide guidance on maintaining adequate intake of essential nutrients, including calcium, vitamin D, and vitamin B12, which may become more challenging with age.
- Address issues related to appetite changes, chewing difficulties, and other factors that may impact dietary intake in older adults [5].

The goal of this systematic review is to provide a summary of the published research data on nutrition and health literacy in order to raise practitioners' knowledge of the value of health literacy in practice and identify research gaps and possibilities.

Aims and objectives
- The objective of this systematic review is to evaluate and synthesize the body of knowledge in order to ascertain the influence of nutritional literacy on dietary practices among people from various socioeconomic backgrounds and age groups.
- This study aims to give a thorough understanding of how nutritional literacy influences dietary choices across broad demographic segments.

Study question
- Does the level of nutritional literacy correlate with the nutritional knowledge of various age groups and socioeconomic backgrounds?
- To what extent does nutritional literacy impact the food consumption patterns of people of different ages and socioeconomic backgrounds?

OR
- "How can we effectively enhance nutrition literacy among diverse demographics in the Indian population to improve dietary practices and mitigate the rising burden of lifestyle-related diseases?"

Inclusion criteria
- Studies that were required to evaluate nutritional literacy and its influence on eating patterns were included.
- Nutritional literacy programmes in different countries.
- Studies involving participants of different age groups (children, adolescents, adults, and elderly) and diverse socio-economic backgrounds.
- Covering articles published from 2013 to 2023.
- Only articles in English were included.

Exclusion criteria
- Articles published before 2013 and after 2023.
- Special physiological conditions like pregnancy and lactation.

Review of some nutrition literacy programme in different countries

Governments around the world recognize the importance of improving nutritional literacy to combat diet related diseases and promote public health. Here are some examples of nutritional literacy programs run by the governments around the world:

1. Special Supplemental Nutrition Program for Women, Infants, and Children (WIC), (USA): It was piloted by the U.S. Department of Agriculture's Food and Nutrition Service (USDA-FNS) in 1972 and enacted into legislation in 1975 (USDA/ERS, 2009). It provides nourishing food, education on nutrition, and health care referrals to low-income pregnant women, nursing mothers, and children under five. It offers personalized nutrition counselling to help participants make healthy food choices [6].

2. Nutrition Australia: This independent national non-profit organization provides services and programs all over Australia with the goal of "inspiring healthy eating." The organization aims to become the leading source of nutrition education in Australia, with the goal of reducing the incidence of lifestyle diseases related to food and encouraging optimal health.

Nutrition Australia offers services and programs for education. They
- Provide scientific data on important nutrition-related topics.
- Make and distribute nutrition-related content to the food

industry, the community, lawmakers, media, and educators.
- Consult on issues related to food and nutrition with government agencies, the food industry, and consumer groups as needed.
- Foster creativity in the communication of nutrition information.
- Own the intellectual property rights to the Healthy Living Pyramid, Aim for the Healthy Weight Range Graph and more than 100 nutrition publications [7].

3. National Nutrition Mission India (Poshan Abhiyaan) It aims to address malnutrition and improve maternal and child health outcomes. It includes nutrition education programs, breast feeding support initiatives, and efforts to promote the consumption of nutritious foods in vulnerable communities.
- Its goal is to enhance the nutritional value, delivery, outreach, and outcomes by focusing on developing practices that support health, wellness, and immunity to disease and malnutrition.
- It is based on four main pillars: AYUSH wellness, treatment of SAM (Severe Acute Malnutrition) /MAM (Moderate Acute Malnutrition), infant and young child feeding norms, and maternal nutrition.
- The goals of Poshan 2.0 include diversifying diets, fortifying foods, utilizing traditional knowledge systems, and increasing millets' use.
- Current nutrition awareness initiatives seek to close the dietary gap by creating regional meal plans that promote long-term health and wellbeing [8].

4. Nutrition Month Campaign (Canada): Canada's Nutrition Month Campaign, organised by dietitians of Canada, promotes nutrition education and awareness throughout the month of March. The campaign offers resources, tools and events to help Canadians make informed food choices and adopt healthier eating habits [9].

5. Health China 2030 (China): It includes efforts to improve nutritional literacy and promote health eating habits among its population. It encompasses public awareness campaigns, school-based nutrition education programs, and initiatives to reduce salt intake and increase consumption of fruits and vegetables [10].

Table 1: Databases and number of articles obtained

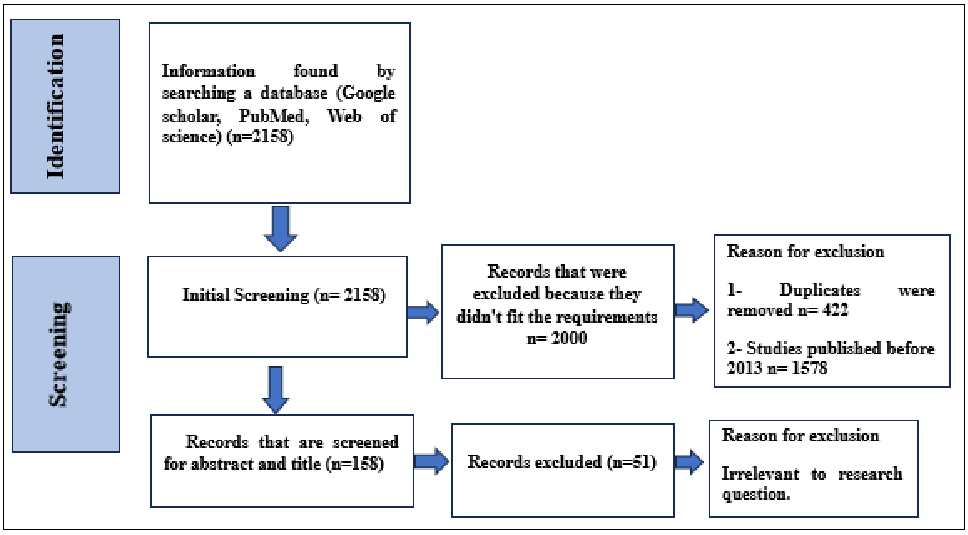
Types of databases	Keywords used	No. of articles found (2013-2023)
PubMed	(Nutritional literacy, dietary habits, socio-economic status, food, diet)	260
Google Scholar	(Dietary literacy, food habits, nutritional literacy, eating habits)	1870
Web of Science	(Nutritional literacy, dietary intake)	28
Total		2158

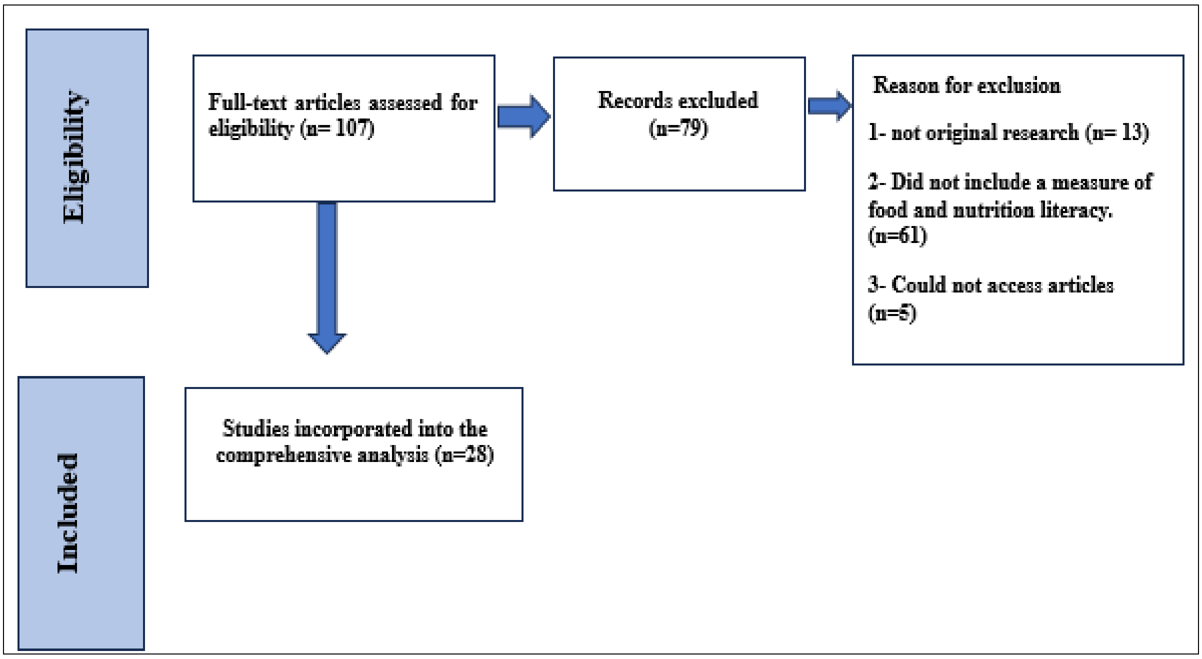
Data extraction
Relevant information is extracted, such as socioeconomic statuses, dietary outcomes, nutritional literacy parameters, age group studied, size of sample, and study design.

Materials and Methods
A checklist that is frequently used in reporting systematic reviews, the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) statement checklist, was followed in the conduct of the systematic review.

Search methods
Studies published in English were taken into consideration. Three databases were used for the electronic searches: Google Scholar, Web of Science, and PubMed. This search engine and databases provide thorough coverage of allied health literature, such as that on nutrition and public health. A food literacy definition matrix was created to determine pertinent search phrases based on each aspect of food literacy because it has a broad definition.

Each search engine and database were searched using a combination of the following search terms: "food literacy", "nutrition literacy", "nutrition", "food", "diet", "nutrition knowledge", "food knowledge", "Dietary intake", "Dietary habits", "socio-economic status", and "eating behaviors". Based on the inclusion and exclusion criteria, articles were evaluated for relevance of scope, completeness of information, and quality of the research. On the reference list of the articles under consideration for review, forward citation searching was done as an addition to this search approach.





Prisma Flow Diagram [11]

A comprehensive table and narrative description of the studies that are part of the systematic review Children

Study details	Study design and sampling method	Sample size	Materials and Methods	Study findings
Heather D. Gibbs *et al.*, 2016, Kansas	Cross-Sectional study	101	Nutritional Literacy Assessment Instrument consisted of five domains Nutrition & Health (literacy), Household Food Measurement (nutrition knowledge), Food Label & Numeracy (literacy and numeracy), Food Groups (nutrition knowledge), and Consumer Skills (nutrition knowledge). Two 24-hour child diet recalls	The study's findings indicate that there is no correlation between child BMI percentiles and parental nutrition literacy [12].
Azam Doustmohammadian *et al.*, 2022, Iran	Cross-Sectional study and multi-stage random sampling	803(419 boys and 384 girls)	Self-administered questionnaire- Three 24-hour dietary recalls. Dietary Diversity Score (DDS)	According to this study, school-age children with low FNLIT have low DDS and nutritional inadequacy, and it may be a significant factor when calculating their dietary intake [13]
Jun-Jie Chang *et al.*, 2022 China	Cross-sectional study	1137	Children's Daily Diet Providers' Dietary Literacy (QCDDPDL).	Area, relationship with the child, age, and provider's educational level all showed significant differences in QCDDPDL scores (all p<.05) [14].
Beatrice Velpini *et al.*, 2022, Italy	Systematic review	4016	PRISMA checklist.	According to study results, NL interventions particularly those that incorporate technology, involve multiple modalities, last longer than four weeks, and involve in-person sessions improve the eating habits of kids and teenagers [15].

Adolescents

Study details	Study design	Sample size	Materials and Methods	Study findings
Manijeh Alavi.et.al., 2013, Iran	Cross-Sectional study and Cluster Sampling	386 girls	Nutrition Knowledge Questionnaire.	Study results show a significant relationship between parental education level and participants' awareness and nutritional performance (p<0.05) [16].
Rimante Vaitkeviciute.et.al 2014, Australia	Systematic review	NA	PRISMA checklist.	Study suggests food literacy influences adolescents' dietary intake [17].
Rimante Ronto.et.al., 2016, Australia	Exploratory Study	131	Focus groups were used to explore adolescents' views and understanding of the importance of food literacy in relation to their dietary behaviors.	This study suggests that Food literacy education for adolescents can significantly impact their dietary behaviours and long-term heath by emphasizing practical application of food and nutritional knowledge [18].
Sherweit El-Ahmady, et.al.2016, Egypt	Cross-sectional study	423 Egyptians (136 males, 287 females)	Self- reported questionnaire.	The study revealed that a positive and significant correlation existed between health-related performance and nutrition literacy (r=0.32). Healthier eating habits and lifestyle were associated more with nutrition conscious students (r=0.73) than knowledgeable students (r=0.56) [19].
Hassan Joulaei, et.al 2018, Iran	Cross-sectional study and Cluster random sampling	388	1. General and anthropometric questionnaire. 2. Food Frequency Questionnaire- 3. Total physical activity (adolescent physical activity and recall questionnaire. 4. General Nutrition Knowledge Questionnaire. 5. 3-dimensional questionnaire- Nutrition literacy	Study finds significant association between nutrition literacy (T-NL, INL, CNL) and diet quality in adolescents. Increase in T-NL and its components improve diet quality in boys. Additionally, higher FNL linked to lower sugar intake and improved energy balance in boys, and higher dairy intake in girls [20].
Sabrina Egg. et.al, 2019, Austria	Cross-sectional Study	513	1. Nutrition and household questions. 2. Socio-demographic scale. 3. Family Affluence scale. 4. International Fitness Scale. 5. Nutritional Knowledge Scale on current Austrian Guidelines. 6. Semi- quantitative Food Frequency Questionnaire.	The findings indicate that increased hours of nutrition education led to better nutrition knowledge and literacy, which can promote healthier dietary habits. School-based nutrition education is highlighted as a preventive approach that enhances nutritional competencies in adolescents, regardless of their Socioeconomic Status (SES) [21].
Bennur Koca.et.al., 2020, Turkey	Cross-sectional design	467	1. Adolescent Nutrition Literacy Scale (ANLS) 2. Adolescent Food Habit Checklist (AFHC).	The study found significant relationships between adolescents' Nutrition Literacy (NL) and gender, father's education, grade, BMI, and Daily Lifestyle Behaviors (DLB), as well as between Family History (FH) and DLB. ANLS positively correlated with AFHC [22].
Sara Taleb,et.al, 2021, lebanon	Cross-sectional study	189	1. Self-administered questionnaire that included the Nutrition Literacy Assessment Instrument (NLAI). 2. Adolescent Food Habits Checklist (AFHC)	The study found no association between nutrition literacy components and BMI categories or between the Adolescents Food Habits Checklist and overweight/obese BMI. There was no link between nutrition literacy and food habits, except for an inverse relationship with macronutrient literacy [23].
Jasmine LeBlanc.et.al., 2022, Canada	Cross-sectional study	1054 (467 boys 570 girls)	Self-reported questionnaire.	Findings showed that students had relatively low scores for vegetable and fruit consumption, other eating behaviors, food skills, and cooking skills. Our study also found that regardless of gender, adolescents who had better cooking and food skills reported having healthier eating behaviors and consuming more vegetables and fruits [24].
Gamze Yurda¸s.et.al, 2022, Turkey	Cross-sectional study	1074 (550 boys and 524 girls)	1. 'Adolescent Nutrition Literacy Scale'. 2. 24-h food recall 3. 'Mediterranean Diet Quality Index'. 4. International Physical Activity Questionnaire (IPAQ)	The scores of nutrition literacy were lower for those who skipped meals. Increased intakes of fiber, protein, calcium, potassium, magnesium, phosphorus, vitamin C, folate, and iron were associated with higher nutrition literacy (P < 0.05). The scores of adolescents who were active were higher than those who were not. There were no noticeable differences in BMI or anthropometric measurements based on nutrition literacy level [25].
Vassiliki Costarelli.et.al, 2022, Greece	Cross-Sectional study	402 parents (68.4% mothers).	1. Comprehensive Parental Feeding Questionnaire, 2. European Health Literacy Questionnaire 47 3. Nutrition Literacy Scale.	This study demonstrates that improved parental feeding practices in Greece are substantially positively correlated with higher parental levels of HL and NL [26].

Adults (18-64)

Study details	Study design and Sampling method	Sample size	Materials and Methods	Study findings
Maartje P. Poelman, *et al*., 2018, Netherlands	Cross-Sectional study	755	Self-perceived food literacy scale (SPFL scale)	Findings of this study tells that Higher levels of food literacy were associated with more self-control, less impulsiveness and healthier food consumption [27].
Faith Agbozo *et al*., 2018, Ghana	Cross-Sectional Study	120 (78 females and 42 males)	1. Structured questionnaire- Nutritional Knowledge 2. Food frequency questionnaire.	The findings suggest that strong significant (p=0.027) positive correlation (r=0.699) existed between diet quality and nutritional status [28].
Indrani Kalkan 2019, Turkey	Cross-Sectional study and random sampling	276	1. ANLS (Adolescents Nutrition Literacy Scale). 2. AFHC (Adolescents Food Habits Checklist).	Female participants scored higher than males in functional, interactive, and critical nutritional literacy, as well as in the AFHC tool [29].
Matthew K Taylor *et al*., 2019, USA	Cross-sectional study	386	1. Diet History Questionnaire II 2. Nutrition Literacy Assessment Instrument (NLit)	Prudent pattern adherence correlated positively with global Nutritional Literacy, indicating better nutrition literacy associated with increased intake of prudent diet foods. Conversely, Western pattern adherence correlated inversely, while Mediterranean pattern adherence correlated positively with global Nutritional Literacy [4].
Shu Ching Yang *et al*., 2019, China	Cross-sectional study	813	1. eHealth Literacy Scale (12-item instrument) 2. Dietary Behaviors Scale (14-item instrument)	The findings suggest that the interaction between gender and interactive eHealth literacy was negatively related to a balanced diet. However, the interaction between monthly expenses and functional eHealth literacy was positively related to a balanced diet, whereas the interaction between monthly expenses and critical eHealth literacy was negatively related [30].
Jade McNamara *et al*., 2021, USA	Cross-sectional Study	24	1. Demographics questionnaire 2. Food questionnaire	Nutrition literacy influences both adults' and college students' eating behaviors. All three domains of nutrition literacy impact young adults' eating decisions, highlighting its importance in influencing their dietary choices [31].
Nihal Natour *et al*., 2021, Palestine	Cross-sectional Study	101 Palestinian	1. Newest Vital Sign quiz 2. Short Format of the Diet Health and Knowledge Survey (SFDHKS) 3. USDA food security questionnaire	The findings indicate minimal association between diet behavior and nutrition literacy, food security, and BMI categories. However, there is a significant association with income and residing in a city compared to a village [32].
ÖzgeMengi Çelik *et al*., 2022, Turkey	Cross-Sectional study	309 (53 male and 256 females)	1. "Information Form', 'Anthropometric Measurements', 'Nutrition Knowledge Level Scale 2. 'Evaluation Instrument of Nutrition Literacy on Adults'.	The study found a significant correlation between nursing nutrition literacy and nutrition knowledge levels. As nutrition knowledge levels increased among nursing students, their nutrition literacy levels also increased [33].
Md. Hasan Al Banna *et al*., 2022, Bangladesh	Cross-sectional study	400	The Nutrition Literacy Scale and National Dietary Guidelines	Findings from this study illustrate a positive moderate relationship between nutrition literacy and healthy eating behavior in Bangladeshi adults [34].
Ashley H *et al*., 2022, Australia	Experimental study	29	Food literacy questionnaire	Significant improvements in food literacy were noted, particularly in meal planning and healthy choices. Fruit and vegetable intake increased, with notable correlations between increased fruit consumption and improved food literacy [35].
Vassiliki Costarelli *et al*., 2022, Greece	Cross-Sectional study	402 parents (68.4% mothers).	1. Comprehensive Parental Feeding Questionnaire, 2. European Health Literacy Questionnaire 47, 3. Nutrition Literacy Scale.	This study shows that higher parental levels of HL and NL are significantly positively associated with better parental feeding practices in Greece [36].
Yoojin Lee *et al*., 2022, South Korea	Cross-Sectional study	325	1. Questionnaire consists of four sections- 2. to measure food literacy levels 3. for health promotion literacy 4. to measure healthy eating habits 5. Demographic information	The study found that both food literacy and health promotion literacy are strongly linked to healthy eating habits [37].
Mariam Al Tell *et al*., 2023, Palestine	Cross-sectional study	149	Short Format of the Diet Health and Knowledge Survey (SFDHKS).	The study shows that young Palestinians, mainly university students, are interested in learning about nutrition from reliable sources. However, they struggle to consistently apply a healthy diet in their daily lives [38].

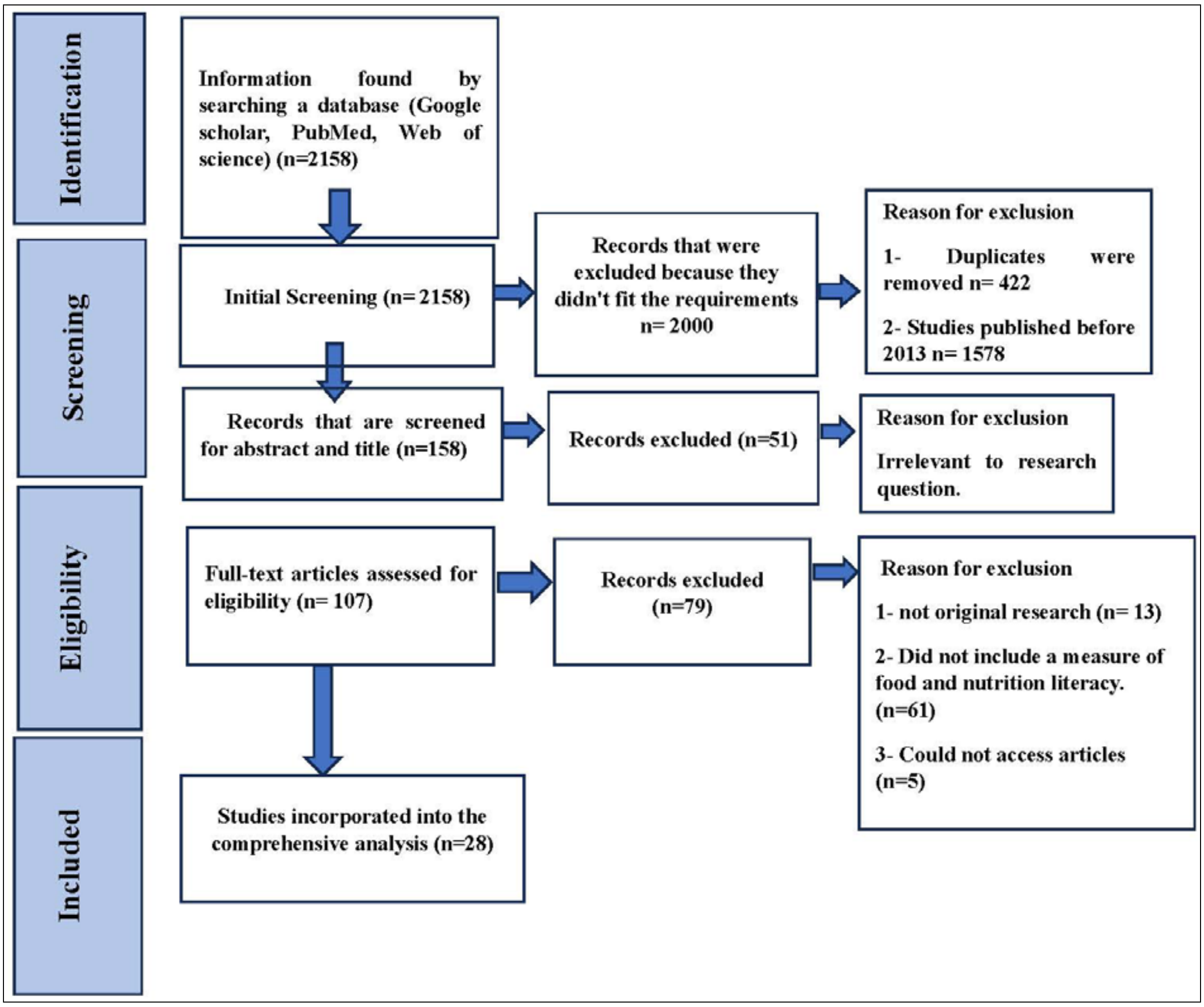


Fig 1: Prisma flow diagram [11]

Discussion

Nutrition literacy, the ability to understand, interpret, and apply nutrition-related information, plays a crucial role in shaping dietary habits across different age groups. For children, adolescents, and adults alike, a lack of nutrition literacy can lead to poor dietary choices, contributing to various health issues.

The studies screened for this review included the study of nutrition literacy and dietary habits. The sample population consists of children and their parents, adolescents, and adults. Published between 2013 and 2022, the studies comprised one experimental study, one exploratory study, two systematic review and twenty-four cross-sectional studies. Four of the studies are conducted in Turkey, three in Australia, three in Iran, two in China, two in the USA, two in Palestine, one in Kansas, one in Italy, one in Egypt, one in Austria, one in Canada, one in Lebanon, two in Greece, one in Netherlands, one in Ghana, one in Bangladesh, one in South Korea. Different types of Questionnaire and scales are used for data collection (i.e. Food Frequency Questionnaire, 24-hr dietary recall- to access dietary intake and Nutritional literacy assessment scale- to access nutritional knowledge/nutritional literacy, Demographic questionnaire, General and Anthropometric questionnaire, Total physical Activity and Recall Questionnaire, Dietary Behaviour Scale, Adolescents Food habits Checklist). Four of these studies are conducted on the children's, 11 studies are conducted on adolescents and 13 studies are conducted on adults.

In children and adolescents, nutrition literacy is instrumental in establishing healthy eating habits early on. With proper education and understanding, they are more likely to choose nutritious foods over processed or unhealthy options. This sets a foundation for lifelong health and reduces the risk of childhood obesity, diabetes, and other diet-related diseases. During adolescence, when dietary habits tend to fluctuate, nutrition literacy empowers individuals to make informed choices about their food intake. They can better navigate peer influence, media messages, and marketing tactics, opting for nutrient-dense foods that support growth and development.

1. Parental nutrition literacy and Children's diet quality

- Heather *et al.*, (2016) emphasized the significant correlation between parental nutrition literacy, educational attainment, parental age and income, and the quality of children's diet. They suggested measuring both parents' nutrition literacy since both may influence nutrition decisions.
- Vassiliki *et al.*, (2022) found higher parental health literacy and nutrition literacy associated with healthier parental feeding practices in Greece.

2. Adolescent nutrition literacy and dietary practices

- Rimante *et al.*, (2014, 2016) highlighted the impact of food literacy on adolescents' dietary intake and emphasized the need for interventions to improve food literacy.
- Hassan Joulaei *et al.*, (2018) noted that functional nutrition literacy was linked to healthier dietary practices in adolescents, with differences observed between genders.

- Jasmine *et al*., (2022) found that adolescent boys' and girls' food literacy influenced their eating habits, particularly fruit and vegetable consumption.
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3. Nutrition literacy and health outcomes in adults
- Faith *et al*., (2018) highlighted the importance of nutrition literacy in preventing malnutrition among adults, especially the elderly.
- Indrani *et al*., (2019) found that higher nutrition literacy correlated with better eating habits, especially in females.
- Md. Hasan *et al*., (2022) observed a positive correlation between nutrition literacy and healthy eating practices in Bangladeshi adults.

4. Educational interventions and nutrition literacy
- Sabrina *et al*., (2019) noted that greater nutrition understanding correlated with increased hours spent in nutrition education, suggesting the importance of educational interventions.
- Ashley *et al*., (2022) and Yoojin *et al*., (2022) both suggested that online interventions and social media platforms could improve food literacy and promote healthy eating practices among adults.

5. Gender and cultural differences
- Shu Ching *et al*., (2019) found that Taiwanese college students with higher eHealth literacy were more likely to follow healthy eating habits, with differences observed based on gender and monthly expenses.
- Nihal *et al*., (2021) noted cultural differences in the correlation between dietary behavior and nutrition literacy among Palestinians.

Overall, these studies highlight the significance of nutrition literacy across different age groups and populations and suggest various strategies for improving nutrition education and promoting healthier dietary practices.

Conclusion
In conclusion, the studies collectively emphasize the significant role of nutrition literacy across various demographics, including children, adolescents, and adults. Parental nutrition literacy influences children's diet quality, highlighting the importance of measuring both parents' literacy levels. Educational interventions are crucial for improving nutrition literacy, as seen in studies advocating for interventions targeting adolescents and adults through online platforms and social media. Additionally, gender and cultural differences play a role in shaping nutrition literacy and dietary practices, underscoring the need for tailored interventions that consider these factors. Overall, enhancing nutrition literacy through targeted educational efforts can lead to improved dietary practices and better health outcomes across diverse populations.

Future recommendations
1. **Conduct research on Indian populations:** Given the lack of published studies on nutrition literacy in Indian populations, future research should focus on conducting comprehensive studies to understand dietary habits, nutrition literacy levels, and their impact on health outcomes across various demographic groups in India.
2. **Develop culturally tailored interventions:** Tailored interventions considering gender and cultural differences should be developed and implemented to improve nutrition literacy and promote healthier dietary practices among diverse Indian populations. These interventions should be culturally sensitive and accessible through multiple channels, including online platforms and community-based programs.
3. **Implement cross-sectional studies:** Cross-sectional studies should be conducted across different regions of India to capture the heterogeneity of dietary habits, demographic conditions, and seasonal variations. This will provide valuable insights into the factors influencing nutrition literacy and dietary practices in various Indian communities.
4. **Create Regional Food Frequency Questionnaires (FFQs):** Developing FFQs that reflect regional food patterns and dietary preferences will enable more accurate assessment of nutritional intake among Indian populations. These FFQs should be validated and widely used in research and clinical settings.
5. **Promote nutritional literacy guidelines:** Guidelines and instructions related to nutritional knowledge should be developed specifically for different age groups (children, adolescents, adults, elderly) in India. These guidelines should be disseminated widely through electronic media, educational institutions, healthcare facilities, and community organizations to enhance nutrition literacy across all age groups.
6. **Invest in educational programs:** Investing in educational programs aimed at improving nutrition literacy should be a priority for public health authorities and policymakers in India. These programs should be integrated into school curricula, workplace wellness initiatives, and healthcare services to reach a wider audience and promote long-term behavior change.
7. **Raise public awareness:** Increasing public awareness about the importance of nutrition literacy and its impact on overall health and well-being is crucial. Mass media campaigns, community events, and social media platforms can be utilized to disseminate key messages and empower individuals to make informed choices about their dietary habits.

Author contributions
Under the guidance of my supervisor, Dr. Vandana Verma, I wrote this article. Contributions from both authors included concept development, article writing, article selection, analysis, and interpretation, as well as a critical revision for significant intellectual content.

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