Contents lists available at IOCS

Science Midwifery

journal homepage: www.midwifery.iocspublisher.org

The influence of nutritional literacy and adolescent eating habits: A literature review

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ARTICLE INFO

Article history:

Received Mar 11, 2025
Revised Mar 17, 2025
Accepted Apr 3, 2025

Keywords:

Adolescent
Eating Habits
Nutritional Status

ABSTRACT

Adolescents are prone to nutrition problems due to low nutrition literacy and unhealthy eating patterns. In Indonesia, the prevalence of chronic energy deficiency (CED), central obesity, and anemia in adolescents is still high, potentially increasing infectious diseases in adulthood. The literature review method was used in this study through a systematic search through BioMed, Googe Scholar, Pubmed, Science Direct, and SAGE databases. Articles that met the inclusion criteria and were published between 2020-2024 and were relevant to nutrition literacy, eating habits, and nutritional status of adolescents were further analyzed. Analysis of the 7 selected articles showed that good nutrition literacy was positively associated with healthier food choices. However, good nutrition literacy is not sufficient without a supportive environment and behavioral skills. Nutritional literacy and adolescent diets are influenced by factors such as socioeconomic status, maternal education, and access to health services. A comprehensive approach through school education, family roles, and policies that contribute to improving nutrition literacy in adolescents is needed. Preventing obesity and non-communicable diseases in the future is important by strengthening nutrition literacy. Prioritizing applicable skills such as healthy cooking, and reading food labels in support of sustainable behavior change is recommended for future interventions.

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INTRODUCTION

An essential investment for the nation's future is a healthy adolescent, a period of rapid physical and hormonal growth that requires optimal nutritional fulfillment in the adolescent phase. The younger generation needs to continue the relay of development and development of the country. It is crucial to plan for adolescent health and nutrition early on. During adolescence, with rapid physical growth and maturing hormonal development, nutritional fulfillment is very important. Nutrient deficiencies during adolescence will affect adulthood. Special attention should be paid to

adolescence as it is an essential period in the development of a person's mentality, thinking ability, morals, and creativity (Dian Eka, 2023).

Changes in adolescents' unhealthy eating habits, such as eating fast food and skipping breakfast, add to the difficulty of maintaining their health. The changes that occur today make adolescents more likely to follow. One of the changes that adolescents experience is changing their eating habits such as eating snacks, rarely consuming fruits and vegetables, often consuming fast food, skipping meals, especially breakfast, following a strict diet, and not being able to manage their eating schedule well (Tinambunan et al., 2021). Additional problems are poor diet and lack of physical activity (World Health Organization, n.d.).

Health problems in adolescents, such as undernutrition and overnutrition can be caused by unhealthy diets, as well as the negative impact of invalid information due to environmental influences (Khairunnisa et al., 2023).

The diets of today's adolescents may not pay attention to the nutrients contained in their food. Adolescents are easily influenced by their environment, such as peers and social media. As a result, they are easily influenced by unhealthy behaviors and obtain unreliable information about health and nutrition (Nasution et al., 2023). Indonesian adolescents are currently faced with a triple burden of malnutrition, Chronic Energy Deficiency (CED), overnutrition (obesity), and micronutrient deficiencies (anemia). In Indonesia, the prevalence of CED in adolescents is 41.9%, central obesity is 16.2% and anemia is 15.5% (Kemenkes BKPK, 2023; Najdah et al., 2024).

Due to globalization and urbanization, changes in diet and lifestyle have led to an increase in the prevalence of adolescent obesity in Indonesia. Indonesia is a country undergoing a rapid nutrition transition, although undernutrition continues. Changes in diet and physical activity caused by economic growth, urbanization, and globalization are major factors in this nutritional transition. The number of overweight people across the country tends to increase with changes in diet and physical activity. National data shows that people often consume processed and energy-dense foods, along with increasingly sedentary lifestyles. These changes are associated with an increase in the number of people who are overweight or obese (UNICEF, 2021). The imbalance of energy in and energy out, as well as a lack of physical activity, eating habits, and knowledge about nutrition lead adolescents to consume more food. Adolescent girls are at risk of unhealthy increases in body fat levels during this transition period. In a person's nutritional state, a positive imbalance occurs, where the amount of energy entering the body is greater than that expended. Multifactors, including nutrition knowledge, eating habits, and exercise habits, are more likely to contribute to nutrition (Maslakhah & Prameswari, 2022).

An individual's ability to obtain, process, and understand information about nutrition to use as a basis for making decisions about their diet and physical activity is strongly influenced by nutrition literacy. Decisions made by individuals about nutrition have a major impact on their diet and physical activity (Priambudi & Farapti, 2023). The effects of low nutrition literacy are not only poor diet but also an increased risk of non-communicable diseases in individuals related to nutrition (Hanun, 2022). Good nutrition in adolescents prevents stunting and supports optimal physical, mental, and psychological growth, which contributes to the future health of the nation. One way to prevent stunting and reduce maternal and child mortality is to become a well-nourished adolescent. Puberty occurs when a person becomes an adolescent. At this stage, adolescents will experience physical growth in addition to cognitive, mental, and psychological development. Inadequate nutrition at this time can cause problems and difficulties in adolescent growth (Purtianti, 2023).

Nutrition literacy plays an important role in shaping adolescents' eating habits. This has been widely researched by several previous studies. The study of LeBlanc et al. (2022) in Brazil, explained that food literacy is associated with increased vegetable and fruit consumption and other healthy eating behaviors in adolescents. In addition, research by Sari et al. (2023), stated that the impact of nutrition education on eating habits among adolescents effectively increases adolescents'

awareness of the importance of choosing nutritionally balanced foods. Meanwhile, Koca & Arkan's research (2020) shows that adolescent nutritional literacy is related to eating habits and the factors that influence them. Among other factors that have an important effect on good adolescent nutritional literacy and are related to eating habits are social and environmental factors.

Although there are many studies on nutritional literacy and eating habits of adolescents. However, some differences have not been thoroughly explained. Research that specifically discusses the relationship between nutrition literacy and the eating habits and nutritional status of adolescents from various socioeconomic backgrounds and educational levels is still minimal. In addition, previous studies on shaping adolescents' eating habits tend to ignore the significant influence of the social environment, such as peers, family, and the role of teachers. Most studies only focus on nutritional knowledge without discussing the supporting and inhibiting factors for healthy eating habits despite good nutritional literacy. By investigating how nutritional literacy and eating habits relate to adolescents' nutritional status, this study seeks to fill this gap. In addition, this study emphasizes the importance of social and environmental factors in shaping healthy eating habits. The results of this study are expected to serve as a basis for developing effective and efficient nutrition education programs by considering these factors.

RESEARCH METHODS

This study used the literature review method, by conducting a systematic search to minimize bias through various databases including Biomed, Google Scholar, Pubmed, Sage, and Science Direct conducted in November 2024. The search method was defined using the keywords "adolescent", "nutritional literacy", and "eating habits". Using the advanced search feature in each database in the search process was conducted to ensure all articles found were relevant. Assessment criteria including topic, clear methods, and results supported by relevant data were used to ensure the quality of the selected articles. Articles that lacked clear methods and results were excluded from the search process.

The inclusion criteria selected to fulfill the articles were as follows: (1) written in Indonesian or English, (2) published in the 2020-2024 timeframe to ensure the data is more relevant and up-to-date according to the current situation, (3) available in free full-text format to facilitate access to complete information and not a duplicate, (4) is a research article to ensure that the data analyzed is measurable and has a clear method, (5) is open archive and open access to make the data accessible and transparent. Articles were excluded from the selection process if they did not meet the inclusion criteria.

Authors attempted to contact the correspondence author or searched for manuscript versions through university repositories or other research platforms if there were relevant articles but they were not available for open access. Once the articles were selected, the method of analysis was to thoroughly read the article abstract, objectives, methods, results, and conclusions. This was done to identify key findings related to nutrition literacy and adolescent eating habits. From 174 articles, 7 articles were selected that met all inclusion criteria and specifically addressed the relationship between nutrition literacy and adolescent eating habits.

To obtain representative results, the selection of articles considered variations in location and respondent characteristics. From the data obtained to obtain consistent and reliable patterns, articles were compared and grouped based on relevant themes. The article selection process is presented in the flowchart in Figure 1.

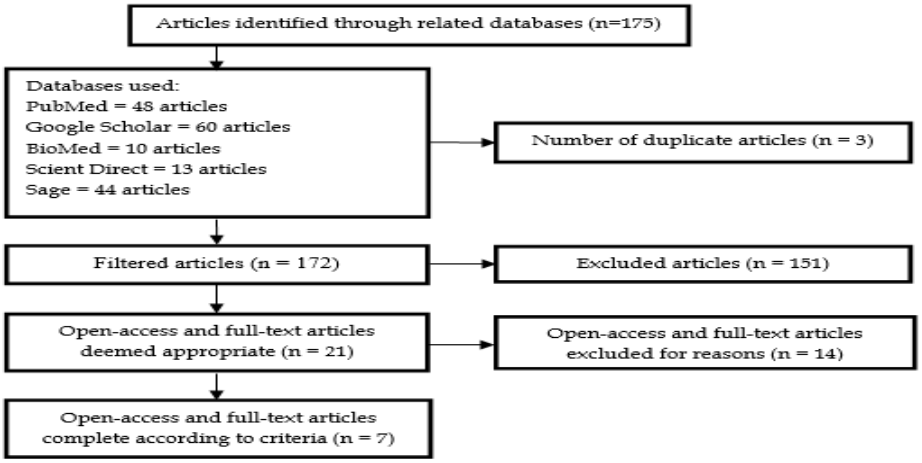

Figure 1. Article search flow

RESULTS AND DISCUSSION

This section describes the findings related to nutritional literacy. 7 full-text and open-access articles according to the selected criteria were observed and examined from the abstract, objectives, methods, results, and conclusions to gather information on adolescent nutritional literacy and eating habits. Based on the review of these articles, a variety of adolescent nutritional literacy and dietary habits were identified, which are described in Table 1.

Table 1. Characteristics of selected articles

Author/Year	Method	Location	Sample	Population
Ahmad Mehri et al. 2020.	Cross-sectional	Ardebil, Iran	504	Students aged 13-15 years
Azam Doustmohammadian et al. 2022.	Cross-sectional	Tehran, Iran	803	Students (aged 10–12 years)
Dicky Andhyka Priambudi dan Farapti. 2023	Cross-sectional	Tangerang, Indonesia	168	Students of SMAN 1 Kota Tangerang
Erina Masri et al. 2022	Cross-sectional	Padang, Indonesia	92	Junior High School Students
Laila Suci Pradita et al. 2023	Cross-sectional	Surakarta, Indonesia	92	Students of SMK Kesehatan Mandala Bhakti Surakarta and SMA Muhammadiyah 1 Surakarta
Sara Taleb dan Leila Itani. 2021	Cross-sectional	Tripoli, Lebanon	189	Adolescents (aged 14–19 years)
Theresia Widyakirana Noviandewi dan Prissilia Nanny Djaya. 2022	Cross-sectional	Jakarta, Indonesia	97	Medical Students of Atma Jaya Catholic University (aged 18–21 years)

The main findings of adolescent nutrition literacy and dietary habits emphasize several aspects including access to health services, literacy domain, socioeconomic factors, nutrition literacy, and dietary habits and nutritional status, which are described in Table 2.

Table 2. Key findings on nutritional literacy and adolescent eating habits

Aspect	Key Findings
Health Service Access	The availability of healthcare services significantly reduces the risk of poor nutritional literacy (Mehri et al., 2020).
Literacy Domain	The "cognitive" and "skills" domains show differences in literacy levels, with the skills domain being lower.(Mehri et al., 2020) Adolescents' "skills" domain in nutrition literacy tends to be weaker than their cognitive understanding, affecting their ability to interpret

Aspect	Key Findings
	food labels and make informed eating decisions (Doustmohammadian et al., 2022).
Socio-economic Factors	Gender, maternal education, and family economic status significantly impact nutritional literacy outcomes (Mehri et al., 2020; Priambudi & Farapti, 2023). Socio-economic factors have a direct relationship and mediation through food label literacy on academic achievement (Doustmohammadian et al., 2022).
Nutrition Literacy	Students with very limited nutritional literacy were found to consume excessive amounts of sugar, salt, and fat. Low nutritional literacy causes mistakes in choosing healthy foods and snacks (Masri et al., 2022).
Eating Habits and Nutritional Status	Health school students tend to have a more adequate level of nutritional literacy. Most students have good nutritional status (Pradita et al., 2023). Despite improved nutrition literacy, adolescents may still struggle to adopt healthier diets due to limited motivation and time constraints (Noviandewi & Djaya, 2023). Good nutritional literacy is not enough to influence adolescents' eating habits or BMI without the support of behavioral abilities and a supportive environment (Taleb & Itani, 2021).

Nutritional literacy plays an important role in shaping adolescents' eating habits A high level of nutritional literacy can support healthy food choices in adolescents, while low nutritional literacy can lead to errors in making food choices. In line with research by LeBlanc et al. (2022) which showed that food literacy, including good cooking and food skills, is associated with more vegetable and fruit consumption and healthier eating behavior in adolescents. Low levels of nutritional literacy result in unhealthy eating habits, such as excessive consumption of sugar, salt, and fat, which can lead to health problems. Unhealthy eating habits can lead to several health risks including deficiencies in essential nutrients, and increased risk of non-communicable diseases including type 2 diabetes, hypertension, and heart disease (Masri et al., 2022; Taleb & Itani, 2021). This is reinforced by the research of Koca & Arkan (2020) showing that a good level of adolescent nutrition literacy not only affects daily eating habits but also reduces the risk of obesity and non-communicable diseases in the future. Ongoing intervention studies planned by national education programs are essential for public health in terms of providing information to students and families regarding nutritional literacy.

Although considered a necessary behavioral skill, nutrition literacy is not sufficient to shape healthy eating behaviors or determine overweight and obesity. Genetics, food preferences, and increased autonomy interact with family, community, culture, and the physical, social, and political environment, as well as the food environment, to influence eating behavior and nutritional status. Therefore, in the context of the causal theory of obesity, early exposure to nutrition literacy acts as a mediator of interactions that over time can increase autonomy eating behavior and diet quality in line with the causes of obesity in adults (Taleb & Itani, 2021). In contrast to the research of Doustmohammadian et al. (2022) which explains that good food and nutrition literacy has a relationship with healthy eating behavior, improved academic achievement, and a reduced risk of overweight.

The level of nutritional literacy among adolescents is significantly influenced by socioeconomic factors. Influential factors include the mother's education level, economic status, and the type of school attended by adolescents. Maternal education has a positive relationship with nutritional literacy in children. High levels of maternal education are likely to have a good understanding of nutrition so that they can apply it to their children. Limited access to information and healthy food has an impact on the nutrition transition, which is exacerbated by the poor socio-economic conditions in Indonesia (Doustmohammadian et al., 2022). Therefore, reinforced by the research of Mehri et al. (2020) which showed that the presence of health workers in schools plays an important role in improving students' understanding of nutrition literacy and healthier eating practices.

Although students who attend health institutions generally have better nutritional literacy compared to students from public schools, this does not always guarantee that they will have healthier eating habits (Noviandewi & Djaya, 2023). In line with the research of Pradita et al. (2023)

who found that although health school students have a better level of nutritional literacy than non-health school students, it is not always directly proportional to ideal nutritional status. Other factors such as motivation, social environment, and eating habits play an important role in supporting the implementation of a healthy diet. This is reinforced by the research of Maslakhah & Prameswari (2022) which states that if not balanced with adequate exercise and eating habits, nutritional knowledge cannot fully prevent overweight status. Therefore, good nutrition literacy must be accompanied by a desire to change behavior and an environment that supports the implementation of healthy eating habits. Another example is a program that emphasizes the importance of healthy eating habits in the family and school environment in the form of community-based nutrition education as a concrete step to support good eating behavior in adolescents (Taleb & Itani, 2021).

Research conducted by Depboylu et al. (2023) tated that adolescents with high nutritional literacy were more likely to follow a Mediterranean diet, which is a popular diet that has many health benefits and is rich in nutrients. This diet emphasizes the consumption of fruits and vegetables, whole grains, nuts, and olive oil, which have many health benefits. Nutritional literacy also plays a role in shaping the eating behavior of their daily food providers, such as parents or guardians, in addition to influencing the eating habits of adolescents themselves. This is reinforced by research by Chang et al. (2022) who explained that parents or guardians with good nutrition literacy have a significant impact on the nutritional status and eating habits of their children. Parents with a good understanding of nutrition tend to be more selective in providing food to their children, thus creating a family environment that contributes to healthy eating habits. In line with the research of Sari et al. (2023) which states that through increased understanding of the selection of nutritionally balanced foods, effective nutrition education contributes significantly to forming healthy eating habits in adolescents. In addition, research by Hanim et al. (2022) found that good breakfast habits were associated with better nutritional status.

In Indonesia, improving the nutritional literacy of adolescents is increasingly difficult due to the nutritional transition phenomenon that occurs due to globalization and urbanization which is still a challenge. The shift from traditional diets that are high in fiber and nutrients to modern diets that are energy-dense but low in nutrients such as processed foods. Further exacerbated by low levels of physical activity among adolescents, this can contribute to the increasing prevalence of obesity and other nutrition-related diseases. According to the Indonesian Health Survey (2023), the prevalence of central obesity in adolescents is 16.2%, reflecting the impact of the nutrition transition in Indonesia. UNICEF seeks to address this by emphasizing the importance of social and behavior change communication strategies involving community-based approaches in raising awareness of healthy eating and active lifestyles among Indonesian adolescents (UNICEF, 2021). Research by Annisa & Setiarini (2022) revealed that sleep disorders in adolescents have a significant impact on nutritional status. Adolescents with sleep disorders tend to have an irregular diet and choose foods that are high in calories, which can increase the risk of overweight and obesity. This confirms that lifestyle factors, such as good sleeping habits, need to be addressed in nutrition literacy programs for adolescents.

Research by Noviandewi & Djaya (2023) showed that good nutrition literacy is associated with healthy eating patterns and better nutritional status. These results confirm that nutrition literacy plays an important role in supporting healthy eating patterns in various age groups, including adolescents and young adults. The level of nutritional literacy of adolescents in Indonesia tends to be lower compared to developed countries. Research by Taleb & Itani (2021) in Tripoli, Lebanon showed that adolescents with good nutritional literacy tend to have a healthier diet and a more ideal body mass index (BMI). Many adolescents in Indonesia still have limitations in understanding information on food labels and have difficulty adopting a healthy diet consistently. This is in contrast to research results in developed countries which show that

sustainable nutrition education programs can contribute to significant reductions in the prevalence of obesity and the risk of non-communicable diseases.

CONCLUSION

Nutrition literacy plays a major role in determining the diet and nutritional status of adolescents. Access to health services, such as the presence of medical personnel in schools, has a positive impact on improving students' understanding of healthy eating. However, socio-economic factors such as the mother's education, type of school, and family's economic status also influence the level of nutritional literacy of adolescents. Adolescents who come from families with better economic conditions compared to those from lower economic backgrounds tend to have greater access to information and nutritious foods. Beyond theoretical understanding, effective nutrition literacy requires practical skills, such as choosing healthy foods and the ability to read food labels. Ironically, many adolescents still have difficulties in implementing this knowledge in their daily lives. Some implementation suggestions include integrating nutrition education into the school curriculum by adding practice-based nutrition education materials that include activities such as healthy cooking, simulating nutritious food shopping, and reading food labels to improve adolescents' nutrition literacy and support healthy eating habits. In addition, it is important to equip teachers and health workers with effective interactive methods of delivering nutrition education through training. Counseling, digital education modules, and seminars are family-based education so that parents can support healthy eating habits at home.

Disseminating information including healthy eating patterns, the negative impact of overconsumption of sugar, salt, and fat, and the importance of breakfast is recommended through digital campaigns using social media. In addition, working with school canteens and local food providers will support the implementation of healthy and affordable diets for adolescents to increase access to healthy food. The limited number of article analyses that may affect the generalizability of the findings, as well as cultural factors and local customs that influence eating habits and nutritional literacy in adolescents are not discussed in depth are limitations in this study. Therefore, it is recommended to include a more diverse sample in terms of demographics and socioeconomics in future studies. In addition, consideration should be given to developing a community-based nutrition education model that involves health cadres and youth organizations. Explore the role of more innovative digital technologies in improving nutrition literacy and supporting the adoption of healthy eating habits in a sustainable manner.

ACKNOWLEDGEMENTS

The author would like to thank all those who supported and contributed to the completion of this article. First, I would like to thank myself for my enthusiasm, hard work, and never giving up. Secondly, the authors would like to express their gratitude to their parents who sincerely prayed for them, and gave them love and endless support. Third, the author would like to thank all lecturers who provided guidance, advice, and support in completing this article. Finally, the author would like to thank Dian Nuswantoro University for providing learning opportunities during the study period.

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