ORIGINAL RESEARCH ARTICLE

Food and Nutrition Literacy and Dietary Behaviors among Lower Secondary School Students in Samut Songkhram Province, Thailand: A Cross-Sectional Study

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DOI: 10.55489/njcm.170720266642

ABSTRACT

Background: Food and nutrition literacy (FNL) is an important determinant of healthy dietary behaviors among adolescents. This study examined the relationship between FNL and dietary consumption behaviors among lower secondary school students in Samut Songkhram Province, Thailand.

Methods: A cross-sectional survey was conducted among 584 Grade 7-9 students selected through multistage sampling from six schools between July and November 2025. Data were collected using validated questionnaires assessing FNL (functional, interactive, and critical domains) and dietary consumption behaviors. Descriptive statistics, Pearson's correlation, t-tests, and multiple linear regression analyses were performed.

Results: Participants demonstrated a moderate overall level of FNL (mean=3.04±0.48), while dietary consumption behaviors were low (mean=2.16±0.16). Overall FNL was positively correlated with dietary behaviors ($r=0.509$, $p<0.001$). Functional ($r=0.250$), interactive ($r=0.155$), and critical literacy ($r=0.206$) were also significantly associated with dietary behaviors (all $p<0.001$). Multiple regression identified FNL ($\beta=0.502$, $p<0.001$) as the strongest predictor of dietary behaviors, with gender also significant ($\beta=0.149$, $p<0.001$). The model explained 29.7% of the variance in dietary behaviors ($R^2=0.297$). Female students reported significantly higher FNL and healthier dietary behaviors than males.

Conclusions: Food and nutrition literacy is strongly associated with healthier dietary behaviors among adolescents. Interventions strengthening nutrition literacy, particularly interactive and critical skills, may improve dietary practices.

Keywords: Food and Nutrition Literacy, Dietary Behaviors, Lower Secondary School Students, Thailand

ARTICLE INFO

Financial Support: None declared
Conflict of Interest: The authors have declared that no conflict of interest exists.
Received: 25-03-2026, **Accepted**: 11-05-2026, **Published**: 01-07-2026
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How to cite this article: Songsin N, Rattakankowibool K, Pektawong D, Taweesap P, Samoh R, Somporn K, Phranphithak A, Wannapaschaiyong P. Food and Nutrition Literacy and Dietary Behaviors among Lower Secondary School Students in Samut Songkhram Province, Thailand: A Cross-Sectional Study. Natl J Community Med 2026;17(7):528-535. DOI: 10.55489/njcm.170720266642

www.njcmindia.com | pISSN: 0976-3325 | eISSN: 2229-6816 | Published by Medsci Publications

INTRODUCTION

Malnutrition in all its forms remains one of the most significant threats to global public health, with the world currently facing a "double burden of malnutrition," characterized by the coexistence of undernutrition and overweight or obesity.[1] This condition encompasses undernutrition, micronutrient deficiencies and diet-related noncommunicable diseases (NCDs).[1] Globally, in 2022, approximately 390 million adults were underweight, while more than 2.5 billion were overweight, including 890 million with obesity.[2,3] Among children and adolescents, substantial burdens of overweight, obesity and stunting persist, with undernutrition contributing to nearly half of all deaths among children under five.[2,4] These trends are driven by increased consumption of energy-dense and ultra-processed foods, reduced physical activity and structural factors such as food insecurity and limited access to nutritious foods.[5,6] Consequently, promoting healthy dietary behaviors among children and adolescents has become an urgent global priority.[7]

In Thailand, childhood and adolescent obesity has emerged as a major public health concern.[8] National data indicate that a substantial number of school-aged children and adolescents are classified as overweight or obese, posing long-term risks for NCDs and reduced quality of life.[9] In response, national strategies have been implemented to address childhood obesity through multisectoral approaches.[10] However, achieving sustainable behavioral change remains a challenge, particularly among adolescents.[9] Food and nutrition literacy has increasingly been recognized as a key determinant of dietary behavior.[11] It refers to the ability to access, understand, evaluate and apply nutrition-related information to make appropriate dietary decisions. Conceptually, food and nutrition literacy is often framed within a multidimensional model comprising three domains: functional, interactive, and critical literacy.[11] Functional literacy refers to basic skills in obtaining and understanding nutrition information.[12] Interactive literacy involves more advanced cognitive and social skills that enable individuals to communicate, engage and apply information in everyday contexts.[11] Critical literacy reflects the ability to critically analyze information and make informed decisions regarding dietary practices.[13] This three-domain framework provides a theoretical foundation for the measurement of food and nutrition literacy in the present study.[9,14] Higher levels of literacy have been associated with healthier eating patterns and improved dietary self-management.[15] Despite its importance, research in Thailand has primarily focused on general health literacy, with limited attention to food and nutrition literacy as a distinct construct.[16] Existing evidence suggests that a substantial proportion of Thai adolescents have inadequate nutrition literacy, highlighting a critical gap in knowledge and application.[17]

Samut Songkhram Province, Thailand, provides a unique context for examining dietary behaviors. Despite its rich food culture, increasing trends in overweight and obesity among school-aged children have been observed, rising from 14.61% in 2020 to 17.84% in 2023, before slightly declining to 16.62% in 2024.[18] This trend may be associated with increased consumption of energy-dense foods, sugar-sweetened beverages, and reduced physical activity, particularly during the COVID-19 pandemic.[8] Although local initiatives have been implemented, sustaining healthy dietary behaviors remains a challenge. Therefore, this study aimed to examine the relationship between food and nutrition literacy and dietary behaviors among lower secondary school students in Samut Songkhram Province, Thailand. The study assessed levels of food and nutrition literacy across functional, interactive, and critical domains, examined dietary consumption behaviors, and identified predictors of dietary behaviors, including literacy and selected demographic factors. The findings are expected to inform targeted interventions to improve adolescent nutrition and health outcomes.

METHODOLOGY

This cross-sectional survey aimed to examine the association between food and nutrition literacy and dietary behaviors among lower secondary school students in Samut Songkhram Province, Thailand. Data were collected between July and November 2025.

Participants: The study population consisted of lower secondary school students (Grades 7-9) in Samut Songkhram Province, Thailand (N = 5,596), distributed across three districts: Mueang Samut Songkhram, Amphawa, and Bang Khonthi. The required sample size was calculated using the Krejcie and Morgan formula[19] (assumed population proportion = 0.5, margin of error = 5%, confidence level = 95%), yielding a minimum of 338 participants. After adding 20% to account for non-response, the target sample size was 406 participants.

A multistage sampling technique was employed. In Stage 1**,** sub-districts within each district were selected using simple random sampling: Laem Yai and Mae Klong (Mueang Samut Songkhram District), Amphawa and Tha Kha (Amphawa District) and Bang Nok Khwaek and Bang Kung (Bang Khonthi District). In Stage 2**,** one school was selected from each sub-district**,** resulting in a total of six schools: Satthasamut School (Laem Yai), Thawaranukul School (Mae Klong), Amphawan Wittayalai School (Amphawa), Thepsuwanchan Wittaya School (Tha Kha), Mateechunhawan Wittayalai School (Bang Nok Khwaek) and Sakolwisuth School (Bang Kung). The cluster unit in this study was defined at the school level**,** not the classroom level. Therefore, all eligible students in Grades 7-9 within each selected school (i.e., entire schools) were invited to participate**,** rather than sampling specific classrooms.

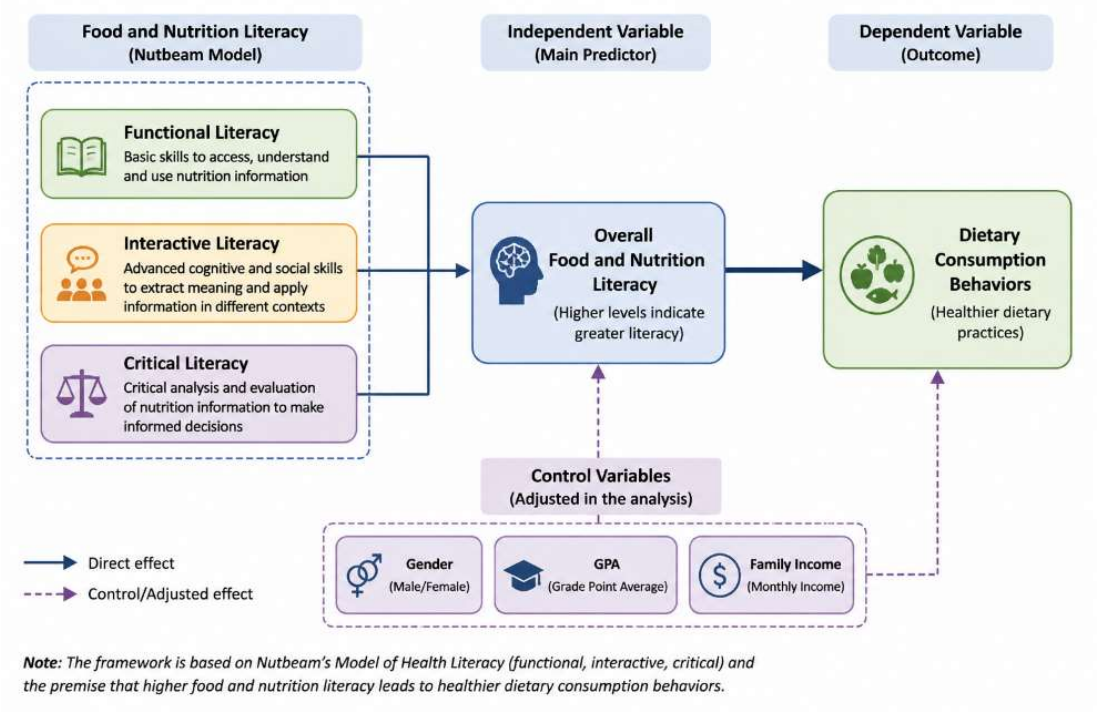

Figure 1: Conceptual framework of the study

This approach ensured comprehensive coverage of students within each cluster. During data collection, all students who met the inclusion criteria and provided informed consent (including parental consent and student assent) were recruited. As a result, a total of 584 participants were included in the final analysis, exceeding the initially calculated sample size. This oversampling strategy was adopted to enhance statistical power, improve estimate precision, and increase representativeness across study areas. No participants were excluded after recruitment unless they met predefined exclusion criteria, ensuring maximal utilization of available data.

Instruments: The instrument used for data collection in this study was a structured questionnaire, which was divided into four parts.

Part 1 Characteristics of the Participants This section consisted of a personal information questionnaire designed to collect the general characteristics of the respondents. The items included sex, age, weight and height, educational level, cumulative grade point average (GPA), daily allowance for school attendance, and family income. This section comprised seven multiple-choice questions.

Part 2 Food and Nutrition Literacy Questionnaire Food and nutrition literacy was assessed using a questionnaire developed and adapted from Chanatda Koedphaen.[20] The instrument comprised 25 items rated on a 5-point frequency scale ranging from "always practiced" to "never practiced," reflecting the frequency of each behavior. The questionnaire covered three domains of food and nutrition literacy: functional, interactive, and critical literacy. Of the 25 items, 21 were positively worded (Items 1, 2, 4, 6, 7, 8, 10-18, and 20-25), while 4 items were negatively worded (Items 3, 5, 9, and 19). For positively worded items, responses were scored from 5 to 1, with higher scores indicating more desirable literacy, whereas reverse scoring was applied to negatively worded items. The raw total score ranged from 25 to 125. To facilitate interpretation, raw scores were converted into percentage scores using the formula: (observed score / maximum possible score) × 100, yielding a total score ranging from 0 to 100. Based on this transformation, food and nutrition literacy levels were classified as high (80-100%), moderate (50-79%), and low (0-49%). In addition, mean scores were interpreted using standard criteria for a 5-point scale[21], with values of 1.00-2.33 indicating low, 2.34-3.66 indicating moderate, and 3.67-5.00 indicating high levels of food and nutrition literacy.

Part 3 Dietary Consumption Behavior Questionnaire Dietary consumption behaviors were assessed using a structured questionnaire adapted from Chanatda Koedphaen.[22] The instrument comprised 19 items rated on a 3-point Likert scale ("regularly practiced," "sometimes practiced," and "never practiced"), reflecting the frequency of each behavior. Of these, 7 items were positively worded (Items 2, 3, 6, 8, 10, 11, and 12), while the remaining 12 items were negatively worded (Items 1, 4, 5, 7, 9, 13, 15, 16, 17, 18, and 19). Positively worded items were scored from 3 to 1, with higher scores indicating more desirable behaviors, whereas reverse scoring was applied to negatively worded items. The total score ranged from 19 to 57, with higher scores indicating healthier dietary consumption behaviors. For interpretability, total scores were categorized into three levels: low (19-31), moderate (32-44), and high (45-57). In addition, mean scores were classified using equal interval criteria for a 3-point scale[21], as low (1.00-1.66), moderate (1.67-2.33), and high (2.34-3.00) levels of dietary consumption behavior.

In the present study, the adapted questionnaire was reviewed by three experts in public health and nutrition to ensure content relevance and cultural appropriateness for the target population. The content validity index (CVI) of the adapted version ranged from 0.83 to 1.00. A pilot test was conducted among 30 students with characteristics similar to the study population to assess reliability. The Food and Nutrition Literacy Questionnaire yielded a Cronbach's alpha coefficient of 0.88, while the Dietary Consumption Behavior Questionnaire yielded a Cronbach's alpha coefficient of 0.91, indicating high internal consistency for both instruments.tio

Statistical analysis: Statistical analyses were performed using SPSS 26.0(IBM Corp., Armonk, NY, USA). Descriptive statistics (frequency, percentage, mean, and standard deviation) were used to summarize participant characteristics and study variables. Multiple linear regression analysis was conducted to identify factors associated with dietary consumption behaviors, with dietary consumption behavior as the dependent variable and food and nutrition literacy and demographic characteristics as independent variables. Categorical variables were coded prior to analysis (gender: 0 = male, 1 = female), and other categorical variables were entered as dummy variables. Regression assumptions were evaluated, including normality of residuals (histograms and normal probability plots), linearity and homoscedasticity (scatterplots of residuals versus predicted values), independence of errors (Durbin-Watson statistic), and multicollinearity (variance inflation factor; VIF < 5). All tests were two-tailed, with statistical significance set at $p < 0.05$. In addition, independent samples t-tests were conducted to compare mean food and nutrition literacy and dietary consumption behavior scores between male and female students.

Ethical Approval: This study received ethical approval from the Human Research Ethics Committee of Suan Sunandha Rajabhat University (COE.2-189/2025), as well as permission from the participating schools to approach students and their parents for data collection. Written informed consent was obtained from parents or legal guardians prior to participation. In addition, assent was obtained from all student participants after providing them with clear information about the study objectives, procedures, and their rights, including the right to withdraw at any time without penalty.

RESULTS

The research participants consisted of 584 students. The sample included an equal proportion of males and females (50.00% each), with a mean age of 13.65 years (SD = 1.04). Most participants were in Grade 9 (45.55%), followed by Grade 7 (27.40%) and Grade 8 (27.05%). In terms of academic performance, the majority of participants had a grade point average (GPA) of 3.01 or higher (71.06%), followed by those with a GPA between 2.51 and 3.00 (22.77%), while only a small proportion had a GPA below 2.50 (6.16%). Regarding daily allowance, most participants received 51-100 baht per day (66.44%), followed by more than 100 baht (28.42%), and less than 50 baht (5.14%). For family income, over half of the participants reported a monthly household income of 10,001-30,000 baht (54.79%), followed by 30,001 baht or higher (28.43%) and less than 10,000 baht (16.78%). The mean body weight of the participants was 53.37 kg (SD = 15.05), and the mean height was 160.66 cm (SD = 9.68) (Table 1).

Most participants demonstrated a moderate overall level of food and nutrition literacy (M = 3.04, SD = 0.48). At the domain level, critical literacy had the highest mean score (M = 3.20, SD = 0.73), indicating a relatively stronger ability to analyze and evaluate nutrition-related information, whereas interactive literacy had the lowest mean score (M = 2.95, SD = 0.67), although it remained within the moderate range. Functional literacy was also at a moderate level (M = 3.02, SD = 0.41), reflecting an adequate basic understanding of food and nutrition information.

Table 1: General characteristics of participants (n= 584)

Demographic variables	Participants (%)
Gender	
Male	292 (50.00)
Female	292 (50.00)
Age (years) Mean±SD	13.65±1.04
Educational Level	
Grade 7	160 (27.40)
Grade 8	158 (27.05)
Grade 9	266 (45.55)
GPA	
<2.50	36 (6.16)
2.51-3.00	133 (22.77)
≥ 3.01	415 (71.06)
Daily Allowance (Baht)	
< 50	30 (5.14)
51-100	388 (66.44)
> 100	166 (28.42)
Family Income (Baht/month)	
< 10,000	98 (16.78)
10,001-30,000	320 (54.79)
≥ 30,001	166 (28.43)
Weight (kg) Mean±SD	53.37±15.05
Height (cm) Mean±SD	160.66±9.68

Table 2: Food and Nutrition Literacy and Dietary Consumption Behavior of participants (n= 584)

Variables	Mean	Standard Deviation	Level
Overall food and nutrition literacy	3.04	0.48	Moderate
Functional food and nutrition literacy	3.02	0.41	Moderate
Interactive food and nutrition literacy	2.95	0.67	Moderate
Critical food and nutrition literacy	3.20	0.73	Moderate
Overall dietary consumption behaviors	2.16	0.16	Low

In contrast, participants exhibited a low overall level of dietary consumption behaviors (M = 2.16, SD = 0.16), indicating suboptimal dietary practices (Table 2).

Pearson correlation analysis revealed that all dimensions of food and nutrition literacy were positively and significantly associated with dietary consumption behaviors among participants. Overall food and nutrition literacy demonstrated a moderate positive correlation with dietary behaviors ($r = 0.509$, $p < 0.001$), indicating that higher levels of literacy were associated with healthier dietary practices. Among the literacy domains, functional literacy showed the strongest correlation ($r = 0.250$, $p < 0.001$), followed by critical literacy ($r = 0.206$, $p < 0.001$) and interactive literacy ($r = 0.155$, $p < 0.001$), although these associations were weak in magnitude.

Regarding demographic variables, gender showed a weak but statistically significant positive correlation with dietary consumption behaviors ($r = 0.183$, $p < 0.001$), suggesting that female students were more likely to report healthier dietary behaviors than male students. GPA was also weakly but significantly correlated with dietary behaviors ($r = 0.085$, $p < 0.05$). In contrast, family income was not significantly associated with dietary consumption behaviors ($r = 0.056$, $p > 0.05$) (Table 3).

Table 3: Relationship between food and nutrition literacy and dietary consumption behaviors in participants (n=584)

Variables	Dietary consumption behaviors	
	Pearson Correlation (r)	p-value
Functional food and nutrition literacy	0.250	<0.001*
Interactive food and nutrition literacy	0.155	<0.001*
Critical food and nutrition literacy	0.206	<0.001*
Overall food and nutrition literacy	0.509	<0.001*
Gender (0 = male, 1 = female)	0.183	<0.001*
GPA	0.085	0.039*
Family Income	0.056	0.179

*p-value statistically significant

Table 4: Multiple Linear Regression Analysis Predicting Dietary Consumption Behaviors (n = 584)

Variables	p-value	B	95% CI for B	VIF
Food and nutrition literacy	<0.001	0.452	0.391 - 0.513	1.010
Gender	<0.001	0.055	0.019 - 0.071	1.080
GPA	0.603	0.006	-0.014 - 0.031	1.090
Family income	0.212	0.013	-0.009 - 0.031	1.120

$R = 0.545$, $R^2 = 0.297$, Adjusted $R^2 = 0.292$, $p < 0.001$

Table 5: Comparison of food and nutrition literacy and dietary consumption behaviors by gender (n = 584)

Variables	Male (n = 292) Mean ± SD	Female (n = 292) Mean ± SD	t	p-value
Dietary consumption behaviors (overall)	1.70 ± 0.20	1.77 ± 0.15	-4.50	<0.001
Food and nutrition literacy (overall)	1.63 ± 0.19	1.68 ± 0.15	-3.89	<0.001

The multiple linear regression analysis of the trimmed model indicated that food and nutrition literacy remained the strongest and statistically significant predictor of dietary consumption behaviors ($\beta = 0.502$, $p < 0.001$). In addition, gender was also significantly associated with dietary consumption behaviors ($\beta = 0.149$, $p < 0.001$). In contrast, academic performance (GPA) ($\beta = 0.018$, $p = 0.603$) and family income ($\beta = 0.048$, $p = 0.212$) were not significantly associated with dietary consumption behaviors ($p > 0.05$). The overall regression model was statistically significant ($p < 0.001$), explaining approximately 29.7% of the variance in dietary consumption behaviors ($R^2 = 0.297$; Adjusted $R^2 = 0.292$). Furthermore, no multicollinearity was detected among the independent variables, as all variance inflation factor (VIF) values were below 5 (Table 4).

An independent samples t-test was conducted to examine differences in food and nutrition literacy and dietary consumption behaviors between male and female students. The results indicated that female students had significantly higher mean scores in overall dietary consumption behaviors ($t = -4.50$, $p < 0.001$) and overall food and nutrition literacy ($t = -3.89$, $p < 0.001$) compared to male students (Table 5).

Discussion

The findings of this study indicate that students demonstrated a moderate overall level of food and nutrition literacy (M = 3.04, SD = 0.48). This suggests that most students possess a basic understanding of healthy food choices, nutrition labeling and the five

food groups. However, gaps remain in more advanced competencies, such as calculating appropriate daily energy intake and identifying foods high in sodium or fat.[23] These limitations may reflect partial exposure to nutrition knowledge through school-based health education and family support, which may not be sufficiently continuous or comprehensive. These findings are consistent with previous studies conducted in Thailand, which reported that secondary school students generally exhibit moderate levels of nutrition literacy, often influenced more by online media than formal education.[18] In addition, similar patterns have been observed in Southeast Asian contexts. A study conducted in rural northern Thailand reported that adolescents' dietary patterns were influenced by multiple factors beyond basic knowledge, including socio-demographic and environmental determinants, suggesting that knowledge alone may be insufficient to promote healthy dietary behaviors.[24] Similarly, findings from Malaysia indicated that although adolescents are generally aware of dietary recommendations, their actual eating patterns are shaped by complex interactions between individual, social and environmental influences.[25] These findings reinforce the notion that possessing basic nutrition knowledge does not necessarily translate into appropriate dietary decision-making, highlighting a gap between knowledge and practice in adolescent populations.[24,25]

At the domain level, functional food and nutrition literacy was also at a moderate level (M = 3.02, SD = 0.41), suggesting that students have a foundational ability to understand basic nutrition concepts, such as selecting a balanced diet, checking food expiration dates and avoiding excessively sweet, fatty or salty foods. Nevertheless, they lack deeper knowledge regarding appropriate nutrient intake and the practical application of nutrition knowledge in meal planning. This may be attributed to limited experiential learning opportunities within schools, where nutrition education is often delivered in a theoretical rather than practical format.[26]

Similarly, interactive food and nutrition literacy was found to be at a moderate level (M = 2.95, SD = 0.67). This suggests that, although students are able to communicate and exchange nutrition-related information with peers or family members to some extent, their engagement with nutrition-related information may still be limited. Previous studies have indicated that adolescents' dietary behaviors are influenced by social and environmental factors, including exposure to information and peer interactions.[27]

In contrast, critical food and nutrition literacy was found to be at a moderate level (M = 3.20, SD = 0.73), which is consistent with the classification criteria used in this study. This indicates that students possess some ability to critically evaluate food-related information; however, this capacity may be limited in more complex contexts, such as assessing the credibility of dietary supplement advertisements or distinguishing misinformation on digital platforms. These findings may reflect increased exposure to food-related information through digital and social media platforms, which has been shown to influence adolescents' eating behaviors.[26]

This finding is consistent with previous studies in Thailand and Southeast Asia, which have reported that adolescents often demonstrate moderate, but not advanced, levels of critical literacy, partly due to educational systems that emphasize memorization rather than analytical thinking and inquiry.[22] From a theoretical perspective, these findings align with Nutbeam's health literacy model, which conceptualizes literacy as a progression from functional to interactive and critical levels. Although students in this study demonstrated moderate functional literacy, the relatively lower development of interactive and critical competencies suggests limitations in translating knowledge into effective health behaviors. This may help explain why dietary consumption behaviors remain suboptimal despite a moderate level of overall literacy.[28,29] Taken together, these results highlight a critical gap between knowledge and practice, emphasizing that improving dietary behaviors requires not only increasing knowledge but also strengthening higher-order literacy skills. Enhancing interactive and critical food and nutrition literacy may therefore be essential to enable adolescents to effectively navigate food-related information and make appropriate dietary decisions within real-world contexts.[30]

The findings of this study indicate that the regression model was able to explain a proportion of the variance in dietary consumption behaviors, accounting for 29.7% (R^2 = 0.297). Food and nutrition literacy emerged as the most prominent factor and was significantly associated with dietary behaviors (β = 0.502, p <0.001). This suggests that individuals with higher levels of food and nutrition literacy tend to report healthier dietary choices. This association may be explained by the role of literacy in encompassing not only basic knowledge but also functional, interactive and critical skills that support individuals in navigating complex food environments, evaluating nutritional information and responding to food marketing.[31] These findings are consistent with previous research highlighting that health literacy is an important resource for adolescent health promotion and is associated with food-related decision-making.[32]

Furthermore, gender was also significantly associated with dietary consumption behaviors (β = 0.149, p <0.001), indicating differences between male and female students. This is consistent with prior studies suggesting that females tend to demonstrate higher health consciousness and greater adherence to nutritional guidelines.[33] In contrast, other demographic and socioeconomic factors, including age, family income and academic performance, were not significantly associated with dietary behaviors (p > 0.05). This may suggest that, within this study context,

competencies related to food and nutrition literacy are more closely associated with dietary behaviors than general academic or socioeconomic indicators.[34] These findings also reflect a potential "knowledge-behavior gap," whereby higher academic performance or financial resources do not necessarily correspond to healthier dietary practices in the absence of specific nutrition-related competencies.[35]

Limitations

This study has several limitations that should be considered when interpreting the findings. First, the cross-sectional design precludes causal inference, and therefore, the observed associations between food and nutrition literacy and dietary consumption behaviors cannot be interpreted as cause-and-effect relationships.

Second, dietary consumption behaviors were assessed using self-reported measures, which may be subject to recall bias and social desirability bias. Participants may have overreported healthy behaviors or underreported unhealthy dietary practices, potentially affecting the accuracy of the findings.

Third, the measurement instrument used in this study was adapted for the local context and, although it demonstrated acceptable validity and reliability, it has not been nationally standardized. This may limit the comparability of the findings with studies using fully validated national or international instruments.

Fourth, the study was conducted in a single province in Thailand, which may limit the generalizability of the findings to other regions with different sociocultural and environmental contexts.

Finally, no objective or biological measures of dietary intake were included. Future studies should incorporate more rigorous assessment methods, such as 24-hour dietary recall or food frequency questionnaires, to provide a more comprehensive evaluation of dietary behaviors.

Conclusion

This study demonstrated that students had a moderate level of food and nutrition literacy but exhibited low dietary consumption behaviors, indicating a clear gap between knowledge and practice. Food and nutrition literacy emerged as the strongest predictor of dietary behaviors, while most demographic and socioeconomic factors were not significantly associated. These findings highlight that improving dietary behaviors among adolescents requires more than basic knowledge acquisition. Strengthening higher-order literacy skills, particularly interactive and critical literacy, may be essential for enabling individuals to apply nutrition knowledge effectively in real-life contexts.

Future research should adopt longitudinal designs to establish causal relationships between food and nutrition literacy and dietary behaviors. In addition, intervention studies targeting the development of interactive and critical literacy skills are warranted to evaluate their effectiveness in improving dietary practices. Multi-province or nationally representative studies are also recommended to enhance the generalizability of the findings. Furthermore, incorporating objective dietary assessment methods, such as 24-hour dietary recall or food frequency questionnaires, may improve measurement accuracy. Overall, promoting food and nutrition literacy should be prioritized as a key strategy for improving dietary behaviors and supporting long-term health outcomes among adolescents.

Acknowledgment: The author extends heartfelt gratitude to all participants for their cooperation in completing the research questionnaires. The author also sincerely acknowledges the support of the provincial education authorities and school administrators who facilitated access to the study sites and assisted in coordinating data collection.

Individual Authors' Contributions: NS, **KR**, **DP** and **PT** contributed to the study conception and design. Material preparation, data collection, and analysis were performed by **RS**, **KS** and **AP**. The first draft of the manuscript was written by **PW** and **NS** commented on previous versions of the manuscript. All authors read and approved the final manuscript.

Availability of Data: The data supporting the findings of this study are available from the corresponding author upon reasonable request.

Declaration of Non-use of Generative AI Tools: This article was prepared without the use of generative AI tools for content creation, analysis, or data generation. All findings and interpretations are based solely on the authors' independent work and expertise.

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