FOOD LITERACY IN THE AGE OF SOCIAL MEDIA: A MIXED-METHODS INVESTIGATION OF NUTRITIONAL KNOWLEDGE AND ATTITUDES IN ITALIAN SECONDARY SCHOOL ADOLESCENTS

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ABSTRACT
This study aims to investigate students' nutritional knowledge and attitudes during a sensitive stage in their lives, adolescence. It explores the main information sources considered influential in the process of educating students about healthy eating.This study adopts a qualitative-quantitative approach. It involved 583 randomly selected students from two secondary schools in Naples. The data were collected through a structured questionnaire and thematic focus groups.The results show that smartphones and social media constitute the most frequently consulted sources of information about healthy eating (41.5%), followed by classroom lessons (21.6%),textbooks (20.2%), and family members (16.7%).Data analysis revealed that students have greater nutritional knowledge in the areas of "nutrition and health" and "nutrient functions and sources," compared to other thematic areas such as "understanding the function of proteins" and "identifying the consequences associated with excessive consumption of added sugars." Furthermore, qualitative analysis, in numerous cases, revealed negative attitudes toward the adoption of healthy eating behaviors, often associated with the influence of social media, group dynamics, and the perceived unattractiveness of healthy food.

KEYWORDS
Food literacy; Social media influence; Adolescent nutrition.

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1. Introduction

Healthy nutrition is essential for promoting proper development throughout all stages of growth (WHO, 2022; UNICEF, 2021). A nutritionally inadequate diet sustained over time may impair physical development, induce metabolic alterations, compromise immune function, and increase the risk of chronic diseases (Black et al., 2013). For this reason, malnutrition, understood as both nutritional deficiency and overeating, represents a significant problem among adolescents (Sawyer et al., 2012). Malnutrition also carries psychosocial consequences, including reduced self-esteem, social withdrawal, and diminished school engagement (Jacka et al., 2011).

From a nutritional perspective, adolescence is a particularly delicate stage, characterized by rapid physiological, cognitive, and behavioral changes that require an adequate nutrient intake (Story et al., 2002). Longitudinal evidence consistently indicates that during this period, unhealthy eating habits are maintained for a long time, consequently increasing the risk of developing obesity, type 2 diabetes, and cardiovascular disease, with significant repercussions on health in adulthood (Lobstein et al., 2015; World Health Organization, 2022). For this reason, proper nutritional literacy and positive attitudes toward the consumption of healthy foods are essential for building healthy eating habits (Velardo, 2015). Food literacy is currently conceptualized of as a multidimensional construct that integrates nutritional knowledge, practical skills, critical thinking, and decision-making awareness related to the selection, preparation, and consumption of food (Vidgen & Gallegos, 2014). From this perspective, nutrition is not merely a biological act, but an educational and cultural process influenced by social, media, and economic factors. The spread of digital environments further alters these dynamics, as adolescents construct their own food representations through informal learning processes mediated by social platforms, algorithmic content, and online sharing practices.

Scientific studies, such as that of Scaglioni et al. (2018), have shown that the acquisition of healthy behaviors during this stage of life contributes both to balanced growth and to consolidating beneficial dietary practices over the long term.

Recent studies highlight how adolescents' nutritional knowledge is often fragmented and influenced by information that is not always accurate, coming from sources not scientifically recognized, such as social media or, more generally, digital environments (Wickham & Carbone, 2018). Other studies highlight that students have difficulty understanding the principles of a balanced diet, interpreting

nutritional labels, and knowing the risks associated with the regular consumption of ultra-processed foods and sugary drinks (Monteiro et al., 2019; Gibney, 2019).

In recent years, numerous nutrition education interventions have been implemented in schools to improve students' nutritional knowledge, attitudes, and eating behaviors (Contento, 2016; Mazzocchi et al., 2021). Perez-Rodrigo & Aranceta (2001) demonstrated how school programs, based on participatory, laboratory, and interdisciplinary approaches, can contribute to improving nutritional awareness and diet quality.

Ventura & Birch (2008) emphasized the importance of involving adolescents' families in nutrition education interventions.

The Italian Ministry of Health (2023) has noted with concern the presence of vending machines selling high-calorie snacks and sugary drinks in schools. This data shows how these environments are often inconsistent with established health goals (Borgi et al., 2020).

In light of these considerations, there is a clear need to examine the contextual factors shaping the nutritional knowledge, attitudes, and practices of Italian adolescents. Therefore, this study investigated the nutritional knowledge and attitudes of adolescents attending two secondary schools in Naples.

2. Study description

This study involved 583 students from two secondary schools in Naples, aged between 14 ± 1 and 18 ± 1 years. A simple random sampling technique was used to select students. The qualitative approach involved targeted participant selection through focus groups, while the quantitative approach employed a deductive method to empirically test hypotheses, randomly selecting a representative sample, collecting the data, and conducting the analysis. It should be noted that the qualitative data were used to supplement and interpret the quantitative results.

Data Collection Procedure

Data collection encompassed students' socioeconomic background, nutritional knowledge, and dietary attitudes. Data collection was conducted through self-administered questionnaires in Italian using Google Forms. The knowledge and attitude questions in the questionnaire were adapted from Macias & Glasauer (2014) and subsequently slightly modified, pretested, and validated to fit the study context. The knowledge section consists of 10 questions, each with a "correct/incorrect" answer. A correct answer is scored 1, while an incorrect answer

is scored 0, for a maximum possible score of 10 points. An overall score for nutritional knowledge and attitudes was calculated for each participant. Given the continuous nature of the data collected, analyses were conducted by maintaining the scores in their original form, avoiding dichotomization procedures that could have reduced statistical variability and the interpretive sensitivity of the results. The relationships between nutritional knowledge and attitudes were therefore analyzed using inferential statistics based on continuous scores.

Regarding students' attitudes toward healthy eating, the questionnaire consists of 10 questions that, taken together, form a positive attitude. Unlike knowledge, attitude was measured using a 5-point Likert scale, where 5 = strongly agree and 1 = strongly disagree. Adolescents' responses, which scored 4 or higher, indicate a higher score. This implies that those who rated positive attitudes with a score of 4 or higher simulate a higher score for a good attitude, otherwise for a bad attitude. This allowed the researchers to clearly distinguish positive from negative attitudes, reclassifying those who were above average as positive and those who were below average as negative.

Each focus group comprised 10 to 12 students. The students selected to provide insights did not participate in the self-administered questionnaires. The focus group guides were essential for gathering additional information regarding nutrition knowledge and attitudes. The focus groups were conducted separately for each class at both schools. The presence of the researcher and the research assistant was crucial, as the former facilitated all focus groups and observed the interactions, while the latter documented the proceedings. The discussions proved invaluable for extracting comprehensive information regarding nutrition knowledge and attitudes within the two schools. Specifically, the focus group was conducted in a methodical and standardized manner. The moderator began the session by introducing the research team, outlining the meeting's objective, and defining the parameters of the discussion. The session began with the moderator presenting the opening question from the focus group guide. While adhering to the guide, the moderator made a deliberate effort to maintain a natural conversational flow of conversation without deviating from the discussion's objectives. The moderator actively encouraged contributions from the more reserved participants and took steps to prevent anyone from monopolizing the discussion, thus ensuring a balanced discussion. At the end of the session, the moderator responded to any pertinent questions or issues that arose during the discussion.

The discussions took place in both schools, with a dedicated session for each class involved, to ensure equal representation from all classes and to obtain a comprehensive perspective from all students. A total of three focus groups were

held in each school. The findings from the focus groups served to triangulate the quantitative data collected in this study.

Data Analysis

Data analysis was performed using dedicated statistical software. Specifically, descriptive statistics were used, including mean, minimum, and maximum values, using SPSS version 27.0 and Stata version 18.0. Frequency tables were generated to provide proportions of the demographic profile of the adolescents participating in the study. Sources of nutritional information, preferences, nutritional knowledge, and nutrition-related attitudes were assessed using frequency tables. To facilitate data exploration, knowledge scores were visualized by education level and grade using bar charts and box plots.

Similarly, nutritional attitudes by gender were analyzed using a box plot. To explore the relationship between nutritional knowledge and attitudes, a scatter plot with a regression line was estimated to reveal whether promoting nutritional knowledge promotes a lasting attitude trajectory.

Inferential analyses were conducted using Pearson correlations and simple linear regression models to examine the association between nutritional knowledge and dietary attitudes. 95% confidence intervals and effect sizes were also calculated to estimate the strength of the observed associations.

Regarding the full transcript of the focus group discussions, a thematic analysis of the qualitative data was performed. The coding process began by assigning labels to the variables' categories, which were subsequently organized into an original coding system to enhance credibility and trustworthiness of the coding process. To ensure the robustness of the analytical process, inter-coder reliability checks were performed; disagreements were discussed and resolved by consensus, ensuring consistency and reducing interpretive bias. The variables were then clarified by grouping the improved codes into more general categories and identifying, grouping, and arranging common themes in a specific sequence. For each theme, specific data were used to draw inferences, which were then combined to formulate conclusions.

To ensure the validity and reliability of the instruments, a pilot survey was conducted on a small sample of students to verify that the questionnaires collected data in line with the stated objectives. Furthermore, the study instruments were shared with experts for review, and their prior approval was provided before the main fieldwork phase began.

To assess the internal reliability of the scales used in the study, Cronbach's coefficient for multi-item constructs was calculated, with values equal to or greater than 0.70 considered acceptable.

Constructs	Average covariance between elements	Item	Scale reliability coefficient (Cronbach's alpha)
Knowledge	0,3174	10	0,7963
Attitudes	0,2931	10	0,7921

Tab. 1. Reliability statistics on nutrition knowledge and attitudes.

The reliability statistics in Table 1 indicate satisfactory internal consistency across all constructs, knowledge, and attitudes, with Cronbach's alpha values equal to or greater than 0.79. These values indicate that the items within each scale are highly correlated and consistently measure their respective constructs, supporting the validity of further analysis and interpretation and strengthening confidence in the relationships between these variables in the context of school nutrition.

Regarding the reliability of the qualitative component, credibility was strengthened through triangulation and peer comparison; dependability through maintaining an audit trail; confirmability through reflective notes; and transferability by providing detailed descriptions of the study context.

3. Results

The results highlighted that the main sources of nutritional knowledge cited by adolescents were textbooks (20.2%), family members (16.7%), classroom lectures (21.6%), and smartphones including social media (41.5%) (Table 2). Focus group findings revealed that adolescents learned about nutrition from newspapers and brochures, friends, and classroom instruction.

Variable	Frequency (f)	Percentage (%)	Cumulative Percentage (%)
Smartphones and social media	242	41,5	41,5
Classroom lessons	126	21,6	63,1
Textbooks	118	20,2	83,3
Family members	97	16,7	100,0

Total	583	100,0	

Tab. 2. Distribution of information sources

Students were asked why they valued a particular information source. Nearly half of participants (41.5%) said they valued smartphones and social media because they were engaging and informative. 20.2% stated that the textbook offered a wide range of clear and easy-to-understand information. Additional reasons for valuing smartphones and social media over textbooks and classroom lectures included the fact that the messages focused more on crucial nutrition-related behaviors, such as washing hands after using the bathroom and before eating. It's important to note that food literacy encompasses not only strictly nutritional aspects, but also practices related to the conscious and safe handling of food. From this perspective, certain hygiene and health behaviors can indirectly contribute to building health-related food literacy.

Thematic Area	Percentage of correct answers	Main critical issues identified
Nutrition and Health	58,6–75,0%	Misperception of the role of added sugars
Eating Habits	42,7%	Widespread belief that skipping meals promotes weight loss
Functions of Nutrients	17,0–48,9%	Confusion about the energy-producing role of protein and salt
Nutrition and Malnutrition	42,0%	Reduced awareness of the risks associated with ultra-processed foods

Tab. 3. Nutritional knowledge analysis

Regarding nutritional knowledge, an analysis of student responses revealed that 41.4% of participants were unable to accurately identify the consequences associated with excessive consumption of added sugars. Seventy-five percent of respondents believed that a high-fiber diet is necessary for healthy bowel function. This finding may suggest that adolescents perceive healthy eating as a holistic concept that includes cleansing.

Furthermore, 42.7% of respondents mistakenly believed that skipping meals would help them lose weight quickly, a harmful habit that can lead to metabolic imbalances. Even more alarming is the fact that 83% of respondents agreed with the false claim that a high-salt diet is necessary for mineral intake, despite its known

link to cardiovascular disease and hypertension. Another concerning finding is that 58% of respondents were unable to name any behaviors that could lead to malnutrition, indicating a serious lack of knowledge about the dangers and causes of unhealthy eating habits. Furthermore, 51.1% of respondents incorrectly identified high-protein meals as the primary source of energy, demonstrating a confusion between nutrients that provide energy and those that contribute to building the body. Overall, these findings highlight important areas where nutrition education is absolutely essential to dispel myths that could negatively impact health.

Regarding knowledge of the functions of dietary nutrients, it is noted that students lack adequate knowledge of the functions of nutrients. In particular, some respondents demonstrated insufficient knowledge of the role of proteins in the body: 47.6% of respondents stated that the primary function of proteins is not the repair of damaged body tissue.

Focus group discussions revealed a lack of knowledge on topics such as a balanced diet and the obstacles to good nutrition. Furthermore, it was observed that first- and second-year students were able to name the various food categories, but were unable to group them according to their bodily functions. This finding highlights the importance of exploring these topics in greater depth during lessons.

Obstacles related to proper nutrition	Testimonials
Need to conform with peers	It's hard to eat healthy when all your friends eat highly processed foods or drink soda.
Lack of willpower	You come home from school, you're alone at home, and you quickly prepare something.
Lack of time	I wake up late and never eat breakfast to be on time for school.
Financial difficulties	My parents buy very few vegetables because they say it's too expensive.
Poor knowledge of food	I don't know and I don't care about knowing about food; I just eat what I want and what I like.

Tab. 4. Specific knowledge regarding nutrition

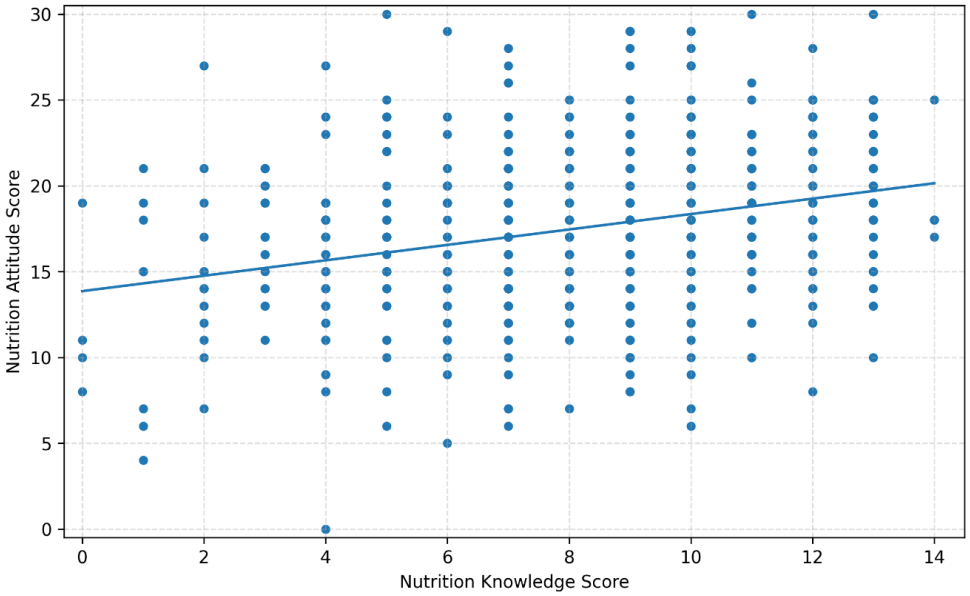
Overall, the study results indicated that adolescents who received nutritional information from teachers during class reported significantly greater nutritional knowledge, suggesting that school represents the ideal educational environment

for fostering greater knowledge of healthy eating, as well as promoting a transformative education that integrates curriculum, experience, and active citizenship. This latter aspect is highlighted by the attitudes students adopt toward healthy eating during a sensitive period like adolescence. Specifically, the interviews revealed that 52% of the participating students stated that eating healthily helps prevent the onset of future diseases. This reflection demonstrates both the students' awareness and critical thinking, as well as their responsibility toward citizenship and the future of society.

Attitudinal dimension	t	p	Cohen's d	Interpretation
Dietary variety	−8,19	< .001	−0,69	Moderate difference
Nutrition education	−9,60	< .001	−0,83	High difference
Healthy habits	−10,42	< .001	−0,89	High difference
Nutritional awareness	−10,00	< .001	−0,87	High difference

Tab.5. Nutritional attitudes of students

According to Table 5, adolescents with good nutrition attitudes scored significantly higher on all attitude items than those with negative attitudes. Specifically, they were more likely to agree that eating a variety of foods is important and that handwashing prevents illness. They also found learning about nutrition enjoyable and expressed strong enjoyment in cooking. Positive feelings emerged toward drinking water and recognized fruit as a healthy snack. Adolescents with good attitudes also enjoyed reading food labels and appreciated the healthy learning program. They placed importance on breakfast. Furthermore, the items "Cooking is enjoyable" and "Handwashing prevents illness" had the highest Cohen's d values, indicating the greatest differences in attitude between adolescents with good and poor nutrition attitudes. These results suggest that adolescents with positive nutrition attitudes expressed significantly greater enthusiasm and appreciation for cooking and hygienic practices such as handwashing.



Graph 1: Relationship between students' knowledge and attitudes regarding nutrition

Investigating the relationship between nutritional knowledge and attitude scores, Figure 1 shows a strong positive correlation between knowledge and attitudes toward nutrition among adolescents. This implies that the greater their knowledge about nutrition, the better their attitudes will be. Therefore, knowledge serves as a foundation for developing positive attitudes that are useful in any context, as nutrition is more likely to be perceived as relevant to daily life. In this regard, the following are the testimonies of some students:

"When I understood why carbonated drinks are bad for you, I tried to drink less. Now I bring water from home";

"When we learned about vegetables in class, I started telling my friends that eating them helps us feel good. I like sharing this knowledge."

4. Discussion

This study assessed nutritional knowledge and attitudes among adolescents in two secondary schools in Naples. In summary, students exhibited poor nutritional knowledge and conflicting attitudes, primarily influenced by smartphone use and related social media (41.5%), classroom lessons (21.6%), textbooks (20.2%), and

family. Considering the difference between the first and the other values, a gap in percentage points highlights a profound crisis in educational agency.

Misconceptions about food and nutrients were common, although classroom teaching improved knowledge. Attitudes were inconsistent, but a strong positive correlation was found between greater knowledge and healthier attitudes, with focus groups highlighting barriers such as family financial difficulties and peer influence.

The study results revealed that adolescents who received nutritional information from classrooms and the school environment were more likely to have good nutritional knowledge than those who learned information from smartphones and social media. This finding is consistent with a study conducted by Pruccoli et al. (2022), according to which Westernization, media exposure, and urbanization are the main factors contributing to the rise in eating disorders. Most adolescents in this survey, however, stated that they learned about nutrition through smartphones and related commercials, which often contained false information and promoted high-calorie meals. Therefore, adolescents may become confused and adopt unhealthy eating habits due to marketing or insufficient messaging. However, interpreting social media exclusively as a source of misinformation risks oversimplifying the relationship between adolescents and digital environments. Social platforms also constitute spaces for identity construction, informal learning, and cultural negotiation, where young people develop representations of the body, well-being, and eating practices. From this perspective, the pedagogical problem does not coincide with mere exposure to digital content, but rather with the lack of critical skills necessary to evaluate the reliability of information and recognize the persuasive dynamics of algorithmic content. Schools are therefore called upon not only to combat food misinformation but also to promote forms of critical food literacy and media literacy aimed at developing students' interpretative autonomy (Jenkins, Ito, & Boyd, 2016). To this end, food education initiatives could also be incorporated into social media and other platforms to help transform the media from a source of confusion to a tool for encouraging better eating habits. Nonetheless, findings suggest that the best context for disseminating accurate nutritional information remains the classroom; therefore, strengthening this aspect of the educational context could help counter misinformation from external sources, such as media advertising.

Regarding adolescents' attitudes toward healthy eating, the study revealed that most of them believed that all tasty foods are beneficial to a healthy lifestyle. The findings are consistent with a study conducted by Toselli et al. (2014) in Bologna, Italy, which found that children and adolescents sometimes exhibit distorted nutritional perceptions, frequently associating highly palatable foods with socially

positive and desirable characteristics, with difficulty clearly distinguishing between food pleasantness and nutritional healthiness.

The results regarding adolescents' attitudes toward healthy eating highlighted a low propensity for healthy food, as the majority of respondents stated that nutritious foods are not tasty. These findings are consistent with those of a previous study (Moriyani & Meena, 2022), which revealed that almost a quarter of adolescents indicated that healthy foods are not tasty and pleasant.

Combining these findings with interventions, it's clear that nutrition education must address not only knowledge, but also attitudes and taste preferences. Schools could implement creative workshops, such as tasting events, and innovative marketing strategies that present healthy meals as appetizing, delicious, and affordable. This could help develop healthy and lasting eating habits in students, as well as help eliminate the perception that nutrient-dense foods are unappealing.

From a pedagogical perspective, viewing healthy food as unappealing demonstrates how teaching must value the peer group, understood as a powerful mediator capable of transforming food choices into an act of identity affirmation rather than a health practice.

An additional aspect worth examining is that more than half of the respondents believed that skipping meals was a good strategy for weight loss. This study is consistent with another conducted by Guarino et al. (2005), which involved 2,121 Italian adolescents, highlighted how the frequent use of dysfunctional weight control strategies, including skipping meals and fasting, is perceived by young people as an effective way to lose weight.

Some of the interviewees showed confusion regarding the nutritional content of certain foods. This suggests that adolescents lack sufficient knowledge about healthy foods. This study is consistent with the findings of a previous study by Tallarini, Zabeo, & Ferraretto (2014), conducted on Italian students aged 9 to 16, which highlighted that adolescents and preadolescents have insufficient nutritional knowledge regarding the principles of healthy eating, especially regarding a balanced diet and the choice of healthy foods. Therefore, adolescents should be provided with adequate nutritional information to change their attitudes towards nutritious and healthy foods. In this regard, studies such as Kyere et al. (2020) and Wang et al. (2022) demonstrated that school-based nutrition programs, particularly those that combine education with practical components such as school gardens and meals, can improve knowledge and reduce micronutrient deficiencies. The current findings reinforce the need for inclusive and context-sensitive educational strategies that prioritize both content and delivery modality.

5. Study Limitations

The study has the following limitations: the use of self-reported data may have introduced biases due to memory and social desirability, as participants may have overestimated or underestimated certain behaviors or attitudes. The results may be influenced by students' tendency to respond according to what they believe is right rather than what they actually do, or according to teachers' expectations. Second, although the sample size is significant, it was limited to two secondary schools in Naples, which may limit participant diversity and the generalizability of the findings to other contexts or populations. Finally, the study's cross-sectional design precludes causal inference. Furthermore, it should be noted that this study does not allow us to assess the evolution of attitudes over time or to establish a univocal relationship between social media use and deterioration in eating habits.

6. Concluding Reflections

According to this study, there are clear differences in attitudes and understanding of nutrition among adolescents in Italian secondary schools. This highlights a disconnect between school, understood as a formal educational agency, and informal learning environments, particularly the digital environment. Although students who learned about nutrition in formal educational settings demonstrated greater understanding, misinformation from the media continues to negatively impact their eating habits. Negative attitudes toward healthy eating persist, such as skipping meals to lose weight and associating nutritious foods with bad taste.

Schools and textbooks are considered authoritative sources of information, thus, as suggested by the study's findings, highlighting the need for in-depth nutrition education programs.

The results revealed that more informed adolescents demonstrated a deeper understanding of a wide range of nutritional topics than their less informed peers. Furthermore, they demonstrated greater awareness of the functions of nutrients and healthy food choices. The current pedagogical challenge is no longer simply transmitting nutritional knowledge; it is also about imparting knowledge that leads to lasting healthy behaviors.

Adolescents with good nutritional attitudes consistently expressed more positive views about healthy eating and hygiene practices than those with negative attitudes. Those with good attitudes were significantly more likely to agree that eating a variety of foods is important and that learning about nutrition and cooking

is enjoyable. They also showed greater appreciation for healthy habits such as drinking water, eating fruit as a snack, reading food labels, and valuing breakfast.

Interactive teaching and practical nutrition demonstrations should be more fully integrated into school curricula through workshops. Parents, teachers, and classmates as role models can help reinforce positive attitudes. Given global trends favoring online learning and access to information, improving digital literacy and ensuring equitable access to online nutrition resources is crucial to improving adolescents' food choices and health outcomes. This allows students to be involved in meal planning or feedback sessions, increasing their sense of belonging and satisfaction, as well as strengthening positive attitudes toward traditional healthy foods. In conclusion, this work, despite the limitations described, suggests the development of school-based interventions that are not limited to the classroom, but utilize laboratory and peer-education strategies. Schools thus become mediators of positive reference values (think of the teacher and the presence of the family) capable of promoting a scientifically valid and, at the same time, socially attractive food culture.

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