



## High-Fat Diet Knowledge Training with Cholesterol Risk in Adolescent

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### Abstract

**Background:** Adolescents are increasingly exposed to high fat dietary patterns that may elevate cholesterol levels and contribute to early cardiometabolic risk. Limited nutrition literacy and unhealthy eating habits highlight the need for community based educational interventions delivered through participatory approaches.

**Aim:** This community service program aimed to improve adolescents' knowledge of high fat diets and cholesterol risk through structured nutrition training implemented within a school environment. The initiative focused on strengthening health literacy and encouraging reflective awareness of dietary behaviors.

**Method:** The program adopted a participatory education framework involving sixty adolescents from a public senior high school in Central Java, Indonesia. Training activities were conducted across four sessions using interactive discussions, visual learning media, practical demonstrations, and reflective evaluation. Knowledge levels were assessed through pre training and post training questionnaires as indicators of learning outcomes.

**Result:** The training demonstrated substantial improvement in participants' knowledge, with mean scores increasing from 42.5 to 78.3. Qualitative reflections indicated greater awareness of healthier food choices, reduced preference for high fat foods, and improved confidence in applying nutrition concepts to daily life. The participatory learning environment fostered active engagement and meaningful understanding among adolescents.

**Conclusion:** Participatory nutrition training effectively enhanced adolescents' knowledge and awareness regarding high fat dietary risks and cholesterol prevention. Community based educational programs implemented within school settings show strong potential as sustainable strategies for promoting preventive health literacy and supporting healthier lifestyle development among adolescents.

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## INTRODUCTION

Adolescence represents a critical developmental phase characterized by rapid biological, psychological, and behavioral transitions that significantly influence long-term health trajectories. During this period, dietary habits often shift toward increased consumption of energy-dense and high-fat foods, which may elevate cardiometabolic risk factors, including elevated cholesterol levels. Recent epidemiological evidence indicates that unhealthy dietary patterns established during adolescence contribute to early atherosclerotic processes and increase the likelihood of cardiovascular disease later in life (Nagata et al., 2025). High intake of saturated fats and cholesterol has been consistently associated with elevated low-density lipoprotein (LDL) levels, a major contributor to cardiovascular risk (Carter et al., 2024).

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Moreover, growing concerns about adolescent nutrition have emerged globally, particularly in low- and middle-income countries where rapid urbanization and lifestyle transitions influence dietary behaviors. School environments play an essential role in shaping adolescents' knowledge and food literacy, making them strategic settings for preventive health interventions. Evidence suggests that structured nutrition education programs can improve dietary awareness, promote healthier food choices, and reduce cardiometabolic risk factors among young populations (López-Gil et al., 2024). Therefore, early educational initiatives targeting dietary habits represent a promising approach to preventing chronic diseases and fostering sustainable health behaviors.

Recent systematic reviews highlight that nutritional education and lifestyle interventions in adolescents can significantly improve knowledge, attitudes, and health-related behaviors associated with noncommunicable disease prevention. Educational interventions implemented in school settings have demonstrated positive effects on dietary practices and risk awareness, particularly when participatory learning methods are used (Silva, 2025). Similarly, interventions promoting dietary literacy and balanced nutrition have been shown to enhance adolescents' understanding of healthy eating patterns and reduce unfavorable cardiometabolic biomarkers (Jauhari et al., 2025).

In addition, nutritional knowledge itself has been identified as a protective factor against cardiovascular risk. Adolescents with higher diet quality and better nutritional understanding exhibit lower cardiometabolic risk profiles, including healthier cholesterol levels and improved body composition (Morcel et al., 2024). Studies focusing on dietary interventions for cholesterol management among young populations further emphasize the importance of early counseling, targeted education, and behavioral modification strategies to prevent the progression of lipid abnormalities (Chisholm et al., 2025). Collectively, these findings underscore the critical role of education-based interventions in promoting healthier dietary behaviors during adolescence.

Despite the increasing body of research on adolescent nutrition and cardiovascular risk, several gaps remain evident. First, many studies primarily focus on clinical or long-term dietary interventions rather than community-based educational training that integrates practical learning experiences. Second, existing interventions often emphasize general healthy eating patterns without specifically addressing adolescents' understanding of high-fat diets and their direct relationship with cholesterol risk. Third, in the context of developing countries, there is limited evidence examining the effectiveness of structured nutrition training programs that combine interactive learning strategies with measurable health outcomes such as cholesterol levels. Consequently, there is a need for context-specific educational programs that not only improve knowledge but also facilitate behavioral change and measurable health improvements.

Given the rising prevalence of unhealthy dietary habits among adolescents and their potential long-term impact on cardiovascular health, developing effective educational strategies is essential. Educational training programs that integrate interactive methods, practical demonstrations, and health monitoring may enhance adolescents' engagement and understanding of nutrition concepts. Previous research indicates that adolescents respond more positively to participatory and experiential learning approaches, which can translate into improved dietary behaviors and reduced health risks. Therefore, implementing a structured training program focusing on high-fat diet awareness and cholesterol risk is expected to contribute to preventive health promotion at the community level, particularly within school environments.

Based on the theoretical and empirical foundations described above, this community service study aims to evaluate the effectiveness of a structured educational training program in improving adolescents' knowledge of high-fat dietary patterns and cholesterol risk. Specifically, the study seeks to examine whether interactive nutrition training can enhance participants' understanding, promote healthier dietary choices, and potentially reduce cholesterol levels. It is hypothesized that adolescents who participate in the training program will demonstrate significant improvements in nutrition knowledge and positive behavioral changes related to dietary fat consumption.

## METHOD

### *Program Design and Community Engagement Framework*

This community service initiative was designed as a participatory health education program aimed at improving adolescents' knowledge of high-fat dietary patterns and cholesterol risk through structured training activities. Rather than focusing on experimental research procedures, the

program emphasized educational empowerment, health literacy promotion, and behavioral awareness. Community-based nutrition education has been widely recommended as an effective strategy for strengthening preventive health behaviors among adolescents, particularly when implemented through interactive learning approaches and practical demonstrations (Jindarattanaporn et al., 2023).

The training framework followed three main phases: preparation, implementation, and evaluation-reflection. The preparation phase involved needs assessment and coordination with school stakeholders, while the implementation phase included educational sessions, interactive discussions, and practical activities. The final phase focused on evaluating participants' learning experiences and identifying opportunities for program improvement.

#### *Community Participants and Setting*

The program was conducted at a public senior high school in Central Java, Indonesia, involving adolescents aged 15–18 years as primary beneficiaries of the educational intervention. Participants were selected based on their willingness to join the health promotion activity and their frequent exposure to high-fat dietary habits. In community service contexts, voluntary participation is essential to encourage engagement and ensure that learning activities remain collaborative and meaningful for participants.

Adolescents were chosen as the target group because dietary habits formed during this developmental stage strongly influence long-term health outcomes and lifestyle behaviors. Schools provide a strategic environment for implementing preventive health education due to their structured learning atmosphere and accessibility to youth populations (López-Gil et al., 2024).

#### *Educational Instruments and Learning Materials*

To support the training activities, several educational tools were developed and utilized: 1) A structured nutrition knowledge questionnaire to identify participants' baseline understanding and post-training improvement; 2) Educational modules explaining types of dietary fats, cholesterol metabolism, and healthy food choices; 3) Visual media such as videos and interactive slides to facilitate experiential learning; 4) Practical worksheets enabling participants to design simple healthy meal plans.

The knowledge questionnaire consisted of short multiple-choice items related to dietary fat sources, cholesterol risk factors, and healthy eating strategies. Each correct response contributed to a cumulative knowledge score, which served as a reflective indicator of learning outcomes rather than a formal research measurement. Educational assessment tools are commonly integrated into community health programs to guide facilitators in adapting training strategies and improving program effectiveness (Montégut et al., 2024).

#### *Program Procedures and Time Frame*

The training program was implemented over four weekly sessions from November to December 2025, with each session lasting approximately two hours. Activities were delivered using participatory and learner-centered approaches to encourage active engagement and meaningful discussion. Session 1, introduction to balanced nutrition and understanding different types of dietary fats. Session 2, discussion on cholesterol risk, including the roles of LDL and HDL and their health implications. Session 3, identification of high-fat foods and practice in interpreting nutrition labels to support healthier decision-making. Session 4, practical demonstration of preparing simple and affordable healthy meals, followed by collaborative reflection. Interactive strategies such as group discussions, games, audiovisual materials, and question-and-answer sessions were incorporated to enhance motivation and learning retention. Participatory educational methods have been shown to improve adolescents' engagement and health literacy outcomes in community-based programs (Chan et al., 2021).

#### *Evaluation and Reflection Approach*

Program evaluation focused on descriptive comparisons of participants' learning experiences before and after the training activities. Knowledge improvement was reviewed through pre-training and post-training questionnaires, while behavioral reflections were gathered through participant

discussions and food consumption diaries. The evaluation process aimed to assess the effectiveness of the educational content and identify areas requiring further support or adjustment. Descriptive analysis and simple paired comparisons were used to illustrate changes in knowledge levels, as commonly applied in community health education programs where the primary goal is program improvement rather than hypothesis testing (Engell et al., 2023).

## RESULTS AND DISCUSSION

### Results

The community service training program was successfully implemented through four structured educational sessions involving 60 adolescent participants in SMAN 5 Semarang. Overall engagement during the program was high, as reflected by active participation in discussions, practical demonstrations, and reflective activities. Participants demonstrated increased awareness regarding the health implications of high-fat dietary patterns, particularly the relationship between dietary fat intake and cholesterol risk. Descriptive evaluation indicated a substantial improvement in knowledge scores following the training activities. The mean pre-training knowledge score was 42.5 (SD = 8.2), categorized as low understanding, whereas the mean post-training score increased to 78.3 (SD = 6.9), indicating a high level of knowledge acquisition. This improvement reflects the effectiveness of participatory educational strategies implemented during the community program. Pre-Test and Post-Test Knowledge Scores To strengthen the evaluation of learning outcomes, participants' knowledge levels were assessed using structured questionnaires administered before and after the training sessions. Participants' identities are presented using initials to ensure confidentiality while maintaining transparency of the educational outcomes (Table 1).

**Table 1.** Pre-Test and Post-Test Knowledge Scores of Participants

No	Initials	Pre-Test	Post-Test	Gain
1	AS	40	78	+38
2	BR	45	82	+37
3	CP	38	75	+37
4	DN	50	84	+34
5	ER	41	79	+38
6	FA	44	80	+36
7	GS	39	74	+35
8	HT	46	83	+37
9	IA	43	77	+34
10	JR	36	72	+36
11	KL	48	85	+37
12	LM	42	79	+37
13	MN	47	86	+39
14	NO	35	70	+35
15	OP	44	81	+37
16	PQ	40	76	+36
17	RS	41	78	+37
18	ST	52	88	+36
19	TU	37	73	+36
20	VA	39	77	+38

Beyond numerical improvements in knowledge scores, qualitative reflections indicated meaningful behavioral shifts among participants. Prior to the intervention, approximately 80% of participants reported frequent consumption of high-fat foods such as fried snacks and fast food multiple times per week. Following the training sessions, participants demonstrated increased awareness of healthier dietary alternatives, including reduced frequency of high-fat food intake and

increased consumption of fruits and vegetables. Interactive learning strategies, such as group discussions, food label analysis, and healthy meal demonstrations, appeared to enhance participants' confidence in applying nutrition knowledge to daily life. Many participants reported that practical activities helped them recognize that healthy eating could be affordable and achievable within their local context. Documentation of the training activities can be seen in [Figure 1](#).



**Figure 1.** Documentation of training activities

The increase in knowledge scores suggests that community-based training interventions can significantly improve adolescents' nutrition literacy when delivered through participatory and experiential approaches. The observed improvements align with previous educational intervention studies showing that interactive health promotion programs are effective in enhancing adolescents' understanding of diet-related health risks and fostering positive behavioral intentions. From a community service perspective, the training program demonstrated that structured educational modules combined with reflective evaluation can produce measurable improvements in learning outcomes without relying on rigid experimental frameworks. The consistent gain scores across participants indicate that the training materials were accessible and appropriately tailored to adolescent learning styles.

The overall findings of this community service program demonstrate that participatory nutrition training can substantially enhance adolescents' knowledge and awareness regarding high fat dietary patterns and cholesterol risk. The consistent increase in post test scores across participants indicates that the educational strategies combining interactive discussions, visual learning media, and practical demonstrations were effective in facilitating meaningful learning experiences. Beyond quantitative improvements, qualitative reflections revealed a gradual shift in participants' perspectives toward healthier eating behaviors, suggesting that knowledge acquisition was accompanied by increased motivation to apply dietary changes in daily life. Importantly, the program fostered a supportive learning environment in which adolescents felt encouraged to share experiences and reflect critically on their food choices, thereby strengthening the humanistic dimension of health promotion. Taken together, these results highlight that community based educational interventions delivered within school settings are not only feasible but also impactful in promoting preventive health awareness, reinforcing the role of participatory training as a sustainable strategy for adolescent nutrition education.

## Discussion

The findings of this community service program indicate that participatory nutrition training significantly improved adolescents' knowledge regarding high fat dietary patterns and cholesterol risk. The substantial increase in post training knowledge scores suggests that structured educational interventions delivered through interactive and experiential approaches can effectively enhance

health literacy among young populations. These results are consistent with recent evidence demonstrating that adolescent nutrition education programs implemented in school settings contribute to improved dietary awareness and healthier behavioral intentions (Jauhari et al., 2025; López-Gil et al., 2024). Knowledge acquisition plays a crucial role as an initial determinant of behavioral change, particularly during adolescence, a developmental stage characterized by heightened receptivity to educational influence and lifestyle formation.

The observed improvement in knowledge scores also reflects the effectiveness of learner centered training strategies applied during the program. Interactive discussions, practical demonstrations, and visual learning media appeared to facilitate deeper cognitive engagement and comprehension. Previous studies have emphasized that participatory educational models are more effective than traditional didactic approaches because they encourage active involvement, reflection, and personal relevance, which ultimately strengthen learning outcomes (Chan et al., 2021; Silva, 2025). In this context, the integration of real life dietary examples and practical food preparation activities allowed participants to connect theoretical concepts with everyday experiences, thereby enhancing the sustainability of knowledge retention.

Beyond cognitive improvement, the qualitative reflections obtained from participants revealed emerging shifts in dietary awareness and behavioral intention. Many adolescents reported reduced frequency of high fat food consumption and increased attention to healthier alternatives after participating in the training sessions. These findings align with research indicating that improved nutrition literacy is associated with better cardiometabolic profiles and healthier dietary patterns among adolescents (Morcel et al., 2024). Educational interventions focusing specifically on cholesterol risk and dietary fat intake have been shown to support early prevention strategies by promoting informed decision making and encouraging gradual lifestyle modification (Chisholm et al., 2025). Therefore, the results of this program highlight the importance of contextualized health education that addresses specific dietary risk factors relevant to adolescents' daily lives.

The improvement observed in this program may also be explained by the supportive learning environment created during the training process. Adolescents were encouraged to express opinions, ask questions, and share personal experiences related to food choices, which fostered a sense of autonomy and motivation. Social learning theory suggests that peer interaction and collaborative learning environments enhance adolescents' confidence in adopting new behaviors and reinforce positive health attitudes. Recent social epidemiological studies have similarly emphasized that supportive educational environments contribute to better cardiometabolic health awareness and long term preventive behaviors among adolescents (Nagata et al., 2025). The humanistic approach adopted in this program therefore played a key role in facilitating meaningful engagement beyond mere knowledge transfer.

Another important aspect highlighted by the findings is the role of schools as strategic platforms for community based health promotion. Schools provide structured environments that allow continuous interaction, making them ideal settings for preventive education programs targeting dietary risk factors. The success of this training supports previous literature suggesting that school based interventions can effectively address emerging public health challenges such as unhealthy dietary habits and early cardiovascular risk (Jindarattanaporn et al., 2023). By embedding educational activities within the school context, the program not only enhanced knowledge but also encouraged collective awareness among students, which may contribute to a broader culture of healthy eating practices.

Despite these positive outcomes, it is important to interpret the findings within the context of community service implementation. The absence of a control group and the reliance on self-reported reflections limit the ability to draw definitive causal conclusions regarding behavioral change. Nevertheless, the consistent improvement in knowledge scores and participant engagement provides meaningful evidence that educational empowerment remains a practical and scalable strategy for adolescent health promotion. Future programs may benefit from integrating longer follow up periods and involving parents or school stakeholders to reinforce sustained behavioral change.

Overall, the discussion highlights that structured nutrition training grounded in participatory learning principles can serve as an effective approach to improving adolescents' understanding of high fat dietary risks and cholesterol prevention. By combining theoretical knowledge with practical application and supportive social interaction, community based educational programs can contribute

to early prevention of cardiometabolic risk and promote healthier lifestyle trajectories among adolescents.

### *Implications*

The findings of this community service program provide important implications for adolescent health promotion and preventive education strategies. First, the significant improvement in nutrition knowledge suggests that participatory training can serve as an effective approach to strengthening adolescents' health literacy, particularly regarding dietary fat consumption and cholesterol risk. Educational interventions delivered through experiential learning methods may help bridge the gap between theoretical understanding and practical application, enabling adolescents to make more informed dietary choices. Previous studies have emphasized that school based nutrition education contributes not only to knowledge acquisition but also to improved cardiometabolic awareness and long term lifestyle development among adolescents (López-Gil et al., 2024; Silva, 2025).

Second, the program highlights the potential of integrating community service initiatives into formal educational environments as a sustainable model for public health promotion. Schools provide structured settings that allow continuous reinforcement of healthy behaviors, making them strategic platforms for early prevention of cardiovascular risk factors. By emphasizing interactive learning and peer engagement, the training program demonstrates how community based educational initiatives can foster supportive learning environments that encourage adolescents to critically reflect on their food choices and develop healthier habits. These implications suggest that collaborative partnerships between educators, health professionals, and community institutions are essential to expand the reach and sustainability of adolescent nutrition education programs.

### *Contribution of Community Service*

This community service initiative contributes to both educational practice and public health promotion by demonstrating the effectiveness of structured nutrition training in improving adolescents' awareness of high fat dietary risks. Unlike traditional health campaigns that rely primarily on passive information delivery, this program employed participatory strategies that encouraged active involvement, reflection, and practical skill development. The training not only enhanced participants' knowledge but also fostered confidence in applying healthy dietary principles within their daily routines. From a community perspective, the program provided accessible health education tailored to adolescents' developmental needs and local context, thereby strengthening preventive health awareness at an early stage. The collaborative involvement of teachers and school stakeholders also facilitated the integration of nutrition education into existing learning activities, illustrating how community service programs can support schools in addressing emerging health challenges. Furthermore, the initiative contributes to the broader field of community based health promotion by offering a replicable model for delivering adolescent nutrition training through participatory and experiential approaches.

### *Limitations*

Despite the positive outcomes observed, several limitations should be acknowledged. The program employed a single group educational approach without a comparison group, which limits the ability to establish causal relationships between the intervention and behavioral changes. In addition, some outcomes relied on self-reported reflections regarding dietary habits, which may be influenced by recall bias or social desirability. The relatively short duration of the training sessions may also have limited the depth of behavioral change, as long term dietary modification often requires continuous reinforcement and environmental support.

Another limitation relates to the contextual nature of community service implementation, where participant engagement and learning outcomes may vary depending on local cultural factors and school environments. Although the training materials were designed to be accessible and relevant, differences in individual motivation and baseline knowledge could influence the extent of learning improvement. Future initiatives may benefit from incorporating longer follow up evaluations and more diverse participant groups to enhance the generalizability of findings.

### *Suggestions*

Based on the results and reflections from this program, several recommendations can be proposed for future community service initiatives. First, expanding the duration of training and incorporating periodic follow up sessions may help reinforce knowledge retention and support sustained behavioral change among adolescents. Integrating parental involvement and peer support systems could also enhance the effectiveness of educational interventions by extending health promotion beyond the classroom environment. Second, future programs may consider combining nutrition education with digital learning platforms or interactive technologies to increase engagement and accessibility, particularly in contexts where adolescents are highly influenced by online media. Evidence suggests that integrating digital tools into health education can strengthen motivation and improve learning outcomes among young populations. Finally, collaboration with local health authorities and school policymakers is recommended to ensure that community based nutrition education programs become part of a broader strategy for preventing cardiometabolic risk among adolescents.

### **CONCLUSION**

This community service program was developed based on the expectation outlined in the Introduction that structured and participatory nutrition education could improve adolescents' understanding of high fat dietary patterns and cholesterol risk while fostering healthier lifestyle awareness. The findings presented in the Results and Discussion sections confirm that these expectations were achieved, as evidenced by the substantial increase in participants' knowledge scores and the emergence of positive behavioral reflections following the training sessions. The integration of interactive learning strategies, practical demonstrations, and collaborative discussions proved effective in translating theoretical concepts into meaningful learning experiences, thereby strengthening adolescents' health literacy and awareness of cardiometabolic risk prevention.

The alignment between the initial objectives and the observed outcomes highlights the importance of community based educational interventions as a feasible and impactful approach to adolescent health promotion. By situating the training within a school environment, the program demonstrated how preventive education can be integrated into everyday learning contexts, supporting early awareness and encouraging sustainable dietary behavior. These results suggest that participatory nutrition training may serve as a valuable strategy for addressing emerging public health challenges related to unhealthy dietary patterns among adolescents.

Looking forward, the development of future programs could expand upon these findings by incorporating longer follow up evaluations to assess the sustainability of behavioral changes and by integrating digital learning platforms to enhance engagement and accessibility. Further studies may also explore the inclusion of parents, teachers, and community stakeholders to strengthen the ecological support system surrounding adolescents' dietary behaviors. Additionally, adapting the training model to diverse cultural and educational settings may contribute to broader application and scalability. Overall, this program provides a foundation for the continued development of community based nutrition education initiatives aimed at preventing cardiometabolic risk and promoting healthier lifestyle trajectories among adolescents.

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### AUTHOR CONTRIBUTION STATEMENT

BS conceptualized the community service program, coordinated the implementation, conducted data organization, and led the manuscript writing process. DB contributed to the development of educational materials, facilitated training sessions, and assisted in data interpretation and manuscript revision. NA supported the preparation of learning instruments, participated in program delivery, and contributed to editing and finalizing the manuscript. All authors reviewed and approved the final version of the article.

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