



COMMUNITY-BASED SCREENING AND HEALTH EDUCATION ON NON-COMMUNICABLE DISEASE RISK FACTORS AMONG HIGH SCHOOL STUDENTS

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Abstrak

Program pengabdian kepada masyarakat ini bertujuan untuk mengidentifikasi faktor risiko PTM serta meningkatkan pengetahuan siswa mengenai gaya hidup sehat melalui kegiatan skrining dan edukasi kesehatan. Kegiatan dilaksanakan di SMA Muhammadiyah 5 Kisaran, Kabupaten Asahan, Sumatera Utara, dengan melibatkan 300 siswa. Kegiatan yang dilakukan meliputi penilaian food recall, skrining aktivitas fisik, penilaian perilaku merokok, pengukuran antropometri, edukasi kesehatan, dan konseling individu. Hasil kegiatan menunjukkan bahwa 52,7% siswa memiliki pola makan kategori sedang, sedangkan 27,3% memiliki pola makan kurang baik. Tingkat aktivitas fisik sedang ditemukan pada 54,0% responden, sementara 26,0% memiliki aktivitas fisik rendah. Sebagian besar responden tidak merokok (79,3%), namun 12,7% pernah mencoba merokok dan 8,0% merupakan perokok aktif. Hasil skrining faktor risiko PTM menunjukkan bahwa 44,7% peserta berada pada kategori risiko sedang dan 18,6% pada kategori risiko tinggi. Setelah intervensi, rata-rata skor pengetahuan meningkat dari 61,8 menjadi 85,6 dengan selisih rata-rata sebesar 23,8 poin. Tingginya tingkat kepuasan dan partisipasi peserta menunjukkan bahwa promosi kesehatan berbasis sekolah efektif dalam mendukung pencegahan dini PTM pada remaja. Program ini berkontribusi sebagai model implementasi skrining faktor risiko PTM dan edukasi kesehatan berbasis sekolah yang dapat direplikasi sebagai upaya promotif dan preventif untuk meningkatkan perilaku hidup sehat pada remaja.

Kata kunci: Kesehatan Remaja; Pendidikan Kesehatan; Penyakit Tidak Menular.

Abstract

This community service program aimed to identify NCD risk factors and improve students' knowledge of healthy lifestyles through screening and health education activities. The program was conducted at SMA Muhammadiyah 5 Kisaran, Asahan Regency, North Sumatra, involving 300 students. Activities included food recall assessment, physical activity screening, smoking behavior assessment, anthropometric measurements, health education, and individual counseling. The findings showed that 52.7% of students had moderate dietary habits, while 27.3% demonstrated poor dietary patterns. Moderate physical activity levels were observed in 54.0% of participants, whereas 26.0% had low physical activity. Most respondents were non-smokers (79.3%), although 12.7% had experimented with smoking and 8.0% were current smokers. NCD risk screening revealed that 44.7% of participants were at moderate risk and 18.6% at high risk. Following the intervention, the mean knowledge score increased from 61.8 to 85.6, with a mean difference of 23.8 points. High participant satisfaction and engagement indicated that school-based health promotion effectively supports early NCD prevention among adolescents. This program contributes as a model for the implementation of NCD risk factor screening and school-based health education that can be replicated as a promotive and preventive effort to improve healthy living behaviors in adolescents.

Keywords: Adolescents; Health Education; Non-Communicable Diseases.

INTRODUCTION

Adolescence is a critical period for establishing health behaviors that may persist into adulthood. Unhealthy dietary habits, insufficient physical activity, prolonged sedentary behavior, and smoking are among the major risk factors contributing to the development of Non-Communicable Diseases (NCDs) later in life. Recent evidence indicates that many adolescents worldwide do not meet the recommended levels of physical activity and continue to engage in behaviors that increase their risk of obesity, cardiovascular disease, diabetes, and other chronic conditions (WHO, 2024).

The community partner in this program was SMA Muhammadiyah 5 Kisaran, Asahan Regency, North Sumatra. Prior to the implementation of the community service activity, a preliminary needs assessment was conducted through direct observation of the school environment and informal interviews with school administrators, teachers, and student representatives. The assessment revealed several health-related concerns among students. Teachers reported that many students frequently consumed fast food and sugar-sweetened beverages, spent substantial time using smartphones and other digital devices, and rarely participated in regular physical activity outside mandatory school activities. In addition, several students were reported to be exposed to smoking behavior within their social environments, increasing their risk of adopting similar habits (Benavides, C., Benítez-Andrades, J. A., Marqués-Sánchez, P., & Arias, 2024).

The preliminary assessment also showed that the school had not previously conducted a structured screening program to identify NCD risk factors among students. Existing school health activities were generally limited to routine health counseling and occasional health campaigns, without systematic assessment of students' dietary patterns, physical activity levels, smoking behavior, or other lifestyle-related risk factors. As a result, neither the school nor the students had baseline information regarding the prevalence of NCD risk factors within the student population (Marques-Sánchez, P., Benítez-Andrades, J. A., Calvo Sánchez, M. D., & Arias, 2024).

This situation highlights an important gap in school-based health promotion efforts. While health education activities have been implemented in many schools, programs that integrate behavioral risk-factor screening with immediate health education interventions remain limited. Recent studies have emphasized that early identification of unhealthy behaviors through school-based screening programs can significantly improve adolescents' awareness of health risks and encourage positive lifestyle changes (Benítez-Andrades, J. A., Arias, N., García-Ordás, M. T., 2024). Furthermore, evidence from multinational studies suggests that physical inactivity, sedentary behavior, and smoking exposure frequently coexist among adolescents



and contribute to adverse health outcomes (de Victo, E. R., Ferrari, G., Drenowatz, C., 2024)

Considering the findings of the needs assessment, there was a clear need for a comprehensive community service program that combined risk-factor screening with health education. Such an approach would not only provide data regarding students' health-risk profiles but also increase their knowledge and awareness of healthy lifestyle behaviors. Therefore, this community service program aimed to conduct screening of NCD risk factors, including food recall, physical activity, and smoking behavior, followed by health education sessions among students of SMA Muhammadiyah 5 Kisaran. The results of this activity are expected to support the school in developing evidence-based health promotion programs and contribute to the early prevention of NCDs among adolescents.

METHOD

This community service program employed a participatory approach through community-based screening and health education activities aimed at identifying Non-Communicable Disease (NCD) risk factors among adolescents and increasing students' awareness of healthy lifestyle behaviors. The activity combined screening, health education, counseling, and evaluation as an integrated health promotion strategy. The program was conducted at SMA Muhammadiyah 5 Kisaran, Asahan Regency, North Sumatra, Indonesia, from January 12–15, 2026. The participants consisted of 300 students of SMA Muhammadiyah 5 Kisaran who voluntarily participated in the activity. Total participation sampling was applied to involve all students attending the program.

The community service program was implemented in three main stages: preparation, implementation, and evaluation. During the preparation stage, coordination meetings were conducted with the school principal, teachers, and the School Health Unit (UKS), administrative approval was obtained, preliminary observations were carried out to identify students' health problems and NCD risk factors, and screening instruments, educational materials, logistics, schedules, and operational procedures were prepared. The implementation stage included participant registration, screening of NCD risk factors using structured questionnaires on dietary habits (food recall), physical activity, smoking behavior, and general health status, followed by anthropometric measurements (body weight, height, and Body Mass Index [BMI]) to assess nutritional status. Subsequently, health education was delivered through lectures, interactive discussions, and visual presentations focusing on healthy eating, physical activity, smoking prevention, and NCD prevention, while individual counseling was provided to students identified as having moderate or high-risk behaviors to encourage healthier lifestyle choices. Finally, the evaluation stage assessed participants' understanding through question-and-answer sessions and interactive discussions, enabling reinforcement of key

health messages while evaluating the overall effectiveness of the program implementation.

In addition to assessing participants' understanding, all program activities were systematically documented through attendance records, photographs, and activity reports. This documentation served as evidence of program implementation and facilitated the evaluation of participant engagement throughout the activity. Furthermore, monitoring and follow-up recommendations were developed and communicated to the school to support the sustainability of health promotion initiatives. These recommendations focused on strengthening future health education programs and encouraging the continuous adoption of healthy behaviors among students.

The overall implementation of the community service program followed a systematic sequence of activities, beginning with problem identification and preparation, followed by participant registration, screening of NCD risk factors, anthropometric measurements, health education, individual counseling, evaluation, and follow-up. This structured approach ensured that each stage of the program was carried out effectively and contributed to the achievement of the program objectives.

Data collection was carried out using a structured questionnaire designed to assess various health-related factors associated with the risk of Non-Communicable Diseases (NCDs) among students. The questionnaire consisted of four main sections. The first section was the Food Recall Questionnaire (Items 1–20), which was used to assess the types, frequency, and quantity of food and beverage consumption. This section provided information regarding students' dietary habits and nutritional intake patterns. The second section was the Physical Activity Questionnaire (Items 21–25), which evaluated the frequency, duration, and intensity of students' daily physical activities. The information obtained from this section was used to identify activity patterns and determine whether participants met recommended levels of physical activity.

The third section consisted of the Smoking Behavior Questionnaire (Items 26–27), which assessed students' smoking history and their exposure to smoking environments. This section aimed to identify behavioral risk factors related to tobacco use and passive smoking. The final section was the Health Status Questionnaire (Items 28–35), which explored participants' general health conditions, physical complaints, and potential indicators of health problems. The data collected from this section provided a broader understanding of the students' overall health status and helped identify potential health concerns requiring further attention.

The research instruments used in this study consisted of two types of questionnaires: a food recall questionnaire and a risk factor questionnaire (covering physical activity, smoking habits, and students' health status). Both instruments



were used to systematically collect primary data on students' food recall, risk factors, and health status at the Muhammadiyah Kisaran Private School. Food recall in this study was measured using a questionnaire designed to assess the types, amounts, and frequency of students' food and beverage consumption over a specific period. This instrument was chosen because it can accurately describe students' dietary patterns and has been widely used in nutrition and public health research. Respondents were asked to record or recall all foods and beverages consumed during the specified time period, thereby providing a realistic picture of their dietary intake.

Meanwhile, students' risk factors and health status were measured using a questionnaire that assessed physical activity, smoking habits, and general health conditions. This questionnaire was used as a screening tool to describe students' health risks and overall health status, not as a clinical diagnostic tool. Each question was designed to explore students' behavioral experiences and health conditions in their daily lives. The details of the aspects assessed in the risk factor questionnaire and health status are presented in Table 1.

Table 1. Food Recall Questions, Risk Factors, and Students' Health Status

No.	Assessed Aspect	Item Numbers	Content Assessed (Summary)
1	Food Recall	1-20	Types, quantities, and frequency of students' daily food and beverage consumption
2	Physical Activity	21-25	Frequency, duration, and intensity of students' physical activities
3	Smoking Habits	26-27	Smoking history and frequency of students' smoking behavior
4	Health Status	30-35	General health condition, physical complaints, and indications of health disorders experienced by students

The collected data were analyzed descriptively using frequency distributions and percentages. The screening results were presented in tables to describe students' food recall patterns, risk-factor categories, and overall health status. The findings were subsequently used as the basis for health education and counseling interventions.

RESULTS AND DISCUSSION

RESULT

Based on the results of the food recall assessment conducted among 300 students at Muhammadiyah 5 Kisaran Senior High School, the majority of respondents were classified in the moderate food recall category, accounting for 158 students (52.7%). This finding indicates that more than half of the students had relatively adequate dietary habits. Their eating patterns generally included regular meal consumption and intake of several essential food groups. However, these dietary practices were not yet fully aligned with the principles of a balanced diet, as

some students still frequently consumed foods high in sugar, salt, and fat, while their intake of fruits and vegetables remained below the recommended levels.

A total of 82 students (27.3%) were categorized as having low food recall. This group demonstrated less healthy dietary behaviors, including skipping meals, inadequate consumption of fruits and vegetables, and frequent intake of fast food, sugar-sweetened beverages, and nutrient-poor snacks. Such dietary patterns may increase the risk of nutritional problems and contribute to the development of non-communicable disease (NCD) risk factors later in life, including obesity, diabetes mellitus, and hypertension.

Meanwhile, 60 students (20.0%) were classified in the high food recall category. These students exhibited healthier dietary patterns characterized by a more diverse and balanced food intake. They were more likely to consume adequate amounts of carbohydrates, proteins, fruits, and vegetables while limiting the consumption of unhealthy foods and beverages. Such positive dietary behaviors can support optimal growth and development, strengthen the immune system, and reduce the risk of chronic diseases in adulthood. Overall, the findings indicate that while the majority of students demonstrated moderate dietary habits, more than one-quarter of the respondents still practiced unhealthy eating behaviors. Therefore, continuous health education and nutrition promotion programs are needed within the school environment to improve students' awareness of balanced nutrition and encourage healthier eating habits as an important strategy for the early prevention of non-communicable diseases.

Table 2. Distribution of Participants' Physical Activity Levels

Physical Activity Category	Frequency (n)	Percentage (%)
Low	78	26.0
Moderate	162	54.0
High	60	20.0
Total	300	100.0

Based on Table 2, the majority of participants had a moderate level of physical activity, accounting for 162 students (54.0%). This finding indicates that most students engaged in regular physical activities through school-related sports, recreational activities, or daily routines. However, the frequency, duration, and intensity of these activities may not have fully met the recommended physical activity guidelines for adolescents.

A total of 78 students (26.0%) were classified as having low physical activity levels. This group tended to exhibit sedentary lifestyles characterized by prolonged sitting, excessive screen time, playing electronic games, or other activities involving minimal physical movement. Such behaviors may increase the risk of obesity and other non-communicable diseases (NCDs) later in life. Meanwhile, 60 students (20.0%) were categorized as having high physical activity levels. These students regularly participated in sports or other physical activities with sufficient frequency



and duration, which may contribute to better overall health and lower risk of developing NCDs compared to their peers.

Table 3. Distribution of Participants' Smoking Behavior

Smoking Behavior Category	Frequency (n)	Percentage (%)
Non-Smoker	238	79.3
Ever Smoked	38	12.7
Current Smoker	24	8.0
Total	300	100.0

Based on Table 3, the majority of participants were non-smokers, with 238 students (79.3%) reporting that they had never smoked. This finding suggests that most students had a relatively good awareness of the harmful effects of smoking and had avoided tobacco use. A total of 38 students (12.7%) reported that they had experimented with smoking but did not smoke regularly. This group may have been exposed to smoking behaviors through peers, family members, or social influences. Although they were not current smokers, these students remain at risk of adopting regular smoking habits in the future. Additionally, 24 students (8.0%) were identified as current smokers. Although this proportion was relatively small, the presence of active smokers among adolescents remains a public health concern because smoking is associated with various adverse health outcomes, including respiratory diseases, cardiovascular diseases, and impaired growth and development.

Table 4. Distribution of Participants According to NCD Risk Level

NCD Risk Category	Frequency (n)	Percentage (%)
Low Risk	110	36.7
Moderate Risk	134	44.7
High Risk	56	18.6
Total	300	100.0

Based on Table 4, the largest proportion of participants fell into the moderate-risk category, with 134 students (44.7%). This level of risk was determined by the presence of one or more risk factors, such as suboptimal dietary habits, insufficient physical activity, exposure to cigarette smoke, or unhealthy nutritional status. A total of 110 students (36.7%) were classified as having a low risk of NCDs. These students generally demonstrated healthier behaviors, including balanced dietary patterns, adequate physical activity, non-smoking status, and normal nutritional status. Such behaviors are associated with a lower likelihood of developing chronic diseases in the future.

Meanwhile, 56 students (18.6%) were categorized as having a high risk of NCDs. This group exhibited multiple risk factors, including low levels of physical activity, unhealthy dietary habits, overweight or obesity, and smoking behavior. These findings highlight the need for targeted interventions, including health

education, individualized counseling, and regular monitoring, to prevent the progression of risk factors into chronic diseases during adulthood.

Overall, the screening results indicate that although many students demonstrated relatively healthy behaviors, a considerable proportion still exhibited risk factors for non-communicable diseases. Therefore, continuous health promotion programs focusing on increasing physical activity, improving dietary habits, preventing smoking behavior, and monitoring health status are necessary within the school setting to support the early prevention of NCDs among adolescents.

Table 5. Pre-test and Post-test Knowledge Scores of Participants

Assessment	Mean Score	SD	Mean Difference
Pre-test	61.8	11.4	
Post-test	85.6	8.7	23.8

Based on Table 2, the average knowledge score of participants before the educational intervention (pre-test) was 61.8 with a standard deviation (SD) of 11.4. This result indicates that students' initial knowledge regarding healthy dietary habits, physical activity, smoking prevention, and non-communicable disease (NCD) risk factors was at a moderate level. The relatively high standard deviation suggests that there was considerable variation in knowledge levels among participants prior to the intervention.

Following the health education program, the average knowledge score increased substantially to 85.6 with a standard deviation of 8.7. This improvement demonstrates that participants gained a better understanding of the health topics presented during the educational sessions. The lower standard deviation observed in the post-test results indicates that students' knowledge scores became more homogeneous, suggesting that the intervention helped reduce disparities in understanding among participants.

The mean difference between the pre-test and post-test scores was 23.8 points, indicating a substantial increase in knowledge after the educational intervention. This finding suggests that the health education activities were effective in enhancing students' awareness and understanding of healthy lifestyle behaviors and NCD prevention. The considerable improvement in scores reflects the success of the educational methods used, including lectures, interactive discussions, visual presentations, and counseling sessions, in delivering health-related information to the participants. Overall, these results demonstrate that the health education program had a positive impact on students' knowledge and supports the importance of implementing school-based health promotion programs as a strategy for improving adolescents' health literacy and encouraging healthier lifestyle choices.



Table 6. Participant Satisfaction with Health Screening and Education Activities

Satisfaction Category	Frequency (n)	Percentage (%)
Very Satisfied	176	58.7
Satisfied	95	31.7
Fairly Satisfied	23	7.6
Dissatisfied	6	2.0
Total	300	100.0

Based on Table 6, the level of participant satisfaction with the health screening and education activities was highly positive. Out of 300 participants, 176 students (58.7%) reported being very satisfied with the program. This finding indicates that the majority of participants perceived the activities as highly beneficial, both in terms of the educational content delivered and the services provided throughout the program. The high level of satisfaction suggests that the activities successfully met students' needs for health-related information and provided a valuable learning experience.

A total of 95 students (31.7%) reported being satisfied with the activities. These participants believed that the program contributed positively to their understanding of healthy lifestyles, non-communicable disease (NCD) risk factors, the importance of regular physical activity, and smoking prevention. In addition, health screening activities, including anthropometric measurements and individual counseling, were considered helpful in increasing students' awareness of their personal health status.

Meanwhile, 23 students (7.6%) stated that they were fairly satisfied with the program. Although they generally acknowledged the benefits of the activities, some aspects may still require improvement, such as extending the duration of educational sessions, providing more opportunities for discussion, or utilizing more engaging and interactive educational media. Only 6 students (2.0%) reported being dissatisfied with the activities. This very small proportion indicates that the program was well accepted by most participants. The dissatisfaction expressed by a few students may have been influenced by individual factors, such as differences in interest toward health-related topics, limited program duration, or expectations that were not fully met during the implementation of the activities.

Overall, the satisfaction evaluation demonstrates that the health screening and education program received a very positive response from participants, with 90.4% of students reporting that they were either very satisfied or satisfied with the activities. These findings indicate that the community service program successfully provided meaningful benefits to participants while increasing their awareness and knowledge regarding the importance of maintaining good health and preventing non-communicable disease risk factors from an early age. The high level of participant satisfaction also serves as an indicator of the program's success and supports the continuation and expansion of similar school-based health promotion initiatives in the future.

Table 7. Participant Participation Rate During Community Service Activities

Activity Component	Number of Participants (n)	Participation Rate (%)
Registration	300	100.0
Completion of Screening Questionnaire	300	100.0
Anthropometric Measurement	300	100.0
Health Education Session	293	97.7
Question and Answer Session	268	89.3
Individual Counseling	245	81.7

Based on Table 7, the level of participant involvement throughout the community service program was exceptionally high across all activity components. Of the 300 students who participated in the program, all students (100.0%) completed the registration process. This full participation at the initial stage demonstrates strong support from the school and a high level of enthusiasm among students to engage in the activities provided. Similarly, all participants (100.0%) completed the health screening questionnaire. This finding indicates that students were willing to provide information regarding their dietary habits, physical activity patterns, smoking behavior, and general health status. The complete participation in questionnaire completion ensured the availability of comprehensive data for identifying risk factors associated with Non-Communicable Diseases (NCDs) among adolescents.

Participation in anthropometric measurements was also 100.0%, with all students undergoing body weight and height measurements as well as Body Mass Index (BMI) calculation. This high level of participation reflects students' awareness of the importance of monitoring their health and nutritional status as part of early disease prevention efforts. Participation remained very high during the health education sessions, with 293 students (97.7%) attending. Only a small number of participants were unable to attend the entire session, possibly due to personal reasons or time constraints. The high attendance rate indicates a strong interest among students in learning about healthy lifestyles, smoking prevention, adequate physical activity, and strategies for preventing Non-Communicable Diseases.

During the question-and-answer and interactive discussion sessions, 268 students (89.3%) actively participated. This percentage suggests that most students were not only present but also actively engaged in the learning process by asking questions, sharing opinions, and discussing the health topics presented. Active participation is an important indicator of educational effectiveness, as it reflects students' interest, understanding, and willingness to interact with the material.

A total of 245 students (81.7%) participated in individual counseling sessions. Although this participation rate was slightly lower than that of other activities, it still represents a high level of engagement. Individual counseling provided students with the opportunity to receive personalized advice and



recommendations based on their specific health conditions and risk factors. Some students may not have attended these sessions because they felt additional consultation was unnecessary or because of limited time availability.

Overall, the findings demonstrate that student engagement was consistently high throughout the program. The excellent participation rates in registration, health screening, anthropometric assessment, health education, discussion sessions, and individual counseling indicate that the community service program was well received by participants. These results further suggest that integrating health screening, education, and counseling within a school setting is an effective strategy for promoting health awareness, encouraging active participation, and fostering healthy lifestyle behaviors among adolescents.

DISCUSSION

The food recall assessment showed that most respondents had a moderate dietary intake (52.7%), followed by low (27.3%) and high (20.0%) categories, indicating that although dietary habits were relatively adequate, they had not fully met balanced nutrition recommendations. The considerable proportion of students with low dietary intake reflects unhealthy eating behaviors, including insufficient fruit and vegetable consumption and frequent intake of fast food and sugar-sweetened beverages. Similar findings have been reported by Hidayat et al. (2025), who observed moderate diet quality with limited dietary diversity, while Rathi et al. (2025) found that fewer than 10% of adolescents met the recommended fruit and vegetable intake. In addition, D'Antonio et al. (2024), Martínez-Gómez et al. (2025), Alves-Costa et al. (2024), Cini et al. (2024), and Mekonen and Abebe (2025) consistently demonstrated that unhealthy dietary patterns, excessive sugar intake, and poor nutritional habits increase adiposity, cardiometabolic risk, and the likelihood of developing non-communicable diseases (NCDs). These findings underscore the importance of continuous school-based nutrition education to promote balanced diets and healthier eating behaviors among adolescents.

Most participants also demonstrated a moderate level of physical activity (54.0%), whereas 26.0% had low and only 20.0% had high physical activity levels. Although many students engaged in routine school or recreational activities, more than one-quarter remained insufficiently active, increasing their risk of obesity, cardiovascular disease, metabolic disorders, and poor mental health. These findings are consistent with studies by Weimann et al. (2025), Chen et al. (2025), Costa et al. (2025), Zhang et al. (2025), Silva et al. (2025), Ma et al. (2025), and Stavinski et al. (2025), which demonstrated that adequate physical activity improves physical fitness, BMI, cardiometabolic health, quality of life, and psychological well-being, while school-based interventions effectively increase activity levels and reduce sedentary behavior. Therefore, strengthening school health promotion programs remains essential for preventing NCDs among adolescents.

Regarding smoking behavior, 79.3% of respondents were non-smokers, while 12.7% had experimented with smoking and 8.0% were current smokers. Although the prevalence of active smoking was relatively low, experimentation during adolescence remains concerning because it increases the likelihood of long-term tobacco use. Recent studies by Silva et al. (2025) identified peer influence, family smoking behavior, curiosity, and social media exposure as important determinants of smoking initiation and reported associations with respiratory, cardiovascular, and mental health problems. Consistent with Wang et al. (2024), Benítez-Andrades et al. (2024), and Ahmed et al. (2025), these findings highlight the importance of comprehensive school-based smoking prevention programs, smoke-free school policies, family involvement, and health literacy enhancement.

The NCD risk screening revealed that 44.7% of students were classified as having moderate risk, 36.7% low risk, and 18.6% high risk, suggesting that a considerable proportion of adolescents already possess modifiable risk factors despite the absence of overt disease. These findings are supported by Cini et al. (2024), Alves-Costa et al. (2024), D'Antonio et al. (2024), Martínez-Gómez et al. (2025), Mekonen and Abebe (2025), Santos Silva et al. (2025), and Zhang et al. (2025), who consistently reported that unhealthy diets, inadequate physical activity, sedentary lifestyles, poor sleep, and socioeconomic factors contribute to cardiometabolic risk and future NCD development. Comprehensive school-based interventions integrating nutrition education, physical activity promotion, smoking prevention, and regular health screening are therefore essential to reduce long-term disease risk.

The health education intervention substantially improved participants' knowledge, with mean scores increasing from 61.8 ± 11.4 before the intervention to 85.6 ± 8.7 afterward (mean difference = 23.8 points). This finding agrees with Shrestha et al. (2025), Waliyanti et al. (2025), who demonstrated that interactive, digital, audiovisual, and participatory educational approaches significantly improve adolescents' knowledge, health literacy, and awareness of healthy lifestyles and NCD prevention. These findings support the integration of regular health education into school curricula as an effective strategy to encourage lifelong healthy behaviors.

The program also achieved very high levels of satisfaction and participation. More than 90% of respondents reported being satisfied or very satisfied with the health screening and education activities, while participation reached 100% for registration and screening, 97.7% during health education sessions, 89.3% in question-and-answer activities, and 81.7% in individual counseling. Similar outcomes were reported by Adewale et al. (2025), Morrison et al. (2025), and Nørgaard et al. (2025), who found that participatory school-based health promotion programs combining screening, education, discussion, and individualized counseling enhance student engagement, satisfaction, health literacy, and behavioral commitment. Collectively, these findings demonstrate that integrated



school-based health promotion programs are both feasible and effective in supporting early prevention of NCDs among adolescents.

CONCLUSION AND SUGGESTIONS

This community service program successfully identified Non-Communicable Disease (NCD) risk factors among students and improved their knowledge of healthy lifestyles. Most participants had moderate dietary habits, physical activity levels, and NCD risk status. Health education effectively increased students' knowledge, while high participation and satisfaction rates indicated strong engagement throughout the program.

It is recommended that schools conduct regular health screening and health education activities to promote healthy eating, physical activity, and smoking prevention among adolescents. Continuous collaboration between schools, families, and health professionals is needed to support sustainable healthy behaviors and reduce future NCD risks.

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