



The Effect of Counseling and Training on Low-Sugar Food Processing with Lifestyle Modification Strategies for Diabetes Mellitus Prevention

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ABSTRACT

Background: Diabetes mellitus (DM) is a chronic disease with rising global prevalence, including in Indonesia. In Dusun Banjar Tengah, Dau District, Malang, community health challenges include low nutritional knowledge, high consumption of sweet foods and beverages among adolescents and young adults, and increasing cases of overweight individuals, highlighting the need for effective diabetes prevention interventions.

Purpose of the Study: This community service program aims to evaluate the impact of counseling and training on low-sugar food processing with lifestyle modification strategies in preventing diabetes mellitus among the community of Dusun Banjar Tengah.

Methods: The program involved 31 community participants (mostly adolescents aged <20 years) over four months. Activities included initial health assessments, health screenings, blood sugar level evaluations, and structured counseling and training sessions led by clinical nutritionists. Participants engaged in practical demonstrations of preparing sugar-free herbal tea and high-fiber beverages. Effectiveness was measured using pretest and posttest questionnaires analyzed with paired t-test.

Results: The program demonstrated a significant increase in participants' knowledge, with the average pretest score improving from 81.45 to 89.31 on the posttest, with a significance value of 0.016 ($p < 0.05$). Most participants (77%) had normal blood sugar levels. Participants showed high enthusiasm during practical sessions and expressed intentions to adopt low-sugar dietary practices. The program effectively improved the community's knowledge about diabetes prevention and promoted healthier lifestyle behaviors.

Keywords

Counseling; Diabetes Mellitus; Prevention; Low-Sugar Food; Lifestyle Modification; Community Service; Health Education

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Introduction

Diabetes mellitus (DM) is a chronic disease with a rising global prevalence, including in Indonesia. It is characterized by elevated blood glucose levels resulting from either insulin deficiency or the body's inability to utilize insulin effectively (Darenskaya et al., 2021). DM is generally classified into diabetes type 1 and type 2. Type 1 DM primarily affects children and adolescents, whereas type 2 DM is more prevalent among adults and is frequently associated with unhealthy lifestyle factors, such as obesity and physical inactivity (Ceriello & Prattichizzo, 2021). The International Diabetes Federation (IDF) predicts that the number of individuals with diabetes in Southeast Asia will increase from 90 million in 2021 to 151 million by 2045. In Indonesia, the prevalence of DM has risen substantially in recent years and Indonesia ranked fifth globally with 19.5 million cases in 2021 and expected to rise to 28.6 million by 2045 (Magliano & Boyko, n.d.). At the local level, the Malang City Health Office reported an increase in DM cases from 22,086 in 2021 to 22,227 in 2022 (Dinas Kesehatan Kota Malang, 2023).

The growing number of diabetes cases is a critical public health issue that requires prioritization in Indonesia. DM is also associated with an increased risk of severe complications, including cardiovascular disease, blindness, kidney failure, and limb amputation (Tomic et al., 2022). Moreover, diabetes even affects the quality of life and imposes a substantial economic burden on society (Smith et al., 2024). Therefore, effective prevention and management strategies are required to mitigate the health and socioeconomic consequences of diabetes mellitus.

Various interventions have been proposed for the prevention and management of diabetes mellitus, including lifestyle modifications, pharmacological therapy, and education (American Diabetes Association Professional Practice Committee et al., 2024). Promoting healthy eating habits, particularly by reducing sugar and processed food consumption is the primary strategy (Feinman et al., 2015). Educational campaigns have proven effective in fostering healthier lifestyles. Counseling and training on low-sugar food processing and lifestyle modifications can enhance community knowledge and skills in selecting and preparing nutritious foods to prevent diabetes (Feinman et al., 2015).

In addition to regional and national data, a focus group discussion (FGD) involving the village head, the head of the Family Welfare Empowerment (PKK) group and the local midwife revealed several health-related challenges in Dusun Banjar Tengah, the target community. The community still exhibits low levels of nutritional knowledge, particularly among younger people. Adolescents and young adults reportedly consume excessive amounts of sweet foods and beverages, which contributes to an increased risk of obesity and metabolic disorders. While there is no formal data on obesity prevalence, health workers have noted an increase in cases of being overweight. Conversely, the village has significant potential for health interventions, including active PKK cadres, regular community health posts (Posyandu) and accessible village facilities for educational activities. Furthermore, community members have expressed a high level of enthusiasm for participating in health education programmes.

Table 1: Health Issues and Community Potentials in Dusun Banjar Tengah Based on FGD Results

Aspect	Findings	Source
Nutritional knowledge	Many residents, especially youth, lack understanding of balanced nutrition	FGD with village stakeholders
Sugar consumption	High intake of sweet foods and drinks among adolescents and young adults	FGD with PKK and village midwife
Obesity	Increasing cases of overweight individuals observed in the community	FGD with village midwife

Health program support infrastructure	Active Posyandu, available village hall	PKK cadres, functioning	FGD with village head
Community engagement	High enthusiasm for counseling and training sessions	for attending	Observation during interventions

The increasing prevalence of diabetes mellitus globally requires a comprehensive approach in improving health care and reducing the societal burden that follows. This research was performed to address the increasing prevalence of diabetes mellitus by enhancing community knowledge and skills in low-sugar food preparation and lifestyle modification. To address this issue, counseling and training sessions were conducted for the community of Dusun Banjar Tengah, Dau District, Malang. In response to epidemiological data, intervention should be carried out to address the uptrend prevalence of diabetes in Malang Regency. In this research, the effectiveness of interventions aimed at reducing this prevalence was analyzed. This research also proposes recommendations for more effective diabetes prevention initiatives in the future.

Method

This community service program adopted a Service-Learning approach, aiming to integrate academic knowledge with real-world community empowerment. Through this participatory method, facilitators collaborated with community members to identify health challenges and co-develop practical interventions focused on diabetes prevention.

The program was conducted in Dusun Banjar Tengah, Dau District, Malang Regency, from November 13, 2022, to March 5, 2023. It targeted 31 residents and members of the Family Welfare Movement (PKK), who participated in structured sessions designed to improve their knowledge and practices related to low-sugar food processing and diabetes prevention. The collected data, including pretest and posttest results, were analyzed using SPSS to evaluate improvements in participants' knowledge.

Initial Assessment

This stage included participant registration, anamnesis, and basic health screenings (blood sugar levels, blood pressure, and BMI). Community health promotion and communication were also conducted, with a particular focus on the role of PKK members in supporting healthy behavior within the community.

Follow-Up Assessment and Education

This stage replicated the format of Stage 1 and incorporated a review of changes in blood sugar levels along with an evaluation of the effectiveness of previous interventions. It served as both reinforcement and feedback collection.

Counseling and Training

The final stage of the program comprised a series of structured activities aimed at deepening participants' understanding and practical competence. It commenced with a pretest to assess baseline knowledge of diabetes and nutrition, followed by a counseling session led by clinical nutritionists who delivered visual presentations outlining the definition, causes, symptoms, and preventive strategies of diabetes through low-sugar food processing. Participants then engaged in a practical training and demonstration session, during which they learned to prepare sugar-free herbal tea and high-fiber beverages. The program proceeded with a question-and-answer discussion that encouraged active participation and allowed clarification of key concepts. This stage concluded with a posttest administered to evaluate improvements in participants' knowledge after the intervention.

Each stage was designed to build on the previous one, progressively enhancing community awareness of diabetes prevention and equipping participants with practical, applicable skills. This structured progression exemplifies the principles of the Service-Learning framework, aligning academic engagement with meaningful community outcomes. The counseling sessions were delivered using interactive educational materials that encouraged community participation and engagement (Figure 1).

This community service program did not require ethical approval as it involved health education activities without clinical intervention, and all participants provided informed consent.

Result

Participant Demographics

This counseling and training activity was attended by 31 female participants from Dusun Banjar Tengah, Dau District, Malang. Participants in the counseling and training program mostly aged <20 years (65%), followed by those aged 40–49 years (16%), 50–59 years (10%), 20–29 years (6%), and 30–39 years (3%). In terms of educational background, the largest proportion of participants have completed high school (39%), while 23% hold a bachelor's degree, 19% have an elementary school education, 16% have completed junior high school, and 3% possess a diploma. Regarding employment status, 77% of participants are unemployed, 13% work in the private sector, 6% are self-employed, and 3% are laborers. Additionally, 84% of participants do not have a family history of diabetes, whereas 16% have a familial predisposition to the disease. The primary source of diabetes-related information for participants is healthcare professionals (65%), followed by family and neighbor health workers (19%), seminars (16%), family members (3%), and scientific articles (3%).

Table 2: Respondents' Characteristics

Variable	Total	
	n	%
Number of subjects	31	100
Age		
< 20	20	65%
20-29	2	6%
30-39	1	3%
40-49	5	16%
50-59	3	10%
Education		
Elementary School	6	19%
Junior High School	5	16%
Senior High School	12	39%

Associate's Degree	1	3%
Undergraduate Degree	7	23%
Employment		
Private Sector	4	13%
Entrepreneur	2	6%
Labor	1	3%
Unemployed	24	77%
Family DM History		
Yes	5	16%
No	26	84%
Source of Information on Diabetes		
Healthcare Workers	20	65%
Seminars	5	16%
Family	1	3%
Healthcare Workers, Family, Neighbor	4	19%
Academic Articles	1	3%

Initial Assessment Outcomes

Most of the respondents have normal blood sugar levels (77%), while 16% are classified as prediabetic, and 6% have diabetes. Most participants' blood sugar percentages were in the normal category. This is in accordance with the purpose of this activity, which is counseling and training on DM prevention strategies, which is targeted at people who have not yet been affected by DM. The 31 residents who came at a relatively young age (10-19 years old) showed their enthusiasm to learn about DM prevention, considering that prevention must be done as early as possible. This also shows the success of this event in increasing residents' interest in learning and trying low-sugar food making and lifestyle change strategies as DM prevention.

Table 3: Distribution of Respondents' Blood Glucose Levels

Classification	n	%
Normal	24	77%
Prediabetes	5	16%
Diabetes	2	6%

Follow-Up Assessment and Reinforcement

The follow-up assessment and mentoring stage aimed to reinforce participants' understanding and sustain behavioral changes introduced earlier. Mentoring was conducted through group discussions and individualized guidance led by facilitators, focusing on participants' progress in adopting low-sugar dietary practices. Approximately 85% of participants reported reducing their use of refined sugar and demonstrated improved comprehension of diabetes prevention strategies. Facilitators addressed common challenges, such as maintaining consistency in dietary changes, and provided practical solutions. The sessions were perceived as interactive and supportive, enhancing participants' motivation to sustain healthier habits.

Counseling and Training Evaluation

To assess the effectiveness of the counseling and training program, pre- and post-tests questionnaires were distributed, which results were analyzed using a paired t-test, as shown in Table 4. Table 4 shows that counseling and training on low-sugar food processing effectively enhanced participants' knowledge about diabetes. This is evidenced by the increase in the average pretest score from 81.45 ± 17.71 (Mean $\pm$ SD) to 89.31 ± 11.09 , with a significance value of 0.016 ($p < 0.05$). This result further supports the effectiveness of the counseling and training in improving the knowledge of residents in Dusun Banjar Tengah, Dau District, Malang.

Table 4. Pre and Posttest Results Analysis

Test	Minimum	Maximum	Mean $\pm$ Sd	Significance
Pre test	31.25	100	81.45 ± 17.71	0.016
Post test	56.25	100	89.31 ± 11.09	

The increased pretest and posttest results show the high enthusiasm and attention of the participants regarding the counseling delivered by nutritionists. It is also evident that participants can understand and remember the material that has been delivered by nutritionists, this indicates the success of this activity in making counseling easy to understand and easy to remember by participants. In addition, participants also showed good enthusiasm during the demonstration on making low-sugar foods by the nutritionist. Participants seemed interested to try it at home and apply it in their daily lives, as shown by the active participants asking more details about the recipes and ingredients used by the nutritionist during the demonstration.

Participant Engagement and Feedback

In the question-and-answer session the participants also showed their enthusiasm by actively asking questions, some participants also received prizes for actively asking and answering questions given by the speaker. Participants also said they were helped by this activity. They also said this activity was useful and could increase the knowledge of local residents about DM prevention strategies. Some participants have already planned to change their lifestyle and spread the information obtained to other local residents. They also hope that activities like this can continue and be held again in the future.



Figure 1. Education about diabetes mellitus

Program Impact and Sustainability

The positive outcomes of the mentoring and counseling sessions were reflected not only in the significant improvement of participants' test scores but also in observable behavioral changes. Participants began reducing refined sugar consumption, preparing low-sugar meals at home, and encouraging family members to adopt healthier diets. Feedback indicated that approximately 80–85% of participants sustained these changes in the weeks following the program. The active engagement of PKK members, the nutritionist, and the organizing team during the sessions (Figure 2) further illustrates the collaborative and participatory nature of the intervention. These results highlight the sustainability and community-level impact of the program, as participants continued to share the knowledge and motivate others to practice diabetes prevention strategies.



Figure 2. Documentation of the nutritionist, PKK members, and organizing committee after the counseling session.

Discussion

Interpretation of Community Profile

The participants in this study consisted of 31 elderly individuals who were residents and members of the Family Welfare Movement (PKK). Age plays a significant role in the risk of developing diabetes and prediabetes, with these conditions being more prevalent among older adults compared to younger individuals. In the elderly, being overweight is a major contributing factor to diabetes, while in prediabetes, factors such as education and cholesterol levels also have an influence, depending on age (Yan et al., 2023). The risk of developing type 2 diabetes gradually increases with age, especially after the age of 45 (Wardhani et al., 2025). This is due to physiological changes such as decreased pancreatic function, increased insulin resistance, and changes in body composition, including higher body fat (adiposity) and loss of muscle mass (sarcopenia) (Kirkman et al., 2012).

Effectiveness of the Intervention

The results of this study indicate that the intervention was effective. Factors such as young age, adequate education, reliable sources of information, availability of time due to unemployment, and appropriate evaluation methods likely contributed to the effectiveness of the counseling and training activities conducted.

The active participation of the community in the counseling and training activities held in Dusun Banjar Tengah indicates encouraging progress toward community empowerment. The majority of the 31 female participants were aged 10–19, suggesting a notable interest among younger individuals in gaining knowledge about diabetes and healthy lifestyles—an important foundation for long-term preventive efforts. Enthusiasm was particularly evident during the practical sessions, where participants were keen to recreate the low-sugar recipes introduced during the training. This active involvement not only reflects engagement but also demonstrates the transfer of practical skills. Participants were not merely receiving information; they were applying it in a meaningful way. The effectiveness of the training is further supported by the increase in knowledge shown through the pre- and post-test scores, which rose from an average of 81.45 to 89.31. This improvement highlights the success of the program in enhancing participants' understanding of diabetes and healthy food choices. Additionally, most participants cited healthcare professionals as their primary source of information, reinforcing the credibility of the knowledge shared. Overall, the combination of strong attendance, hands-on involvement, increased knowledge, and the ability to apply learned skills reflects a constructive process of empowerment within the community.

Although the counseling and training on low-sugar food processing successfully improved participants' knowledge significantly, several challenges were identified that should be considered for future activities. First, the wide age range of participants, from adolescents aged <20 years to older adults aged 50–59 years, potentially posed difficulties in delivering the material effectively. Differences in learning needs, information absorption abilities, and communication styles across age groups may have affected the training's overall effectiveness. Highly technical content or a lack of varied delivery methods might not have been suitable for both younger and older participants. Second, time constraints likely limited the depth of material coverage and the opportunity for hands-on practice. Limited time during the counseling sessions often reduces the possibility for thorough discussions, Q&A sessions, or practical activities. Third, the diverse educational backgrounds of the participants also influenced their understanding of the material. While most had completed secondary or higher education, some participants had only an elementary education, requiring simplified language and more visual or practical information delivery methods. Fourth, from a technical training perspective, challenges such as limited training tools, materials, or space may have hindered participants from fully engaging in practical sessions. Additionally, since the majority of participants (77%) were unemployed, this could present both an advantage and a challenge. On one hand, they might have more time to participate in the training, but on the other, limited prior access to information or experience in healthy food preparation could affect their active involvement.

Potential for Sustainability and Replication

The data suggests that the counseling and training program has strong potential for sustainability, both in terms of participant engagement and the readiness of the program implementers (PKK). The statistically significant increase in participants' knowledge scores ($p = 0.016$) indicates the effectiveness of the intervention and reflects a high level of participant involvement. Although explicit requests for follow-up sessions were not documented, the substantial knowledge gain and the relevance of the topic to the participants' daily lives imply a strong interest in continued learning. This interest can serve as a foundation for further sessions

or community health initiatives. The program aligns well with the principles of a community-based intervention (CBI), which emphasizes empowering local populations to play an active role in health improvement efforts. By addressing local needs, involving community members directly, and enhancing health literacy, this initiative demonstrates key characteristics of CBI. Moreover, the dominant presence of adolescent participants presents an opportunity to develop peer-led education or community health cadres. Given the success of this initial intervention, PKK appears well-positioned to expand the program into a sustainable community-driven model that integrates ongoing education, local leadership, and collaboration with healthcare providers.

Based on the data, the counseling and training program on low-sugar food processing combined with lifestyle modification strategies demonstrated strong effectiveness in increasing community knowledge about diabetes prevention. The program successfully engaged participants across various age groups and educational backgrounds, even though the majority were unemployed. The involvement of healthcare professionals as the primary source of information also contributed significantly to the program's success. Therefore, it is recommended that similar programs be expanded to other areas, incorporating broader collaboration across sectors such as healthcare facilities, educational institutions, and community organizations, in order to develop a more comprehensive and sustainable approach to diabetes prevention at the community level.

Table 2 presents the profile characteristics of 31 participants in counseling and training sessions. Participants mostly aged 10-19 years (65%), followed by those in the 40-49 years (16%), 50-59 years (10%), 20-29 years (6%), and 30-39 years (3%) age groups. This distribution aligns with the general trend that the prevalence of diabetes mellitus increases with age, peaking around 65 years ([Pinchevsky et al., 2020](#)). Participants are mostly high school graduates, while some others have lower educational levels. This situation has been associated with higher risk factors for diabetes, such as prolonged sitting, obesity, and alcohol consumption. Whereas, individuals with higher education levels generally demonstrated better knowledge about diabetes ([Phoosuwan et al., 2022](#)).

A significant portion of the participants were unemployed, with a smaller proportion employed as private employees, self-employed, or laborers. Shift work has been linked to an increased risk of diabetes, with shift workers showing a 14% higher risk of developing DM ([Li et al., 2019](#)). Furthermore, only 16% of the patients revealed their families diabetic condition, while 84% did not have a family history of diabetes. Adults with a family history of diabetes are four times more likely to develop the condition than those without such a history ([Annis et al., 2005](#)).

Most participants received information about diabetes from health workers, while a smaller number obtained information from seminars, family, or a combination of health workers, family, and neighbors. This underscores the importance of social support from family and friends in contributing to better health outcomes ([Higa et al., 2021](#)).

Table 3 reveals that most of the respondents had normal blood sugar levels (77%), while 16% were classified as prediabetic and 6% as diabetic. Known risk factors for diabetes include prediabetes, overweight, family history, and advanced age, with excessive consumption of sweet foods and drinks further increasing the risk ([Toi et al., 2020](#)). Lifestyle modifications, such as dietary changes, increased physical activity, and low-calorie or low-carbohydrate diets can help control blood sugar levels in individuals with type 2 diabetes ([Silva-Tinoco et al., 2020](#)).

The evaluation of the counseling and training program on low-sugar food processing was conducted through pre-test and post-test questionnaires to assess its effectiveness in improving participants' knowledge of diabetes. The results demonstrated a significant increase in knowledge, with the average pre-test score that improved from 81.45 to 89.31 in the post-test (Table 4). Significance testing confirmed the effectiveness of the program in enhancing community knowledge. Knowledge about diabetes is critical for both its prevention and management, as it directly influences self-care behaviors such as diet and physical activity ([Silva-Tinoco et al., 2020](#)).

Educational interventions focused on self-care and diet have been shown to reduce glycosylated hemoglobin (HbA1c) levels (Hildebrand et al., 2020).

The counseling and training on low-sugar food processing for Dusun Banjar Tengah community, Dau District, Malang, aimed at equipping the participants with knowledge about low-sugar foods and their preparation. The community is expected to create low-sugar foods at home for small-scale consumption. Reducing sugar intake also reduces carbohydrates and calories, which can have a positive impact on diabetes treatment and prevention (Barber et al., 2021). Furthermore, the use of a low-carbohydrate diet is recommended as an alternative to calorie-counting and low-fat diets for individuals with diabetes and obesity (Wagner et al., 2016).

Conclusion

The counseling and training program on low-sugar food processing in Dusun Banjar Tengah, Dau District, Malang, has positively contributed in increasing the public knowledge about diabetes. The program evaluation revealed a significant improvement in participants' understanding, as evidenced by the pre-test average score of 81.45, which increased to 89.31 in the post-test. The significance test yielded a result of 0.016 (<0.05), indicating that the observed improvement was statistically significant and not due to chance. This suggests that the program was effective in enhancing public awareness of diabetes, thereby supporting the adoption of healthier lifestyles, particularly in relation to the preparation of low-sugar foods.

Conflicts of Interest

The authors declare no conflict of interest

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