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Community Empowerment in the Production and Utilization of Household Probiotics to Improve Digestive Health in Pakal Village, Surabaya

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Abstract

Digestive health problems remain a significant public health concern in urban communities, including Pakal Village, Surabaya. These issues are closely associated with dietary patterns, lifestyle changes, and limited access to affordable functional foods that support gut health. Probiotics are widely recognized for their role in maintaining intestinal microbiota balance and improving digestive function. However, community knowledge and skills related to the production and utilization of probiotics at the household level are still limited. Therefore, community empowerment through locally based probiotic production is considered a strategic and sustainable health promotion effort.

This community service program aimed to empower residents of Pakal Village in the production and utilization of household probiotics to improve digestive health and promote independent healthy behavior. The program was implemented using a participatory community-based approach. The methods included health education through structured counseling sessions and interactive discussions, practical training on simple household probiotic production using locally available materials, and continuous mentoring. Evaluation of participants' understanding was conducted using a pre-test and post-test questionnaire, supported by direct observation during the training activities.

The results showed a significant increase in participants' knowledge and skills. Based on post-test evaluation of 100 participants, 95 individuals (95%) demonstrated good understanding of digestive health concepts and household probiotic utilization, while 5 individuals (5%) showed limited understanding. Participants were also able to independently produce household probiotics and apply them in their daily dietary practices. Increased awareness of preventive digestive health behavior and positive community participation were observed.

In conclusion, community empowerment through household probiotic production using education, hands-on training, and systematic evaluation is effective in improving digestive health knowledge, skills, and self-reliance. This model has strong potential to be replicated as a sustainable community-based health intervention.

Keywords: community empowerment, household probiotics, digestive health, health education, participatory approach

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Introduction

Digestive health is a fundamental component of overall health, as the gastrointestinal system plays a vital role in nutrient absorption, immune modulation, and metabolic regulation. Disruptions in digestive function may lead to various health problems, such as diarrhea, constipation, gastritis, and functional gastrointestinal disorders, which can negatively affect quality of life and daily productivity (Black and Ford, 2020; WHO, 2020). In many developing countries, including Indonesia, digestive health problems remain prevalent and are closely associated with unhealthy dietary patterns, low fiber intake, excessive consumption of processed foods, and sedentary lifestyles (Afifah and Setiati, 2021; Ministry of Health RI, 2021).

Urbanization and socio-economic development have significantly influenced lifestyle and dietary behaviors in urban and peri-urban communities. The increasing availability of fast food and ultra-processed foods has contributed to a decline in the consumption of traditional, fiber-rich diets that support digestive health (Monteiro et al., 2022). These changes are often accompanied by limited public awareness of preventive digestive health practices. Pakal Village, located in Surabaya, represents an urban community experiencing such transitions, where changes in eating habits and daily routines may increase vulnerability to digestive health disturbances.

Probiotics are defined as live microorganisms that, when consumed in adequate amounts, provide health benefits to the host, particularly by maintaining the balance of intestinal microbiota (FAO/WHO, 2022). Numerous studies have demonstrated that probiotics play an important role in improving digestive function, enhancing immune responses, preventing gastrointestinal infections, and reducing inflammation-related digestive disorders (Hill et al., 2022; Sanders et al., 2023). Recent research has also highlighted the role of probiotics in supporting gut–brain interaction and metabolic health, further emphasizing their importance in overall well-being (Cryan and O'Riordan, 2023).

Despite the proven benefits of probiotics, their routine consumption among communities remains limited. Commercial probiotic products, such as fermented milk, yogurt, and dietary supplements, are widely available but are often relatively expensive and not easily accessible to all population groups, particularly low- to middle-income households (Kumar and Nagpal, 2023). In addition, reliance on commercial products does not promote independence or long-term sustainability in health practices. Limited knowledge regarding the benefits, safe use, and production of probiotics further constrains their utilization at the community level.

Household-scale probiotic production offers a practical and sustainable alternative to address these challenges. By using simple techniques and locally available materials, communities can independently produce probiotics that support digestive health while reducing dependence on commercial products (Widodo and Nurhayati, 2024). Household probiotic production not only provides functional food benefits but also serves as a medium for community empowerment by enhancing knowledge, skills, and self-confidence. Such an approach aligns with the principles of preventive and promotive public health, which emphasize community participation and the utilization of local resources.

Community empowerment is widely recognized as an effective strategy for improving public health outcomes, particularly for health issues influenced by behavior, lifestyle, and socio-cultural factors. Empowerment-based interventions focus on increasing community capacity to identify problems, develop solutions, and take collective action to improve health conditions (Wallerstein and Duran, 2024). Empowered communities are more likely to adopt sustainable healthy behaviors and actively participate in health promotion activities (Rifkin, 2024). In the context of digestive health, empowerment enables communities to understand the importance of gut health, adopt healthier dietary practices, and utilize functional foods such as probiotics effectively.

Several community-based health programs in Indonesia have demonstrated positive impacts of empowerment approaches on nutrition improvement, sanitation behavior, and health literacy (Sari and Pratiwi, 2025; Hidayat and Lestari, 2025). However, community service programs specifically focusing on household probiotic production as a strategy to improve digestive health remain limited. Most existing interventions emphasize supplementation or distribution of external products rather than capacity building and skill development. This gap highlights the need for integrated programs that combine health education with practical training in probiotic production and utilization.

The household probiotic empowerment program implemented in Pakal Village was designed to address both health and empowerment objectives. The program adopted a participatory community-based approach that combined structured health education, hands-on training in household probiotic production, and continuous mentoring. Participatory methods have been shown to enhance learning effectiveness, community engagement, and behavioral change (Israel et al., 2025). Evaluation using pre-test and post-test methods allows for objective measurement of changes in knowledge and understanding resulting from the intervention (Creswell, 2026).

In addition to health benefits, household probiotic production has potential social and economic implications. Community members who acquire probiotic production skills may disseminate knowledge to others and potentially develop small-scale economic activities, contributing to household income and community resilience (Nugroho and Santoso, 2026). Although economic outcomes were not the primary focus of this program, they represent an important added value for sustainable community development.

This community empowerment initiative aligns with national and global health promotion policies that emphasize preventive care, community participation, and sustainable use of local resources (Ministry of Health RI, 2025; United Nations, 2026). By empowering communities to actively maintain digestive health through household probiotic production, this program contributes to the achievement of sustainable development goals related to health and well-being. Therefore, this article aims to describe and analyze a community empowerment program focused on the production and utilization of household probiotics to improve digestive health in Pakal Village, Surabaya, and to provide a replicable model for similar communities.

Method

This community service program was conducted in Pakal Village, Surabaya, with the objective of empowering the community in the production and utilization of household probiotics to improve digestive health. The program applied a participatory community-based approach, emphasizing active involvement of community members throughout all stages of the activity to ensure sustainability and community ownership.

Program Design

The program used a descriptive–participatory design consisting of three main stages: preparation, implementation, and evaluation. During the preparation stage, a situational analysis was carried out through informal interviews and coordination with community leaders and local health volunteers to identify digestive health issues, dietary habits, and community needs. Based on this analysis, educational materials, training modules, and evaluation instruments were developed.

Participants

Participants were residents of Pakal Village who voluntarily participated in the program. A total of 100 adult participants were involved in the counseling and training activities. Inclusion criteria included willingness to attend educational sessions and participate in hands-on training. Community representatives assisted in mobilizing participants and facilitating program activities.

Implementation Procedures

The implementation stage consisted of health education, practical training, and mentoring activities. Health education was delivered through structured counseling sessions using lectures supported by visual media and interactive discussions. The educational content included digestive health concepts, the role and benefits of probiotics, food safety principles, and preventive health behaviors.

Practical training involved hands-on demonstrations of simple household probiotic production using locally available and affordable materials. Participants were guided through preparation, fermentation, storage, and safe utilization procedures. Training was conducted in small groups to ensure effective skill acquisition. Mentoring activities were provided during and after training to reinforce learning and address participant challenges.

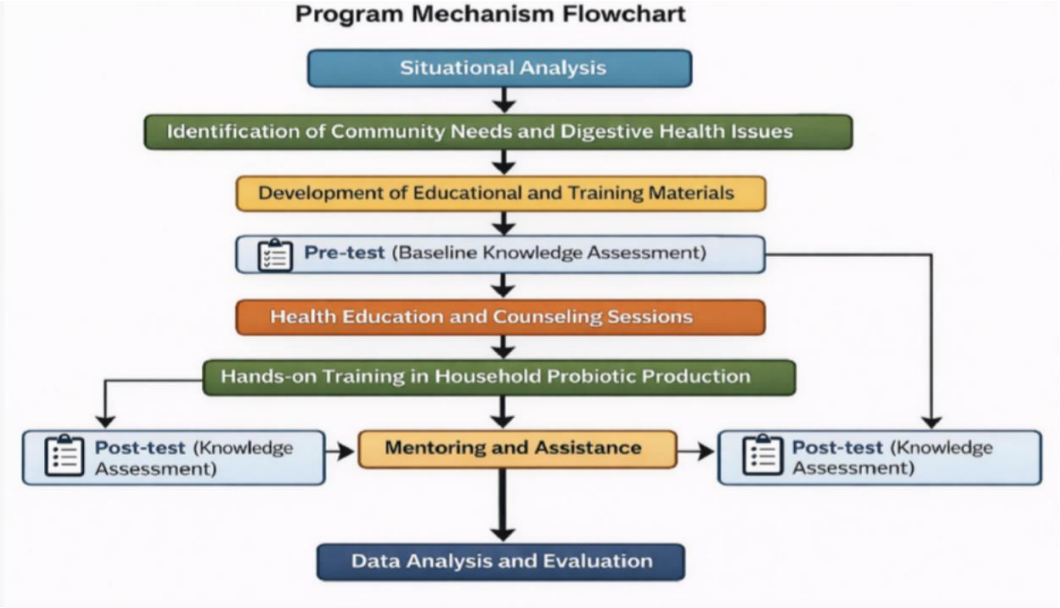

Figure 1. Method Flow Diagram

Evaluation and Data Analysis

Program evaluation was conducted using a pre-test and post-test design. A structured questionnaire was administered before the educational sessions (pre-test) and after the completion of training (post-test). The questionnaire assessed participants' knowledge of digestive health, probiotic benefits, production methods, and utilization practices.

Quantitative data were analyzed using descriptive statistical methods. Pre-test and post-test scores were summarized using frequencies and percentages to determine changes in knowledge levels. The proportion of participants demonstrating good understanding was calculated, showing that 95 participants (95%) achieved good understanding after the intervention, while 5 participants (5%) demonstrated limited understanding. Knowledge improvement was interpreted by comparing pre-test and post-test distributions.

In addition, observational data were collected during training sessions to assess participants' practical skills and engagement. Observational findings were used to support quantitative results and provide qualitative insights into the effectiveness of the training process.

Ethical Considerations

Participants were informed about the objectives, procedures, and benefits of the program. Participation was voluntary, and informed consent was obtained from all participants. Confidentiality and respect for community values were maintained throughout the program.

Results and Discussions

Figure 2. Counseling on making prebiotics

Participants consisted of adult community members with diverse educational and occupational backgrounds, including housewives, informal workers, and community health volunteers. Most participants had never received formal education related to digestive health or probiotics prior to the program. During implementation, participant attendance and engagement were high, as indicated by full participation throughout counseling, training, and mentoring sessions. Active involvement was observed during interactive discussions and hands-on training, reflecting strong community interest in digestive health and functional food practices.

Table 1. Results of Pre-test and Post-test Evaluation of Participants' Knowledge Level

Knowledge Level	Pre-test (%)	Post-test (%)
Good Understanding	20	95
Limited Understanding	80	5

Pre-tests showed that the majority of participants (80%) had limited understanding of digestive health and household probiotics. After the intervention, significant improvement occurred, with 95% of participants achieving a good understanding.

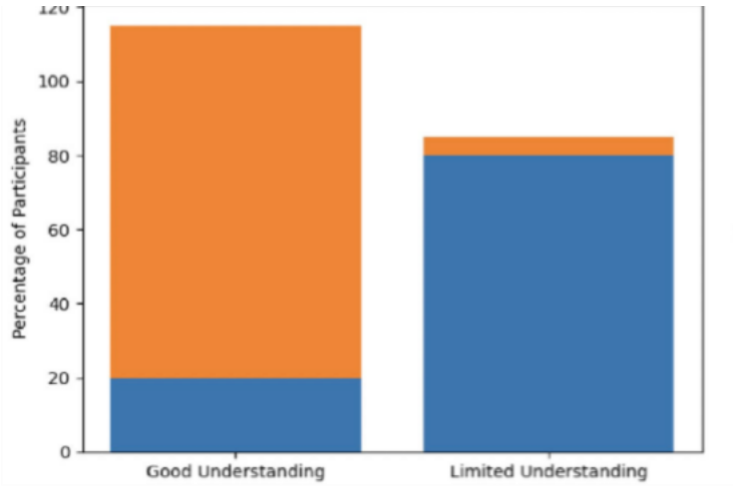

Figure 3. shows the shift in participants' knowledge levels

Figure 3 shows the shift in participants' knowledge levels before and after the empowerment program. There was a very clear increase in the good understanding category after the implementation of household probiotic counseling and training.

The community empowerment program focusing on the production and utilization of household probiotics was implemented successfully in Pakal Village, Surabaya, involving a total of 100 participants. The results are presented based on quantitative findings from the pre-test and post-test assessments, observational data during training activities, and qualitative feedback obtained from participants.

Knowledge Improvement Based on Pre-test and Post-test

Evaluation of participant knowledge was conducted using a structured questionnaire administered before (pre-test) and after (post-test) the intervention. The pre-test results indicated that most participants had limited understanding of digestive health, the role of probiotics, and household probiotic production methods. Common misconceptions included the belief that probiotics were exclusively commercial products and that fermentation processes were complex and unsafe for household application.

Post-test results demonstrated a substantial improvement in knowledge levels. Of the 100 participants evaluated, 95 participants (95%) demonstrated good understanding of digestive health concepts, probiotic benefits, production procedures, and utilization practices. Only 5 participants (5%) showed limited understanding, primarily related to fermentation duration and storage conditions. This improvement indicates that the educational and training components were effective in enhancing community knowledge.

The descriptive statistical analysis showed a clear shift from low to high knowledge categories when comparing pre-test and post-test distributions. Although inferential statistical testing was not applied due to the descriptive nature of the program, the magnitude of improvement suggests a meaningful educational impact.

Skill Acquisition and Practical Outcomes

Observational data collected during training sessions revealed that the majority of participants were able to independently perform household probiotic production steps, including material preparation, fermentation, and storage. Participants demonstrated appropriate hygiene practices and followed safety instructions as guided by facilitators. Small-group training was particularly effective in facilitating hands-on learning and peer-to-peer interaction.

During mentoring sessions, participants reported confidence in reproducing the probiotic production process

at home. Several participants expressed willingness to share the knowledge with family members and neighbors, indicating potential diffusion of innovation within the community. These findings suggest that the program not only improved knowledge but also successfully transferred practical skills essential for sustainable application.

Behavioral and Attitudinal Changes

In addition to cognitive and skill-based outcomes, positive behavioral and attitudinal changes were observed. Participants showed increased awareness of the importance of digestive health and preventive health behaviors, such as balanced diets, adequate fiber intake, and regular consumption of functional foods. Enthusiasm for adopting household probiotics as part of daily dietary practices was evident from participant feedback and active discussion during mentoring sessions.

Discussion

The results of this program demonstrate that community empowerment through household probiotic production is an effective strategy for improving digestive health knowledge and skills in urban communities. The significant increase in participant understanding aligns with previous studies indicating that participatory health education combined with practical training can lead to substantial knowledge gains and behavior change (Israel et al., 2022).

The finding that 95% of participants achieved good understanding after the intervention highlights the effectiveness of using structured counseling, interactive discussions, and hands-on training. This approach supports adult learning theories, which emphasize experiential learning and active participation as key factors in knowledge retention and skill acquisition. The remaining 5% of participants who demonstrated limited understanding reflect the variability in learning pace and cognitive readiness among community members, underscoring the importance of continuous mentoring and follow-up activities.

The success of the hands-on training component confirms that household probiotic production is a feasible and acceptable practice for community members when appropriate guidance and support are provided. Similar findings have been reported in previous community-based functional food interventions, where practical demonstrations significantly improved participant confidence and adoption of new practices (Widodo and Nurhayati, 2024). The use of locally available materials further enhanced feasibility and affordability, reducing barriers to adoption.

From a public health perspective, the empowerment-based approach used in this program addresses key determinants of digestive health, including knowledge, behavior, and access to functional foods. By enabling communities to produce probiotics independently, the program reduces reliance on commercial products, which are often cost-prohibitive for low- to middle-income households (Kumar and Nagpal, 2023). This aligns with preventive and promotive health strategies that prioritize sustainability and community self-reliance.

The observed behavioral changes, such as increased awareness of digestive health and enthusiasm for preventive practices, indicate that the program influenced not only cognitive outcomes but also attitudes and intentions. Behavioral change is a critical component of successful health promotion, as knowledge alone does not always translate into practice. The participatory nature of the program likely contributed to these outcomes by fostering a sense of ownership and relevance among participants.

In the context of Pakal Village, the program addressed local health needs shaped by urbanization and lifestyle changes. The integration of health education with practical skill development responded to the gap between awareness and action often observed in community health programs. This finding is consistent with evidence suggesting that empowerment-based interventions are more effective when they combine information delivery with capacity building (Rifkin, 2024).

The potential social and economic implications of household probiotic production also merit discussion. Although economic outcomes were not formally measured, participant feedback suggested interest in further developing probiotic production as a small-scale activity. Previous studies have shown that community-

based functional food initiatives can contribute to local economic resilience when supported by appropriate training and market access (Nugroho and Santoso, 2026). This indicates an opportunity for future program expansion that integrates health promotion with livelihood development.

Despite the positive outcomes, several limitations should be acknowledged. First, the evaluation relied on descriptive statistics and did not include inferential analysis, limiting the ability to statistically quantify the magnitude of knowledge improvement. Second, the short duration of the program did not allow for long-term assessment of behavior change or health outcomes. Third, digestive health improvements were inferred from knowledge and behavior changes rather than measured through clinical indicators. Future programs should consider longitudinal designs and objective health measurements to strengthen evidence of impact.

Nevertheless, the program provides valuable insights into the implementation of community empowerment strategies for digestive health promotion. The high level of participant engagement and knowledge improvement demonstrates the acceptability and effectiveness of household probiotic interventions. The use of pre-test and post-test evaluations, combined with observational data, offers a practical evaluation framework suitable for community service programs with limited resources.

The findings of this program contribute to the growing body of evidence supporting community-based preventive health interventions. In line with national health promotion strategies and global sustainable development goals, empowering communities to take an active role in maintaining their health is essential for achieving long-term public health improvements. The empowerment model implemented in Pakal Village can serve as a reference for similar urban communities seeking cost-effective and sustainable approaches to digestive health promotion.

Implications for Practice and Policy

The results suggest several implications for public health practice and policy. First, household probiotic production can be integrated into existing community health programs, such as family welfare or community health post activities. Second, training community health volunteers as facilitators may enhance program scalability and sustainability. Third, local governments and health institutions can support such initiatives through policy frameworks that encourage community participation and utilization of local resources.

In conclusion, the results and discussion highlight that community empowerment through household probiotic production is an effective and feasible approach to improving digestive health knowledge, skills, and preventive behaviors. The program demonstrates the value of participatory methods, practical training, and simple evaluation techniques in achieving meaningful community health outcomes. Further research and program development are recommended to expand impact and strengthen evidence of long-term health benefits.

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