



Community-Based Nutrition Intervention Strategies for Improving Dietary Quality and Public Health Outcomes

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ABSTRACT

Community diet quality remains a public health challenge, and evidence from integrated evaluations of community-based nutrition interventions is still limited. This mixed-methods quasi-experimental study evaluated a 10-week community-based nutrition intervention in two peri-urban communities around Medan City, involving 80 housewives divided into intervention and control groups. The intervention combined nutrition education, local food-based cooking demonstrations, and cadre assistance. Quantitative analysis showed significant improvements in diet quality, food diversity, and nutritional status in the intervention group compared to the control group. Qualitative findings indicated increased nutritional knowledge, local food processing skills, and motivation to sustain healthy eating behaviors. Overall, the study demonstrates that community-based nutrition interventions integrating local empowerment and multidimensional evaluation are effective promotive-preventive strategies with strong potential for sustainable public health programs.

INTRODUCTION

Diet quality is a major determinant of public health that has a direct effect on the burden of non-communicable diseases, nutritional status, and population productivity globally. International reports show that the consumption patterns of the world community are still dominated by high intake of sugar, salt, and fat, accompanied by low consumption of fruits, vegetables, and various foods, thereby increasing the risk of obesity and metabolic diseases (Afshin et al., 2020). This condition does not only occur in developed countries, but also is increasingly evident in developing countries that are experiencing a nutritional transition. In Indonesia, this phenomenon is exacerbated by inequality of access to healthy food and limited nutritional literacy at the community level, especially in peri-urban areas that are located between urbanization dynamics and limited local resources.

Various approaches to nutrition interventions have been developed to respond to these problems, ranging from macro policies to individualized education programs. However, the community-based approach is considered more contextual because it considers eating cultures, local food availability, and social networks that influence consumption behavior (Ruel et al. 2021). Community-based nutrition interventions place the community as the main actor in the process of changing eating behavior. In the context of public health, this approach is seen as relevant to bridge the gap between normative nutrition recommendations and daily eating practices at the household level.

However, empirical studies show that most nutrition intervention research still focuses on quantitative measurements, such as changes in dietary quality scores or indicators of nutritional status, without delving deeply into participants' experiences and perceptions. Hawkes et al. (2020) emphasize that the effectiveness of nutritional interventions is strongly influenced by social, cultural, and motivational factors that are often not fully captured through quantitative approaches. As a result, the understanding of the mechanisms of changes in eating behavior becomes less comprehensive. This condition shows a research gap related to the integration between measurable impact evaluation and subjective interpretation of participants in community-based nutrition interventions.

In addition, some previous research was conducted on a national or institutional scale, so it did not represent the dynamics of local communities with heterogeneous socioeconomic characteristics. Fanzo et al. (2021) suggest that local contexts, including local food utilization and community stakeholder engagement, are important factors in the sustainability of nutrition interventions. However, empirical evidence specifically examining the implementation of community-based nutrition interventions in peri-urban areas of developing countries is still limited. This gap underscores the need for research that places communities as active subjects as well as key units of analysis.

Based on these gaps, this study aims to evaluate the effectiveness of community-based nutrition intervention strategies in improving the quality of diet and public health outcomes through a mixed methods approach. In particular, this study was directed to quantitatively analyze changes in dietary

quality and nutritional status indicators, as well as explore the experiences, perceptions, and challenges of intervention participants qualitatively. This integrated approach is expected to provide a more comprehensive picture of the process and potential impact of nutrition interventions at the community level. Thus, the purpose of the research is not only oriented to the measurement results, but also to the understanding of the process of changing eating behavior.

Theoretically, this study is expected to strengthen the conceptual framework of community-based nutrition interventions through the integration of multidimensional measurements, as recommended by Creswell and Plano Clark (2021) in the development of mixed methods research. This approach allows for a more complete analysis of the relationship between interventions, social contexts, and individual responses. By combining quantitative and qualitative data, this study has the potential to enrich public health studies related to eating behavior change strategies. This contribution is relevant for the development of a more contextual and adaptive theory of nutritional intervention.

Practically, this research is expected to provide implications for public health program designers and policymakers at the local level. The study of community-based nutrition intervention strategies can be a reference in designing promotive and preventive programs that are more in line with the socio-cultural conditions of the community. In addition, the identification of potential implementation challenges, such as time constraints and practice consistency, can be a basis for consideration in the development of more effective and sustainable programs (Swartz et al., 2022). Thus, this research is expected to contribute to supporting efforts to improve the quality of diet and public health contextually.

THEORETICAL REVIEW

Diet Quality as a Determinant of Public Health Outcomes

Diet quality is a fundamental factor that determines public health outcomes because it is directly related to nutritional status, immunity, and chronic disease risk. A global study by Monteiro et al. (2022) shows that increased consumption of ultra-processed foods is consistently correlated with an increased risk of obesity, cardiovascular disease, and metabolic disorders. On the contrary, a diverse diet based on fresh food has been proven to support long-term health and reduce the burden on the health system. These findings confirm that the quality of diet is not only an individual issue, but also a structural issue in public health.

At the community level, the quality of diet is influenced by food access, cultural preferences, and socioeconomic conditions. Research by Miller et al. (2023) emphasizes that communities with limited access to healthy food tend to have lower dietary quality and a higher risk of disease. This inequality reinforces the urgency of interventions that focus on improving people's consumption patterns collectively. Therefore, improving the quality of diets at the community level is seen as an important strategy in achieving better public health outcomes.

H1: Community-based nutrition interventions have a positive effect on improving the quality of people's diets.

Community-Based Nutrition Interventions and Improving Public Health Outcomes

Community-based nutrition interventions are developing as a strategic approach in public health as they target changes in eating behaviors at the collective level. A study by Pérez-Escamilla et al. (2021) shows that structured community interventions are able to improve health indicators such as nutritional status, metabolic health, and community quality of life. This approach works by strengthening the supportive environment that facilitates healthy food choices. Thus, community interventions affect not only individuals, but also social norms and communal eating practices.

In addition, community-based interventions contribute to the prevention of non-communicable diseases through a promotive-preventive approach. Research by Mozaffarian et al. (2023) confirms that dietary changes at the population level have a broader health impact than individual clinical interventions. This strengthens the position of community-based nutrition interventions as an important instrument in public health policy. Therefore, the study of the effectiveness of community intervention strategies is relevant in the context of improving public health outcomes.

H2: Community-based nutrition interventions have a positive effect on public health outcomes.

Utilization of Local Food in Community Nutrition Intervention Strategies

The use of local food is an important element in community-based nutrition interventions as it relates to cultural availability, affordability, and acceptance. Studies by Burlingame and Dernini (2021) show that local food has great potential in improving the quality of diets while maintaining the sustainability of the food system. The integration of local food in nutrition programs strengthens the relevance of interventions to the social and economic context of the community. This approach also encourages food self-sufficiency at the community level.

Furthermore, interventions based on local food have been shown to increase the sustainability of dietary changes. Research by Kuhnlein et al. (2022) shows that people are more likely to maintain healthy consumption patterns when interventions are aligned with local habits and resources. Thus, the use of local food not only has an impact on the quality of the diet, but also on the sustainability of healthy eating practices. This reinforces the urgency of including local dimensions in community nutrition intervention strategies.

H3: The use of local food in community-based nutrition interventions has a positive effect on the sustainability of healthy diets in the community.

Community Empowerment in Nutrition Interventions

Community empowerment is a key principle in long-term change-oriented public health interventions. A study by Wallerstein et al. (2020) confirms that interventions that involve active community participation are more effective

in producing changes in health behaviors. Empowerment allows the community to have control and a sense of ownership over the nutrition programs that are carried out. This condition increases commitment and consistency in implementing a healthy diet.

In the context of nutrition, community empowerment contributes to increasing local capacity in managing health issues. Research by Rifkin (2021) shows that participatory approaches strengthen community resilience in the face of nutrition and health challenges. Thus, community-based nutrition interventions not only function as a means of education, but also as a process of social development. This places empowerment as a strategic component in improving the quality of diet and public health.

H4: Community empowerment mediates the relationship between community-based nutrition interventions and improved dietary quality and public health.

METHODOLOGY

Types and Approaches to Research

This study uses a mixed methods approach with quasi-experimental design and control groups, combined with qualitative exploration to gain a comprehensive understanding of the effectiveness of community-based nutrition interventions. The mixed methods approach was chosen because it allows the integration of quantitative data that is measurable with qualitative data that captures the experiences, perceptions, and social dynamics of intervention participants in more depth (Creswell & Plano Clark, 2021). Quantitatively, the study applied a pretest-posttest with control group design, while qualitatively an exploratory descriptive design was used through in-depth interviews. This combination of designs is seen as relevant for evaluating the impact of nutritional interventions while also understanding the mechanisms of change in eating behavior in a community context (Hawkes et al., 2020).

Location, Population, and Research Characteristics

The research was carried out on two communities in peri-urban areas around Medan City, North Sumatra, which have characteristics of socio-economic transition and diverse food consumption patterns. The study population is housewives who play a role as the main manager of family food consumption, as this group has a significant influence on the quality of household diets (Pérez-Escamilla et al., 2021). The selection of peri-urban areas is based on the consideration of high nutritional vulnerability due to limited access to healthy food and rapid lifestyle changes (Fanzo et al., 2021).

Quantitative Sampling Techniques and Quantities

Quantitative sampling was carried out using a non-probability purposive sampling technique, with inclusion criteria including: housewives aged 20–55 years, domiciled at least one year at the research site, and willing to participate in the entire series of interventions. The total sample was 80 respondents, who were divided evenly into the intervention group (n = 40) and the control group (n = 40). The sample count was considered adequate for a quasi-experimental

community design and was in line with the recommendations of community-based nutrition intervention research at the local scale (Swartz et al., 2022). The control group did not receive any specific interventions, but still received routine health services available in the community.

Participants and Qualitative Sampling Techniques

The qualitative component involved 10 main informants who were purposively selected from the intervention group. The informants consisted of 7 housewives participating in the intervention and 3 community health cadres who were directly involved in the implementation of the program. The number of informants is determined based on the principle of information saturation, which is when the data obtained has shown repeated patterns and themes (Guest et al., 2020). The involvement of health cadres aims to obtain the perspective of program implementers related to the process, challenges, and sustainability of community-based nutrition interventions.

Quantitative Data Collection Techniques and Instruments

Quantitative data was collected through structured questionnaires and anthropometric measurements. Dietary quality was measured using the Dietary Diversity Score and dietary quality index adapted from instruments that have been widely used in community nutrition research (Miller et al., 2023). Nutritional status was measured through body mass index and upper arm circumference indicators using standard public health procedures. The validity test of the content was carried out through expert judgment, while the reliability of the instrument was tested using Cronbach's alpha coefficient with a value of ≥ 0.70 as a feasibility criterion (Taber, 2021).

Qualitative Data Collection Techniques

Qualitative data were obtained through semi-structured in-depth interviews using interview guidelines compiled based on research objectives and a community-based nutritional intervention theoretical framework. The interviews focused on participants' experiences participating in interventions, changes in nutritional understanding, local food processing practices, and challenges in maintaining a healthy diet. All interviews were recorded with the consent of the informant and transcribed verbatim to maintain data accuracy (Braun & Clarke, 2021).

Research Implementation Procedure

The research is carried out through several systematic stages. The initial stage includes licensing, coordination with local stakeholders, and training of health cadres. The next stage is the collection of baseline data (pretest) in the intervention and control groups. Nutrition interventions were carried out for 10 weeks, including nutrition education, demonstrations of local food-based cooking, and assistance for health cadres. After the intervention was completed, posttest measurements and in-depth interviews were carried out. All research procedures follow the ethical principles of public health research, including participant consent and data confidentiality (World Medical Association, 2022).

Data Analysis Techniques

Quantitative data were analyzed using descriptive and inferential statistics. The paired sample t-test was used to analyze changes before and after the intervention in the group, while the independent sample t-test was used to compare the intervention and control groups. The analysis was carried out with the help of the Statistical Package for the Social Sciences software. Qualitative data were analyzed using thematic analysis following the stages of data familiarization, coding, theme determination, and interpretation of meaning (Braun & Clarke, 2021). The results of quantitative and qualitative analysis are then integrated at the interpretation stage to produce a holistic understanding of the effectiveness of the intervention (Creswell & Plano Clark, 2021).

RESEARCH RESULTS

Changes in Dietary Quality and Diversity of Food Consumption

The results showed a significant improvement in the quality of diet and diversity of food consumption in the intervention group compared to the control group. Quantitative analysis showed that community-based nutrition interventions had a significant positive impact on improving the quality of diet and diversity of food consumption in the intervention groups. Measurement using *Dietary Diversity Score* and a diet quality index was conducted before and after the intervention for ten weeks. Descriptively, the intervention group showed a greater increase in scores than the control group, indicating a change in consumption patterns towards a more diverse and balanced direction. This difference reflects the effectiveness of the nutrition education component and the demonstration of local food-based cooking in encouraging changes in eating behavior at the household level.

Table 1. Changes in Dietary Quality Index and Food Consumption Diversity Score

Variabel	Groups	Pretest (Mean ± SD)	Posttest (Mean ± SD)	Average Difference	p- value
Diet Quality Index	Intervention	52.40 ± 6.85	68.75 ± 7.12	+16,35	< 0.001
	Controls	53.10 ± 7.02	55.30 ± 7.45	+2,20	0,081
Food Diversity Score	Intervention	4.1 ± 0.9	6.8 ± 1.0	+2,7	< 0.001
	Control	4,2 ± 1,0	4,5 ± 1,1	+0,3	0,094

Table 1 shows that the intervention group experienced statistically significant improvements in both the diet quality index and the food diversity score based on the test *paired sample t-test* and *independent sample t-test*. In contrast, the changes in the control group were relatively small and insignificant. These findings indicate that the interventions carried out not only increase the number

of types of food consumed, but also improve the balance of daily food composition. This increase reflects a change in more nutritionally conscious and targeted eating behaviors. The quantitative changes are in line with qualitative findings obtained through in-depth interviews. Participants revealed that there was an increase in awareness in choosing food ingredients and the courage to combine various types of local food in the daily menu.

This is reflected in the statement of one of the participants as follows: "*Now I understand better that the food must be diverse, not just full. So I started to get used to having vegetables, different side dishes, and fruits even though they are simple*" (B-03, November 12, 2025). Similar views were also conveyed by community companion informants who observed changes in family consumption practices: "*In the past, the menu was just that, now mothers are more creative because they already know the variations and benefits*" (K-01, November 18, 2025). The quote emphasized that the increase in diet quality scores was not solely the result of a momentary change, but was supported by a change in participants' understanding and attitude towards the meaning of healthy eating. Thus, the findings on this theme show a strong relationship between quantitative outcomes and the qualitative experience of intervention participants.

Improvement of Nutritional Status Indicators as Health Outcomes

In addition to the quality of diet, the results showed a significant improvement in nutritional status indicators in the intervention group compared to the control group. Nutritional status measurements were carried out using body mass index and upper arm circumference, which represent general nutritional conditions. The results of the analysis showed that improvements in nutritional status were more pronounced in the intervention group.

Table 2. Changes in Participants' Nutritional Status Indicators

Indicator	Groups	Pretest (Mean ± SD)	Posttest (Mean ± SD)	p- value
Body Mass Index (kg/m ²)	Intervention	24.8 ± 3.2	23.6 ± 3.0	0,002
	Controls	24.6 ± 3.1	24.4 ± 3.2	0,214
Upper Arm Circumference (cm)	Intervention	27.4 ± 2.5	28.3 ± 2.4	0,001
	Controls	27.6 ± 2.6	27.7 ± 2.5	0,337

Based on Table 2, the intervention group showed significant changes in body mass index and upper arm circumference after the intervention. A decrease in body mass index reflects an improvement in energy intake balance, while an increase in upper arm circumference indicates an improvement in healthier nutritional status. Meanwhile, the control group showed no meaningful changes. The participants' experiences reinforced these quantitative findings, especially related to the perception of changes in body condition and daily health.

This was expressed by one of the participants as follows: "*Now the body feels lighter, not as easily tired as before. Eat more regularly and not just be full*" (B-06, November 21, 2025). Observations from community facilitators also corroborate

the findings: "We see that mothers are starting to be more aware of the portions and how to cook them, so the impact on the condition of the body is also visible" (K-02, 22 November 2025). These findings suggest that the intervention not only impacts aspects of knowledge, but also results in measurable physiological changes.

Improving Nutrition Understanding and Local Food Processing Skills

Qualitative findings show that community-based nutrition interventions not only increase participants' knowledge of balanced nutrition principles, but also strengthen practical skills in local food processing. Nutrition education combined with cooking demonstrations creates a learning process that is contextual, participatory, and relevant to the socio-economic conditions of the participants. This approach allows participants to connect nutritional information with daily practice, so that the knowledge gained is not abstract, but applicable.

Participants described that the practice-based learning process provides a deeper understanding than the delivery of material purely theoretically. Through direct involvement in cooking activities, participants gain concrete experience related to food selection, healthier processing techniques, and balanced menu arrangements. This is reflected in the statement of one of the following participants: "If you only hear explanations, sometimes you forget. But because I immediately practice cooking, I know how to do it and can try it at home" (B-01, November 10, 2025).

In addition to improving technical skills, this intervention also encourages a change in participants' perspective on local food. Food that was previously considered ordinary or less valuable is beginning to be understood as an important source of nutrition and worthy of being optimized in the family menu. This understanding expands participants' food choices without relying on expensive or hard-to-reach foodstuffs. This was conveyed by the community assistance informant as follows: "Local food that used to be considered ordinary, is now the main menu because we already know its nutritional value" (K-03, November 24, 2025).

This increase in understanding and skills serves as a key mechanism that bridges knowledge and practice. Participants not only know what a healthy diet is, but also have the capacity to apply it independently in a household context. Thus, the findings on this theme show that the intervention successfully builds sustainable nutritional competence, which is an important foundation for improving the quality of long-term diets.

Motivation, Challenges, and Consistency of Healthy Eating Practices

Although the intervention showed a positive impact on diet quality and nutritional status, qualitative findings revealed that the consistency of healthy eating practices still faces a number of challenges. Participants identified time constraints, domestic work burdens, and family members' long-standing habits as factors that affect the sustainability of behavior change. These challenges show that dietary changes do not only depend on individual knowledge and skills, but

are also influenced by the dynamics of daily life and the social context of households.

However, the results of the interviews showed that participants had a relatively strong internal motivation to maintain healthy eating practices. This motivation is mainly driven by direct experience of the benefits felt, both in the form of better body condition and confidence in managing family menus. This is reflected in the following participant statements: "*Sometimes it's hard when you're busy, but there is already an intention to continue to cook healthier even though it's simple*" (B-05, November 20, 2025).

In addition to individual motivation, social support and community mentoring emerged as important factors in maintaining consistency in practice. Continuous mentoring serves as a reminder, a commitment reinforcement, and a space for sharing experiences between participants. Community companion informants emphasize that habit change requires a process that is not always linear, but can be sustained through shared support: "*The challenge is in the old habit, but if there is assistance and mutual reminding, it can usually go again*" (K-01, November 26, 2025).

These findings suggest that the success of community-based nutrition interventions is not only determined by the effectiveness of the materials and methods, but also by the existence of a support system that is able to maintain participants' motivation and consistency. Thus, this theme emphasizes that interventions have established the basis for positive behavior change, but long-term sustainability requires strengthening social support and mentoring strategies that are adaptive to the participants' conditions.

DISCUSSION

The results of this study show that community-based nutrition interventions have a positive effect on improving the quality of diet and diversity of food consumption, so that the first hypothesis (H1) is acceptable. The improvement in the Dietary Quality Index and Dietary Diversity Score in the intervention group reflected a change in more targeted and balanced eating behavior. These findings are in line with health behavior change theories that emphasize the importance of contextual learning and the active involvement of individuals in their social environment (Contento, 2021). A community-based approach allows nutrition messages to be conveyed in a relevant way to the realities of daily life, thereby increasing the chances of adopting a healthy diet in a sustainable manner.

The identified changes in dietary quality were not only quantitative, but also showed a shift in participants' awareness of the meaning of healthy eating. The increasing diversity of food consumption reflects the ability of participants to combine various food groups in a more balanced manner. According to the theory of nutrition literacy, increasing nutritional literacy plays an important role in shaping more rational and health-conscious consumption decisions (Velardo & Drummond, 2021). Thus, these findings strengthen the contribution of community interventions as an effective strategy in improving nutritional literacy and the quality of people's diets.

In addition to having an impact on diet, this study also found significant improvements in nutritional status indicators, namely body mass index and upper arm circumference, in the intervention group. These findings support the second hypothesis (H2) that community-based nutrition interventions have a positive effect on public health outcomes. Measurable physiological changes suggest that improved dietary quality contributes directly to a balance of energy intake and healthier nutritional status. This is in line with a nutrition-sensitive intervention approach that emphasizes the direct relationship between dietary improvement and population health outcomes (Ruel et al. 2020).

Qualitative findings reveal that the use of local food is an important factor in the sustainability of participants' dietary changes. Interventions that emphasize the use of local foods allow participants to access sources of nutrition that are affordable and appropriate to the local cultural context. This supports the third hypothesis (H3) that the use of local food in community-based nutrition interventions has a positive effect on the sustainability of healthy diets. In line with the sustainable diets approach, the use of local foods not only supports individual health, but also food security and the sustainability of community food systems (Johnston et al. 2020).

The results of this study also show that community empowerment acts as a mediation mechanism between nutritional interventions and improving the quality of diet and public health, so that the fourth hypothesis (H4) is acceptable. Cadre mentoring and social support between participants strengthened motivation, consistency, and a sense of ownership towards behavioral changes. The community empowerment perspective asserts that sustained behavioral change is more likely to occur when individuals feel in control and support in their environment (Wallerstein et al. 2021). Thus, community empowerment not only amplifies the impact of interventions, but also extends their effects socially.

Although the results of the study showed a positive impact, challenges in maintaining the consistency of healthy eating practices were still found, especially related to time constraints and family old habits. These factors suggest that changes in eating behavior are complex processes influenced by social, economic, and cultural dynamics of households. The literature mentions that without long-term structural support, behavioral changes are at risk of decline after the intervention ends (Hawkes et al. 2020). Therefore, the results of this study confirm the importance of integrating nutrition interventions with sustainable social support and local policies.

Theoretically, this research contributes to strengthening a community-based nutrition intervention model that integrates quantitative and qualitative approaches simultaneously. These findings expand the understanding that the success of interventions is not only measured by numerical outcomes, but also by the process of empowerment and meaning of participants. Practically, the results of this study provide an empirical basis for the development of community-based promotive-preventive programs that are adaptive and contextual. Further research is recommended to use longitudinal design and expand the regional context to test the sustainability of the intervention's long-term impact.

CONCLUSION AND RECOMMENDATION

Based on the results of the research and discussion, it can be concluded that community-based nutrition interventions that integrate nutrition education, local food utilization, and health cadre assistance have proven to be effective in improving the quality of diet, diversity of food consumption, and public health outcomes in peri-urban areas. A quasi-experimental approach with a mixed methods design showed that the intervention group experienced quantitatively significant improvements in indicators of dietary quality and nutritional status, which was reinforced by qualitative findings related to improved nutritional understanding, food processing skills, and motivation for healthy eating behaviors. These findings confirm that community empowerment plays an important role as a mechanism that amplifies the impact of interventions on behavioral change and public health. Overall, this study confirms that contextual and multidimensional community-based nutrition intervention strategies are promotive-preventive approaches that are relevant, applicative, and potentially replicated in the development of sustainable public health programs.

FURTHER STUDY

Future studies are recommended to examine the long-term sustainability of community-based nutrition interventions and their scalability across different socio-cultural and geographic contexts. Further research could also explore the role of digital tools and policy integration in strengthening community empowerment and improving the effectiveness of promotive-preventive nutrition programs.

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