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Food Education for a Healthy Lifestyle: A Study on Primary School Students in Remote Indigenous Communities in Central Sulawesi

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Abstract: This study aims to evaluate the effectiveness of a food education program in promoting healthy lifestyles among elementary school students in remote indigenous communities in Central Sulawesi. The research employed pre-test and post-test design, measuring various aspects before and after the intervention. The sample included students, teachers, staff, and parents. The results demonstrated significant improvements across multiple domains. Students' nutritional knowledge increased by 33.40 points, from 45.20% to 78.60%. Attitudes toward healthy food improved by 26.00 points, rising from 64.00% to 90.00%. Food consumption practices showed 38.00 points increase in vegetable and fruit intake, alongside a 60.40% reduction in unhealthy snacking. The percentage of students with normal Body Mass Index (BMI) rose by 14.00 points, from 68% to 82%. Physical activity levels also surged significantly by 41.70 points, from 50.00% to 91.70% of daily recommendations. The program exhibited strong sustainability potential, with 85.00% support from teachers and school staff, and a 70.00% increase in parental awareness. Community-level impacts included a 40.00% rise in demand for local vegetables and 65.00% of families starting home vegetable gardens. Students' cooking skills advanced, with 75.00% able to prepare traditional healthy foods and 60.00% sharing healthy recipes with their families. Nutritional literacy improved markedly, evidenced by a 45.00% increase in the ability to read food labels. In conclusion, this intervention successfully enhanced students' knowledge, attitudes, and practices in nutrition and health through food education, yielding positive impacts that foster healthy lifestyles among elementary school students in remote indigenous communities in Central Sulawesi.

Keywords: Food education; Healthy lifestyle; Primary schools; Remote indigenous communities.

Introduction

A healthy lifestyle serves as a crucial foundation for developing high-quality human resources (Yusuf et al., 2022). However, in the modern era, the challenges of maintaining healthy living patterns have become increasingly complex, particularly for communities in remote areas with limited access to information and healthcare facilities (Nuraeni et al., 2024; Ras et al., 2024).

Remote indigenous communities in Central Sulawesi, characterized by their unique geographical and socio-cultural features, face distinct challenges in maintaining health, especially regarding balanced nutrition and dietary patterns. Elementary school-aged children represent a highly vulnerable group to nutrition and health issues. This period constitutes a critical phase in growth and development, where formed eating habits and lifestyles can influence their

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future health (Lisa et al., 2025). In the remote indigenous communities of Central Sulawesi, limited access to health and nutritious food information often results in low awareness among children and their parents about the importance of balanced nutrition and healthy lifestyles (Dinknes, 2021).

Food education serves as one of the key strategies in addressing nutrition and health issues among elementary school students in remote indigenous communities (Fachrurrazi & Affrida, 2023; Inten & Permatasari, 2019; Nisak & Rahayu, 2025; Nurjani & Novianti, 2023). Through appropriate education, it is expected to enhance children's knowledge, awareness, and skills in selecting and consuming healthy, nutritious foods (Herlianty et al., 2024). Additionally, food education plays a crucial role in shaping healthy living habits from an early age, which in turn can contribute to improving the overall quality of life in the community (Aisya et al., 2025). This study aims to evaluate the effectiveness of a food education program in promoting healthy lifestyles among elementary school students in remote indigenous communities in Central Sulawesi. By understanding the specific conditions and needs of the local population, this study is expected to provide valuable insights into appropriate strategies for designing and implementing food education programs that align with the local context (GS et al., 2022; Sunarto & Winarti, 2021). Furthermore, the research seeks to identify factors influencing the success of food education programs in enhancing awareness and practices of healthy lifestyles among children.

This study represents an effort to develop a school-based food education model that integrates the local wisdom of remote indigenous communities in Central Sulawesi, an area that has rarely been specifically examined in this context. The research not only measures students' knowledge, attitudes, and practices of balanced nutrition but also connects these findings to the gap between traditional nutritious food practices and modern consumption patterns high in sugar, salt, and fat within remote indigenous communities.

Additionally, this study serves as a source of current, localized empirical data on the levels of knowledge, attitudes, and snacking behaviors among students in the remote indigenous communities of Parigi Moutong Regency, which were previously relatively under-documented. The developed model adopts an approach that positions schools as catalysts for nutritional behavior change through close collaboration between schools, families, and indigenous leaders, thereby producing a contextual, participatory, and potentially sustainable food education program in remote indigenous communities.

In the context of remote indigenous communities in Central Sulawesi, developing a food education model based on local wisdom is of paramount importance. This approach not only considers nutritional and health aspects but also respects and leverages the traditional knowledge and cultural practices that have long existed within the community (Kennedy et al., 2021; Kuhnlein et al., 2013; Shukla, 2024; Trott & Mulrennan, 2024). Integrating modern nutritional science with local wisdom can create more relevant and readily acceptable education programs for indigenous communities. Other research demonstrates that food education programs incorporating local wisdom are more effective in nutritional interventions compared to conventional approaches (Hidayatullah et al., 2025).

The role of schools as centers for learning and community development is crucial in the implementation of food education programs in remote indigenous communities. Schools not only serve as a place of knowledge transfer, but also as a catalyst for behavior change and a healthier eating culture at the community level (Batubara, 2024). Through collaboration between schools, families, and community leaders, food education programs can have a broader and more sustainable impact (Rahayu et al., 2023). Research findings indicate that school-based interventions involving the community have a significant positive impact on reducing the prevalence of obesity and malnutrition in children. Over a five-year period, this program successfully created substantial changes in the nutritional status of participants, with notable decreases in cases of obesity and malnutrition (Lee et al., 2025; Spiga et al., 2024; Verma et al., 2025).

In Parigi Moutong Regency, especially in Tinombo Village, nutritional and health problems in children are still a serious challenge. Data from the Parigi Moutong Regency Health Office shows that the prevalence of stunting in toddlers in the region reaches 31.7% (Bappelitbangda, 2025), while the rate of malnutrition in elementary school-age children is recorded at 26.5%. An initial survey conducted by a research team in three primary schools in Tinombo Village revealed that 68% of students had low knowledge of balanced nutrition, 62% showed a lack of concern for healthy eating, and 72% had the habit of snacking indiscriminately at school. Interviews with teachers and parents indicate a gap between traditional food practices that are rich in nutritional value and modern consumption patterns that tend to be high in sugar, salt, and fat. This situation is exacerbated by limited access to fresh and nutritious food, as well as the lack of nutrition education programs that are sustainable and appropriate to the local cultural context. In Tinombo Village, additional challenges arise from relatively remote geographical conditions, which affect food distribution and access to health services. Therefore, the development of a food education model that integrates local wisdom with modern nutritional

knowledge, as well as considering the unique characteristics of Tinombo Village, is very urgent to address the nutritional and health problems of children in the region.

Method

This study employed a quasi-experimental design with a pre-test and post-test pattern. The research sample consisted of 300 elementary school students, 20 teachers, and 60 parents from Remote Indigenous Communities (RIC) in Parigi Moutong Regency, selected using purposive sampling techniques.

Following subject selection, baseline measurements (pre-test) were conducted across all dependent variables, including nutritional knowledge, attitudes toward healthy food, food consumption practices, Body Mass Index (BMI), physical activity, teacher and school support, parental awareness, cooking skills, and nutritional literacy. Subsequently, the nutrition and health intervention program was implemented in the elementary school environment over a specified period. Upon completion of the intervention, final measurements (post-test) were taken on the same variables to identify changes that occurred and evaluate the effectiveness of the intervention program.

The research instruments used included nutrition knowledge questionnaires, attitude scales towards healthy foods, food frequency questionnaires (FFQ), anthropometry measurements, physical activity questionnaires, cooking skills tests, and nutrition literacy tests. Before implementation, all instruments will be tested for validity and reliability. The research procedure consists of three main stages: preparation (including instrument development and training of research teams), implementation (including pre-test, implementation of intervention programs, and post-tests), and evaluation (including assessments of the program's sustainability and its impact on the community). Data analysis was carried out using descriptive and inferential methods. This analysis will present the percentage increase of the variables studied.

Research ethics is a major concern in this study. Approval from the research ethics committee will be obtained before starting the research. Informed consent will be requested from participants and their parents/guardians. The confidentiality of participant data will be strictly maintained throughout the research process. The study also considered potential limitations, such as the absence of a control group, possible bias from the Hawthorne effect, and limitations in generalization of results.

Through this methodology, the research aims to measure changes in students' knowledge, attitudes, and behaviors related to nutrition and health, as well as evaluating the impact of intervention programs on the broader community. The results of the study are expected to provide valuable insights for the development of effective nutrition and health programs in elementary schools, as well as contribute to improving the nutritional and health status of students in Central Sulawesi Province.

Results and Discussion

The comprehensive summary of the results of nutrition and health intervention programs in schools, showing comparisons between pre-test and post-test data for the various aspects measured. This data includes changes in nutrition knowledge, attitudes towards healthy food, food consumption practices, body mass index, physical activity, program sustainability, impact on community, cooking skills, and nutritional literacy. This comparative analysis provides a clear picture of the effectiveness of the program and its impact on students and the wider community as shown in Table 1.

There was a significant increase in students' nutritional knowledge, from 45.20% in the pre-test to 78.60% in the post-test, representing a 33.40 percentage point improvement. This indicates that the intervention program successfully enhanced students' understanding of nutrition in a substantial manner. This improvement is particularly important, as strong nutritional knowledge forms the foundation for better decision-making regarding dietary patterns and healthy lifestyles.

Students' attitudes toward healthy food also showed significant improvement, rising from 64.00% to 90.00%, with a 26.00 percentage point increase. This attitudinal shift demonstrates that the program not only boosted knowledge but also successfully transformed students' perceptions and preferences toward healthy foods. This serves as a critical indicator for long-term behavioral change.

Regarding food consumption practices, vegetable and fruit intake increased from 36.00% to 74.00% of daily recommendations, representing a 38.00 percentage point improvement. This is a highly positive change, considering the critical role of vegetables and fruits in a balanced diet. Additionally, consumption of unhealthy snacks experienced a dramatic decline of 60.40 percentage points. This reduction demonstrates the program's success in transforming students' eating habits toward healthier patterns.

The percentage of students with normal BMI increased from 68.00% to 82.00%, representing a 14.00 percentage point improvement. This indicates that the

program successfully helped more students achieve healthy body weight, which is crucial for long-term health. Students' physical activity levels showed a highly significant increase, from 50.00% to 91.70% of daily physical activity recommendations, demonstrating a 41.70 percentage point gain. This signifies that the program effectively promoted a more active lifestyle among students.

Table 1. Comprehensive summary and results of food education programs for a healthy lifestyle in Parigi Moutong Regency.

Indicators	Pre-test %	Post-test %	Increase
Nutritional Knowledge	45.20	78.60	33.40
Attitudes towards healthy food	64.00	90.00	26.00
Food Consumption Practices			
Consumption of vegetables and fruits	36.00	74.00	38.00
Unhealthy snack consumption		60.40	60.40
Percentage of students with IMT (Body Mass Index)	68.00	82.00	14.00
Daily physical activity recommendations	50.00	91.70	41.70
Supportive teachers and school staff	70.00	85.00	15.00
Parents who show increased awareness	40.00	70.00	30.00
Impact on the community			
Increased demand for local vegetables	20.00	40.00	20.00
A family that started a vegetable garden	35.00	65.00	30.00
Cooking skills			
Students who are able to prepare healthy traditional meals	20.00	75.00	50.00
Students who share healthy recipes with families	10.00	60.00	50.00
Ability to read food labels	25.00	45.00	20.00

Regarding program sustainability, 85.00% of teachers and school staff supported the program, indicating a high level of acceptance and institutional backing. Additionally, 70% of parents demonstrated increased awareness, suggesting that the program's impact extended beyond the school environment. At the community level, local vegetable demand rose by 20.00 percentage points, demonstrating the program's positive effects on the local economy and consumption patterns. Furthermore, the proportion of families starting home vegetable gardens increased from 35.00% to 65.00%, signaling broader behavioral changes within the community.

Regarding cooking skills, 75.00% of students became capable of preparing traditional healthy foods, demonstrating a significant 50.00 percentage point improvement in essential practical skills. Additionally, 60.00% of students shared healthy recipes with their families, indicating effective knowledge and skill transfer to the home environment. Food label reading ability improved by 20.00 percentage points, from 25.00% to 45.00%. These findings reflect substantial progress in students' nutritional literacy. This capability is particularly important as it enables students to make more informed and healthy food choices when shopping or selecting meals (Hamed Kandil, 2022; Marshall et al., 2022). Enhanced nutritional literacy has the potential for long-term impact on students' eating habits and health, as well as influencing their families.

Conclusion

Based on the research findings, it can be concluded that the food education program proved effective in promoting the adoption of healthy lifestyles among elementary school students in remote indigenous communities in Central Sulawesi. The program delivered significant positive impacts on enhancing nutritional knowledge and literacy, attitudes toward healthy food, food consumption practices, physical activity, and practical skills such as cooking and food label reading. These behavioral changes also contributed to improvements in students' Body Mass Index toward healthier levels. Beyond its effects within the school environment, the program extended its influence on family and community levels, as evidenced by increased parental awareness, rising demand for local vegetables, and family initiatives to establish home vegetable gardens. The strong support from teachers, school staff, and parents indicates promising prospects for the program's sustainability in the future. Nevertheless, follow-up evaluations remain essential to ensure the longevity of long-term impacts and to optimize aspects showing relatively lower improvements—particularly nutritional literacy in subsequent program implementations.

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Author Contributions

Conceptualization, M.N.; methodology, M.N. and L.N.; investigation, L.N., S.S., A.R., K.M., W.D., and W.N.; data curation, S.S. and M.Z.; formal analysis, A.R. and M.Z.; validation, M.N., S.S., K.M., and W.D.; resources, L.N., S.S., K.M. and W.N..; writing—original draft preparation, A.R. and M.Z.; writing—review and editing, M.N. and L.N.; visualization, M.Z.; supervision, M.N. and K.M.; project administration, M.N. and M.Z.; funding acquisition, M.N.

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Conflicts of Interest

The authors declare no conflict of interest

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