

Enhancing Awareness of Fish-Based Nutrition: Processed Fish Products Education at Aisiyiah Orphanage, Malang

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Abstract

This community service program was conducted at Aisiyiah Orphanage in Malang to improve nutritional knowledge, practical skills in fish processing, and healthy eating habits among students. A total of 31 orphanage students, 2 orphanage caregivers, and 14 faculty members from the Program of Fishery Product Technology, Universitas Brawijaya participated, reflecting a collaborative model of knowledge transfer and community engagement. Activities were structured into socialization, educational presentations, interactive discussions, hands-on demonstrations, evaluation, and follow-up planning. A pre-test assessed baseline knowledge of fish species, handling, nutrition, and processed products. Results showed that while students were generally aware of nutrition, they lacked technical understanding of processing methods and functional ingredients. Educational sessions and peer-led demonstrations addressed these gaps through the preparation of fish balls, nuggets, and gohyong, supported by recipe modules to encourage independent practice. Post-test scores demonstrated significant improvements, particularly in areas previously identified as weak, confirming the effectiveness of combining theory with practice. The follow-up phase emphasized sustainability by embedding food preparation into daily routines and encouraging entrepreneurial opportunities in fish product marketing. Overall, the program demonstrated that multi-component, participatory interventions can enhance knowledge, skills, and confidence, while promoting healthier eating behaviors and community empowerment among vulnerable youth.

Keywords: Community service; experiential learning; fish products; nutrition education; orphanage

INTRODUCTION

The issue of nutritional adequacy has become a central concern in Indonesian society, particularly following the 2024 presidential election, when President Prabowo Subianto emphasized nutrition as a national development priority. This priority is reflected in major initiatives such as the Free

Nutritious Meal (Makan Bergizi Gratis, MBG) program, implemented under the newly established National Nutrition Agency (Badan Gizi Nasional, BGN) (Mahmudiono et al., 2020). The program aims to ensure equitable access to nutritious meals for children and adolescents nationwide. These efforts align with Article 28H paragraph (1) of the 1945 Constitution of the Republic of Indonesia, which affirms every citizen's right to adequate food and nutrition. While fulfilling this mandate lies largely with the government, academic institutions are also expected to contribute through research, innovation, and community service, thereby enhancing public understanding and practices related to nutrition (Heikkilä et al., 2024).

Fish, one of the most abundant and affordable sources of high-quality protein in Indonesia, plays a crucial role in this nutritional framework. To promote fish consumption, the Ministry of Marine Affairs and Fisheries launched the national campaign Gerakan Memasyarakatkan Makan Ikan (Gemarikan) in 2004, aimed at increasing public awareness of the health benefits of fish and stimulating demand for fishery products. Compared to other animal protein sources, fish offers superior nutritional value, containing essential amino acids and long-chain omega-3 fatty acids such as eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA). These bioactive compounds are essential for brain development, cardiovascular health, and immune function (Abdel-Rahman et al., 2022). Fish also provides critical micronutrients such as vitamin D, vitamin B12, iodine, and selenium, all of which contribute to growth, cognitive performance, and disease prevention (Siregar et al., 2022). Extensive evidence confirms that regular fish consumption improves learning ability and memory in children, enhances cardiovascular resilience, and lowers the risk of chronic diseases in adults (Marini et al., 2022). Despite these well-documented benefits, disparities in fish consumption persist across Indonesian regions and population groups. Coastal communities generally consume fish more frequently due to better access, whereas inland and urban populations often report lower intake influenced by dietary preferences, availability, and socio-economic constraints. Vulnerable groups, particularly children living in orphanages, represent an overlooked demographic in nutrition studies. Orphanages serve as vital institutions for raising and educating orphans and underprivileged children, with the expectation of providing adequate nutrition to support growth and development. However, preliminary observations reveal that many orphanages struggle to meet balanced nutritional needs due to limited resources, insufficient nutritional knowledge, and the absence of structured dietary programs (Marini et al., 2022).

The Aisiyiah Orphanage in Malang illustrates these challenges. Although committed to the care and education of disadvantaged children, the orphanage continues to face challenges in providing optimal nutrition. Field interviews indicated that children had limited exposure to nutrition education and diverse fish-based foods, resulting in lower fish consumption despite local market availability (Manyullei & Arundhana, 2021). Addressing this problem requires more than simply supplying food; it calls for a cultural and behavioral shift that elevates fish as part of daily diets. Educational interventions have been shown to effectively shape children's dietary behaviors, especially when delivered in engaging and participatory formats (Syahputra et al., 2024). Introducing fish-based processed products represents a strategic entry point, as these items present fish in familiar, palatable, and convenient forms that overcome barriers such as taste preference and the presence of bones (Yewande et al., 2024). Popular products like fish nuggets and meatballs not only retain most of the nutritional benefits of whole fish but also increase children's willingness to consume fish regularly.

Community service programs led by higher education institutions can bridge the gap between scientific knowledge and practical application in local communities. By working directly with orphanages, universities can improve nutritional practices, foster lifelong healthy habits, and reinforce national initiatives such as MBG and Gemarikan. Such initiatives demonstrate the academic community's social responsibility in promoting sustainable human development and preparing healthier, more resilient future generations. Nevertheless, despite the recognized

importance of fish consumption and the existence of campaigns like Gemarikan, research on effective models for nutrition education in orphanage settings remains limited. Most existing studies focus on schools, households, or coastal communities, leaving a gap in understanding how interventions can be adapted for institutional care environments (Victoria et al., 2024). To address this gap, the present study was designed as a community service initiative tailored to the needs of children at the Aisiyiah Orphanage. It combines structured, interactive educational sessions with the introduction of processed fish products to improve nutritional awareness and promote positive dietary behavior among orphanage children.

METHODS

Socialization and activity scheduling

The community service program commenced with a socialization phase designed to inform and engage caregivers at the Aisiyiah Orphanage in Malang regarding the objectives, themes, and technical aspects of the planned activities, thereby fostering cooperation and ensuring alignment with the program's goals (Diannita et al., 2021). The core purpose of the initiative was to provide education on the Gerakan Makan Ikan (Fish Consumption Movement) and to introduce fish-based processed products, namely fish balls (bakso), nuggets, and gohyong, selected for their popularity, practicality, and nutritional benefits. Catfish (*Clarias* sp.) and barracuda (*Sphyraena barracuda*) were chosen as raw materials because of their high protein content, affordability, and local availability, thereby promoting the utilization of accessible resources for improving community health. The implementation date was mutually agreed upon with the orphanage administration and scheduled for 26 August 2025 in the main hall of the orphanage, reflecting participatory planning that ensures context relevance and responsiveness to local needs. This collaborative scheduling highlights the significance of shared decision-making and culturally sensitive approaches in strengthening community engagement and empowerment (Sallay et al., 2023).

Presentation and discussion sessions

The implementation phase of the community service program involved orphanage caregivers, 31 students, and faculty members from the Program of Fishery Product Technology, Faculty of Fisheries and Marine Science, Universitas Brawijaya, reflecting a collaborative approach to knowledge transfer and community engagement. The program commenced with an opening address by the program leader, A. Aziz Jaziri, M.Sc., followed by a pre-test designed to assess participants' baseline knowledge of fish species, handling practices, nutritional values, and fish-based processed products. The educational component was delivered in two sessions: the first, presented by Rahmi Nurdiani, Ph.D., addressed fish identification, handling, and nutritional composition to strengthen health literacy, while the second, delivered by Hefti Salis Yufidasari, M.P., focused on the preparation of processed fish products, including catfish fish balls, barracuda nuggets, and barracuda gohyong, highlighting practical applications for enhancing dietary options. Each session was complemented by interactive discussions and a question-and-answer segment to reinforce comprehension and ensure active participation. This structured combination of assessment, theoretical instruction, and applied demonstration exemplifies a best-practice methodology in community service, bridging scientific knowledge with practical skills to promote sustainable improvements in nutritional awareness and dietary behavior (Tajuria et al., 2024).

Demonstration of fish-based processed products

Following the educational presentations, a practical demonstration was conducted to train orphanage students in preparing fish-based products such as fish balls, nuggets, and gohyong, which were selected for their popularity in Malang's local food stalls and simple processing methods suitable for skill acquisition in culinary education. The session was facilitated by three undergraduate students from the Department of Fishery Product Technology (Eva Maulidia

Zuhra, Syelma Syafrili, and Lidia Trisabilla) each responsible for one product, adopting a peer-led approach that fosters participant engagement and improves learning outcomes (Reicks et al., 2014). Students were divided into three groups, each assigned to a product, ensuring hands-on participation, which aligns with active learning principles and has been shown to increase cooking confidence and skills. In addition to observing demonstrations, participants actively engaged in the preparation process, reinforcing skill development and enhancing self-efficacy in cooking. To support sustained learning, each participant received a module containing detailed recipes and step-by-step instructions, enabling independent reproduction of the products. Providing such educational resources is recognized as best practice in cooking interventions, as it promotes self-sufficiency and the long-term adoption of healthy food practices within community settings (Garbo & Hadikusuma, 2023).

Evaluation of the program

The evaluation phase of the community service program employed both formative and summative approaches to assess learning outcomes and program effectiveness. Informal discussions and feedback sessions were conducted during and after the demonstrations to monitor student engagement and comprehension, consistent with best practices in continuous feedback that enhance learning effectiveness (Selvaraj et al., 2025). To measure knowledge improvement, a post-test identical to the pre-test was administered to all 31 participants, enabling direct comparison and ensuring validity in assessing learning gains related to fish nutrition, handling, and processed fish products. The results demonstrated notable improvements in post-test scores, confirming the effectiveness of the structured teaching methodologies and interactive demonstrations, findings that align with previous evidence on the positive impact of educational interventions in nutrition and health contexts. This systematic evaluation not only verified the success of the program but also provided critical insights for refining future community service initiatives, emphasizing the value of evidence-based strategies in designing and assessing educational interventions for vulnerable populations.

Follow-up plan

The final stage of the program emphasized follow-up actions to ensure sustainability and continuity, confirming that orphanage students not only acquired knowledge and skills in preparing fish-based processed products but also had opportunities to practice them regularly, a key factor in skill retention and proficiency. The follow-up agenda further prioritized institutionalizing these practices within the orphanage, enabling students to independently produce nutritious fish-based products and fostering a self-sufficient environment (Maltinsky et al., 2025). Beyond skill reinforcement, students were encouraged to pursue entrepreneurial initiatives by scaling up production and exploring marketing opportunities within their communities, thereby integrating economic empowerment with nutritional improvement. Such strategies align with evidence showing that structured follow-up interventions support sustained behavior change and practical application of acquired skills. Ultimately, this approach is expected to generate both nutritional and economic benefits for the orphanage, ensuring that the program's impact extends beyond initial educational activities and contributes to long-term community engagement and development (Khalid et al., 2022).

RESULTS AND DISCUSSION

The community service program at Aisiyiah Orphanage in Malang was implemented through structured stages, including socialization, presentations, interactive discussions, hands-on practice, evaluation, and follow-up. Supported by caregivers and the Faculty of Fisheries and Marine Science, Universitas Brawijaya, the program combined theory with practical demonstrations, particularly in preparing fish-based products such as fish balls, nuggets, and

gohyong. This approach enhanced students' knowledge, skills, and confidence in nutrition-related practices while fostering active caregiver involvement. The positive response and outcomes highlight the program's potential for sustainability and replication, demonstrating how collaborative, multi-component interventions can effectively improve dietary awareness and promote healthier habits among vulnerable populations.

Socialization of community service activities

The socialization stage of the community service program at Aisiyiyah Orphanage underscored the collaboration between facilitators from the Program of Fishery Product Technology, Universitas Brawijaya, and the orphanage caregivers, driven by the relevance and benefits of promoting the Gerakan Makan Ikan (Fish Consumption Movement) and diversified fish-based products (Figure 1). Such initiatives resonate with global evidence demonstrating that nutrition-focused educational interventions can significantly improve children's knowledge and dietary practices (Gao et al., 2022). The content provided included not only theoretical instruction but also practical resources, such as modules and recipe booklets for fish balls, nuggets, and gohyong. Integrating educational material with hands-on demonstrations has been shown to enhance retention and skill transfer, enabling participants to replicate practices independently, a model consistent with best practices in nutrition education.

A SWOT analysis contextualized the program within the orphanage environment (Table 1), identifying key strengths such as high student enthusiasm, strong caregiver involvement, and robust institutional support that facilitated coordination (Kholifah, 2022). However, weaknesses included varied baseline knowledge among students, age heterogeneity, and logistical barriers linked to the dormitory layout, emphasizing the need for tailored educational strategies. Opportunities for program expansion were evident in the orphanage's proximity to local fish markets, sufficient facilities, and strong backing from the Muhammadiyah Foundation, which provide favorable conditions for nutrition-oriented interventions. At the same time, external threats, including the relatively high price of fish, competing school schedules, and age diversity among participants, posed challenges to sustained implementation. Similar community-based studies emphasize that aligning program design with local contexts and resource realities is essential to ensure sustainability and long-term impact (Boak et al., 2025).

Taken together, the program demonstrated strong potential to enhance students' nutritional knowledge and practical skills in fish processing through a structured integration of education, demonstration, and community support. By leveraging institutional strengths and community opportunities while strategically addressing weaknesses and external threats, the initiative offers a replicable model for nutrition education in orphanage settings. Ultimately, it contributes not only to improving awareness of fish-based nutrition but also to fostering healthier, more self-sufficient dietary habits among vulnerable youth populations (Girma & Molla, 2021).



Figure 1. Socialization of Community Service Activities

Table 1. SWOT Analysis of the orphanage context

Strengths (S)	Weaknesses (W)
a. High student interest in gaining new knowledge; b. Students are easily coordinated by caregivers; c. Strong institutional structure of the orphanage.	a. Limited knowledge of fish species, handling, and processing; b. Age diversity among students, with some still in primary school; c. Physical separation between male and female student dormitories.
Opportunities (O)	Threats (T)
a. Easy access to fish markets; b. Sufficient orphanage facilities; c. Strong support from the Muhammadiyah Foundation.	a. Relatively high price of fish; b. Heterogeneity in age groups, especially among primary school students; c. Busy school schedules.

Presentations and interactive discussions

The implementation phase of the community service program at Aisiyiah Orphanage in Malang engaged 31 students, orphanage caregivers, and faculty members from the Program of Fishery Product Technology, Faculty of Fisheries and Marine Science, Universitas Brawijaya. This collaborative participation reflects an effective model of knowledge transfer and community engagement, consistent with prior findings that highlight the importance of collective involvement in ensuring the success of community-based interventions. The program began with an opening address from the program leader, followed by a pre-test designed to assess students' baseline knowledge of fish species, handling practices, nutritional values, and fish-based processed products, an established practice in educational interventions to measure learning progression (Kearney et al., 2024). The schedule of community service activities was tabulated in Table 2.

The educational component was delivered in two structured sessions. The first, presented by Rahmi Nurdiani, Ph.D., emphasized fish identification, handling practices, and nutritional composition, aiming to strengthen students' health literacy. The second, led by Hefti Salis Yufidasari, M.P., focused on practical fish processing techniques, including the preparation of catfish fish balls and barracuda nuggets (Figure 2). Evidence suggests that combining theoretical instruction with experiential learning enhances comprehension and skill acquisition, thereby improving educational outcomes (Micha et al., 2017). Both sessions incorporated interactive discussions and a question-and-answer segment, which are recognized as best practices in nutrition education for fostering active participation and deeper understanding.

The pre-test results offered valuable insights into students' initial knowledge (Figure 4). Higher scores were observed in general topics, such as identifying marine fish (80%) and recognizing the purpose of soaking fish with lime juice (80%). Similarly, knowledge of fish nutrition (70%) and the function of bread crumbs in nuggets (70%) were relatively strong. However, substantial knowledge gaps were evident in more technical aspects. Only 60% of participants correctly identified the primary gelling agent in fish balls, while just 40% understood preparation steps such as nugget pre-frying, the role of garlic in nuggets, the wrapping material for gohyong dough, and the role of salt in fish ball dough. This imbalance between general awareness and technical understanding mirrors earlier studies, which found that learners often perform well in conceptual areas but face challenges in applying this knowledge to food preparation and cooking practices (Hollywood et al., 2017).

These findings highlight the importance of integrating practical demonstrations with theoretical sessions to close technical knowledge gaps. Prior research emphasizes that while students may acquire nutritional concepts in classroom-based formats, skill development requires hands-on engagement to reinforce procedural learning (Garcia et al., 2020). Experiential learning approaches, such as cooking demonstrations and active practice, have been shown to significantly

improve not only knowledge retention but also long-term dietary behaviors (Fernando et al., 2024). Thus, the inclusion of direct practice in preparing fish balls, nuggets, and gohyong was a crucial component of this program, allowing students to apply theoretical knowledge in real-world contexts.

Overall, the program demonstrated that structured educational interventions enriched with interactive and practical components effectively bridge the gap between nutritional knowledge and technical application. The strong support from caregivers and active engagement of students further indicates the potential sustainability of the initiative and its applicability in similar community settings. These outcomes are consistent with broader evidence underscoring the value of collaborative, multi-stakeholder approaches in nutrition education and community service programs.

Table 2. Schedule of Community Service Activities

Session 1	
Activities	- Explanation of the methods for implementing the community service program - Introduction of the faculty team from the Department of Fishery Product Technology - Presentation of examples of common fish-based processed products
Objectives	- To introduce the methods and approach used in implementing the community service program - To familiarize participants with the facilitators responsible for delivering the program - To provide examples of fish-based processed products commonly available in the market
Session 2	
Activities	- Delivery of materials on types of marine and freshwater fish - Introduction to proper fish handling techniques - Explanation of the nutritional content of fish and its health benefits
Objectives	- To enable participants to distinguish between marine and freshwater fish species - To provide knowledge on proper fish handling methods - To enhance understanding of the nutritional value of fish and the benefits of its consumption
Session 3	
Activities	- Explanation of fish-based processed products (fish balls, nuggets, and <i>gohyong</i>) - Delivery of recipes using catfish and barracuda as raw materials - Demonstration of production techniques for fish-based products
Objectives	- To provide an overview of fish-based processed products - To explain recipes for preparing fish balls, nuggets, and <i>gohyong</i> - To describe the step-by-step process of producing fish-based products
Session 4	
Activities	- Administration of post-test questions as an evaluation tool for the community service program - Explanation of follow-up plans after the training on fish-based products - Presentation of acknowledgments to participants
Objectives	- To assess the extent of participants' understanding of the "Eat More Fish" education program and fish-based product processing - To ensure program sustainability beyond the community service activities - To provide recognition and appreciation to the orphanage students



Figure 2. Educational process of community service in the orphanage boarding school

Hands-on practice of processed fish products

The practical demonstration phase of the community service program at Aisyiyah Orphanage was designed to equip students with hands-on experience in preparing popular fish-based processed products, including fish balls, nuggets, and gohyong (Figure 3). These products were selected for their popularity in local food stalls in Malang and their straightforward processing techniques, making them accessible entry points for culinary skill acquisition. The session was led by three undergraduate students from the Department of Fishery Product Technology (Eva Maulidia Zuhra, Syelma Syafrili, and Lidia Trisabilla) who guided each group's preparation of a different product. Implementing a peer-led instructional model is beneficial; studies show that peer-assisted learning notably enhances student engagement and comprehension during educational interventions (Magallanes et al., 2021).

To foster equitable participation, students were divided into three groups, which ensured that all participants were actively involved in the preparation process. This grouping strategy aligns with the principles of active learning, which emphasize the benefits of engagement and hands-on experience as vital drivers of improved learning outcomes. The combination of demonstrations and active practice provided participants with the opportunity to both observe culinary techniques and directly apply the knowledge they gained, reinforcing technical skills and enhancing self-efficacy in cooking. Research indicates that experiential learning, particularly through direct food preparation, significantly boosts cooking confidence, fosters practical competence, and contributes to long-term improvements in dietary behaviors (Wise, 2015).

To facilitate knowledge retention and encourage independent practice beyond the program, each participant received a learning module that included detailed recipes and step-by-step preparation instructions for all three products. The provision of such resources represents a best-practice approach in nutrition and cooking interventions, as it enables learners to replicate activities on their own and encourages repeated practice, which is crucial for skill consolidation. Furthermore, these recipe modules serve as a bridge between supervised training and real-world application, thereby supporting the sustainability of behavior change by integrating nutritional practices into everyday routines (Lillquist et al., 2022).

The outcomes of this demonstration underscore the effectiveness of combining theoretical instruction with practical application in nutrition education. While earlier pre-test results revealed gaps in students' technical knowledge concerning processing methods, this stage effectively addressed those deficiencies by offering tactile and experiential learning opportunities. By aligning educational strategies with active engagement and utilizing culturally relevant food products, the program reinforced technical knowledge while promoting positive attitudes toward fish consumption. These findings resonate with international studies demonstrating that integrated, practice-based interventions are more impactful than traditional lecture-only formats in enhancing both skills and nutritional behavior (Magallanes et al., 2021).



Figure 3. Pratical demonstration of processed fish products

Evaluation of the community service

The evaluation phase of the community service program at Aisiyah Orphanage utilized both formative and summative assessments to measure student learning and program effectiveness. Formative evaluation was conducted through informal discussions and feedback sessions during and after the demonstrations, which provided opportunities to monitor student engagement and clarify areas of misunderstanding. This practice is consistent with evidence showing that continuous feedback enhances comprehension and learning effectiveness in educational interventions (Waskito et al., 2022). Summative evaluation was conducted through a structured post-test administered to all 31 participants. The post-test was identical to the pre-test, thereby ensuring comparability and validity in measuring knowledge improvement related to fish nutrition, handling, and processed fish products.

The post-test results revealed substantial improvements across nearly all indicators (Figure 3). For example, knowledge of the nutritional composition of fish and the role of ice cubes in fish ball preparation increased from 70–80% in the pre-test to 100% in the post-test, demonstrating a complete acquisition of these concepts. Similarly, understanding of the purpose of soaking fish with lime juice improved from 80% to 100%. Technical knowledge also improved significantly: correct identification of the primary gelling agent in fish balls rose from 60% to 80%, while knowledge of the wrapping material for gohyong dough improved from 40% to 80%. Skills related to cooking steps, such as pre-frying procedures in nugget preparation and the role of salt in fish ball dough, also increased from 40% to 70%. Overall, the most notable improvements were observed in areas where pre-test scores had been lowest, reflecting the effectiveness of the practical demonstration and interactive learning approach.

These results confirm that the structured methodology, combining theoretical instruction, peer-led demonstrations, and hands-on practice, was effective in bridging the gap between baseline knowledge and applied technical understanding. The largest gains were observed in product-specific areas, such as the role of garlic in nuggets (+40%) and the use of wrapping materials for gohyong (+40%), underscoring the importance of experiential learning for developing practical food-processing skills. Such findings are consistent with international evidence demonstrating that interactive, practice-oriented interventions are more effective than lecture-based formats in improving nutritional knowledge and food literacy (Lerchenfeldt et al., 2019).

The outcomes also highlight the potential for long-term impact. Improvements in both general and technical knowledge suggest that students not only absorbed information but also gained confidence in applying it, a result that aligns with studies showing the value of active participation in fostering self-efficacy and sustainable behavior change in dietary practices. Moreover, the high post-test scores in key areas such as nutritional composition (100%) and food safety practices (lime juice soaking, 100%) indicate that the program successfully addressed both health literacy and culinary skill development (Burgess et al., 2020).

The evaluation confirmed the effectiveness of this community service program in enhancing students' knowledge and skills in fish nutrition and processing. The systematic assessment through pre- and post-tests provided robust evidence of learning gains, while the integration of formative feedback ensured active engagement throughout the program. These findings reinforce the importance of evidence-based, experiential, and participatory approaches in community-based nutrition education, particularly for vulnerable populations such as orphanage students.

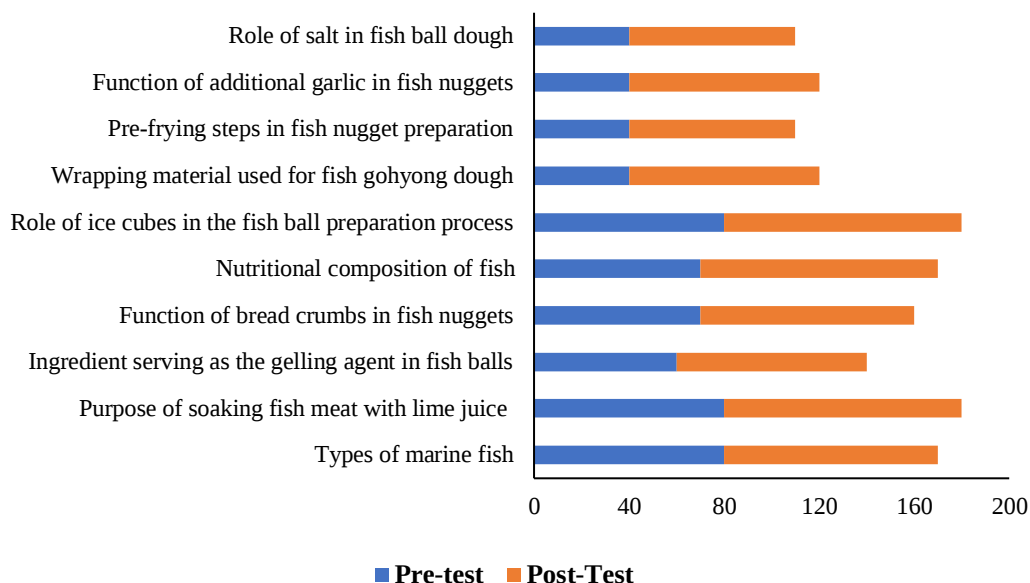


Figure 4. Pre-test and post-test evaluation

Follow-up of community service program

The final stage of the community service program emphasized follow-up actions to ensure the sustainability and continuity of the intervention established at Aisyiyah Orphanage. This stage was crucial in confirming that students not only acquired valuable knowledge and skills for preparing fish-based processed products but also had the opportunity to engage in these practices regularly. The importance of regular practice as a key factor in skill retention and proficiency development is well documented in educational literature. Research indicates that consistent practice enhances the learner's ability to integrate gained knowledge into skillful everyday applications (Alharbi et al., 2024). For instance, studies have highlighted that educational interventions should be interwoven with continuous practice to ensure effective knowledge retention and application over time.

To reinforce the outcomes, embedding the preparation of fish-based products into the orphanage's daily routines was prioritized. This institutionalization encouraged students to independently produce nutritious foods, contributing to a culture of self-sufficiency and promoting healthier eating habits. The significance of integrating such practices into institutional frameworks is supported by evidence that suggests structured environments foster sustained behavioral changes. The approach employed in the program ensured that the educational impact extended beyond a single training session, transforming knowledge into a sustainable practice that supports long-term health benefits (Bihani et al., 2025).

In addition to skill reinforcement, the follow-up actions motivated students to explore entrepreneurial ventures related to fish product marketing within their communities. This dual focus on nutrition and entrepreneurship provided avenues for improved dietary practices alongside economic empowerment. Linking health education with livelihood opportunities has been associated with enhanced community engagement and development, reflecting a holistic view of educational programs (Nord et al., 2017). An analysis of similar programs has shown that such initiatives not only support better dietary choices but also catalyze economic activity in local communities through sustained involvement in food preparation and marketing.

Thus, the community service program's approach confirms the importance of both educational and practical methodologies in fostering a culture of health and self-reliance. This

comprehensive framework ensures that the initiatives yield lasting impacts, cultivating essential skills and reinforcing nutritional knowledge in vulnerable populations. Establishing a pattern of continuous learning and application signifies a transformative model for community-based educational programs addressing both health and economic needs.



Figure 5. Follow-up process of the community service program

CONCLUSION

The community service program at Aisiyiah Orphanage in Malang successfully demonstrated that structured, multi-stage interventions combining socialization, theoretical instruction, practical demonstrations, evaluation, and follow-up can significantly improve nutritional knowledge, technical skills, and confidence among orphanage students. The integration of pre- and post-tests confirmed measurable learning gains, particularly in areas that were initially weak, such as the functional role of ingredients and specific preparation steps. Hands-on practice and the provision of recipe modules reinforced technical competence, while the strong engagement of caregivers and institutional support ensured that the initiative was contextually relevant and sustainable. Overall, the program highlighted the effectiveness of experiential and participatory approaches in bridging the gap between knowledge and practice, ultimately fostering healthier eating habits and greater self-sufficiency among vulnerable youth populations.

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REFERENCES

- Abdel-Rahman, R., Fouda, L., Ebrahim, H., Aisha, N., & Soliman, F. (2022). Effect of developing protocol of care on satisfaction of bio-psychosocial needs of institutionalized school-age orphans children. *Tanta Scientific Nursing Journal*, 26(3), 166–188. <https://doi.org/10.21608/tsnj.2022.255762>
- Alharbi, A., Mullen, R., McClure, J., & Miller, W. (2024). Effectiveness of simulation-based learning on knowledge and skill acquisition and retention among nursing students: A quasi-experimental study. *Research Square*. <https://doi.org/10.21203/rs.3.rs-5372326/v1>
- Bihani, P., Paliwal, N., Jaju, R., & Rajpurohit, V. (2025). Evaluation of a multidisciplinary simulation training curriculum for local anesthetic systemic toxicity management: A quasi-experimental study using the Kirkpatrick model in India. *Anesthesia and Pain Medicine*, 20(2), 166–174. <https://doi.org/10.17085/apm.24146>

- Boak, R., Palermo, C., Beck, E., Pelly, F., Wall, C., & Gallegos, D. (2025). Five actions to strengthen the nutrition and dietetics profession into the future: Perspectives from Australia and New Zealand. *Journal of Human Nutrition and Dietetics*, 38(3), 1–11. <https://doi.org/10.1111/jhn.70064>
- Burgess, A., Diggele, C., Roberts, C., & Mellis, C. (2020). Feedback in the clinical setting. *BMC Medical Education*, 20(Suppl 2), 460. <https://doi.org/10.1186/s12909-020-02280-5>
- Diannita, R., Muslih, M., Wijayanti, N., & Fatayati, U. (2021). Participatory rural appraisal (PRA) for the development of safe weaving bamboo production through community empowerment to improve health and safety of bamboo weaving craftsmen in Mojorejo, Ponorogo, East Java, Indonesia. *International Journal of Community Service*, 1(3), 243–252. <https://doi.org/10.51601/internationaljournalofcommunityservice.v1i3.44>
- Fernando, J., Alonso, L., Gastaldo, I., Coll, A., Lozano, J., Martini, V., ... & Moizé, V. (2024). Enhancing healthcare professionals' culinary skills, food management, counseling confidence, and Mediterranean diet adherence through a culinary medicine boot camp: A pilot implementation program (PIP). *American Journal of Lifestyle Medicine*. <https://doi.org/10.1177/15598276241261654>
- Gao, Z., Wang, S., Peng, L., Sun, L., Qiu, P., Bai, B., ... & Wang, Q. (2022). Comparison of the effects of different forms of nutrition education on adolescent male soccer players. *International Journal of Environmental Research and Public Health*, 19(21), 13803. <https://doi.org/10.3390/ijerph192113803>
- Garbo, A., & Hadikusuma, S. (2023). Empowerment of women's culinary business in Persit Kartika Chandra Kirana organization, Yogyakarta. *Asian Journal of Community Services*, 2(11), 907–916. <https://doi.org/10.55927/ajcs.v2i11.6759>
- Garcia, T., Ford, B., Pike, D., Bryce, R., Richardson, C., & Wolfson, J. (2020). Development and implementation of a community health centre-based cooking skills intervention in Detroit, MI. *Public Health Nutrition*, 24(3), 549–560. <https://doi.org/10.1017/s1368980020003481>
- Girma, A., & Molla, A. (2021). Maternal minimum dietary diversity and associated factors among pregnant women, Southwest Ethiopia, 2021. *BMC Nutrition*, 7(1), 1–9. <https://doi.org/10.1186/s40795-021-00474-8>
- Heikkilä, A., Elovainio, M., Raaska, H., & Lapinleimu, H. (2024). One-third of children had clinical signs of developmental coordination disorder six months after their international adoption. *Acta Paediatrica*, 114(2), 310–318. <https://doi.org/10.1111/apa.17428>
- Hollywood, L., Surgenor, D., Reicks, M., McGowan, L., Lavelle, F., Spence, M. & Dean, M. (2017). Critical review of behaviour change techniques applied in intervention studies to improve cooking skills and food skills among adults. *Critical Reviews in Food Science and Nutrition*, 58(17), 2882–2895. <https://doi.org/10.1080/10408398.2017.1344613>
- Kearney, M., Maheu, A., Booth, M., Newberg, A., Cronholm, P., & Ayubcha, S. (2024). Promoting healthful and diverse eating behaviours through an extracurricular culinary skills intervention in Philadelphia. *Journal of Nutritional Science*, 13, e31. <https://doi.org/10.1017/jns.2024.31>
- Khalid, A., Morawska, A., & Turner, K. (2022). Pakistani orphanage caregivers' perspectives regarding their caregiving abilities, personal and orphan children's psychological wellbeing. *Child Care, Health and Development*, 49(1), 145–155. <https://doi.org/10.1111/cch.13027>

- Kholifah, S. (2022). Empowerment of orphanage caregivers with the IHC model to improve adolescent psychological needs. *Frontiers in Community Service and Empowerment*, 1(3), 123–131. <https://doi.org/10.35882/ficse.v1i3.18>
- Lerchenfeldt, S., Mi, M., & Eng, M. (2019). The utilization of peer feedback during collaborative learning in undergraduate medical education: A systematic review. *BMC Medical Education*, 19(1), 321. <https://doi.org/10.1186/s12909-019-1755-z>
- Lillquist, S., Barnecett, G., Flexman, N., & Mikati, N. (2022). Recipes for health: A community-based nutrition and culinary intervention. *Cureus*, 14(8), e32322. <https://doi.org/10.7759/cureus.32322>
- Magallanes, E., Sen, A., Siler, M., & Albin, J. (2021). Nutrition from the kitchen: Culinary medicine impacts students' counseling confidence. *BMC Medical Education*, 21(1), 436. <https://doi.org/10.1186/s12909-021-02512-2>
- Mahmudiono, T., Nindya, T., Rachmah, Q., Segalita, C., & Wiradnyani, L. (2020). Nutrition education intervention increases fish consumption among school children in Indonesia: Results from behavioral-based randomized control trial. *International Journal of Environmental Research and Public Health*, 17(19), 6970. <https://doi.org/10.3390/ijerph17196970>
- Maltinsky, W., Swanson, V., Tanyan, K., & Hotham, S. (2025). An evaluation of health behavior change training for health and care professionals in St. Helena. *Healthcare*, 13(4), 435. <https://doi.org/10.3390/healthcare13040435>
- Manyullei, S., & Arundhana, A. (2021). Analysis of household food security based on the proportion of food expenditures and energy consumption in flood-prone areas in Wajo District. *Open Access Macedonian Journal of Medical Sciences*, 9(E), 241–245. <https://doi.org/10.3889/oamjms.2021.5874>
- Marini, G., Susanti, E., Saputro, S., Reliani, R., & Husna, A. (2022). The food intake pattern in relation to the nutritional status of school-age 6–12-year-old children in Muhammadiyah orphanage. *Gaceta Médica de Caracas*, 130(Suppl. 1). <https://doi.org/10.47307/gmc.2022.130.s1.30>
- Micha, R., Peñalvo, J., Cudhea, F., Imamura, F., Rehm, C., & Mozaffarian, D. (2017). Association between dietary factors and mortality from heart disease, stroke, and type 2 diabetes in the United States. *JAMA*, 317(9), 912–924. <https://doi.org/10.1001/jama.2017.0947>
- Nord, A., Svensson, L., Claesson, A., Herlitz, J., Hult, H., Kreitz-Sandberg, S., ... & Nilsson, L. (2017). The effect of a national web course “Help-Brain-Heart” as a supplemental learning tool before CPR training: A cluster randomised trial. *Scandinavian Journal of Trauma, Resuscitation and Emergency Medicine*, 25(1), 36. <https://doi.org/10.1186/s13049-017-0439-0>
- Reicks, M., Trofholz, A., Stang, J., & Laska, M. (2014). Impact of cooking and home food preparation interventions among adults: Outcomes and implications for future programs. *Journal of Nutrition Education and Behavior*, 46(4), 259–276. <https://doi.org/10.1016/j.jneb.2014.02.001>
- Sallay, V., Martos, T., Lucza, L., Papp-Zipernovszky, O., & Csabai, M. (2023). Health psychology services for people in disadvantaged regions of Hungary: Experiences from the primary care development model program. *Preprints*, 2023, 1–12. <https://doi.org/10.20944/preprints202301.0038.v1>

- Selvaraj, F., Ethiraj, T., Rajendran, S., G., Narayanasamy, V., Babu, G., ... & Subbaiya, S. (2025). Enhancing knowledge and attitudes toward modern temporary family planning methods: A nurse-led intervention study among reproductive-age women. *Journal of Pharmacy and Bioallied Sciences*, 17(Suppl. 1), S670–S672. https://doi.org/10.4103/jpbs.jpbs_1626_24
- Siregar, Z., Tarigan, N., & Sahnan, M. (2022). Strengthening human resources through introduction and stunting prevention. *East Asian Journal of Multidisciplinary Research*, 1(7), 1221–1228. <https://doi.org/10.55927/eajmr.v1i7.1058>
- Syahputra, O., Anggraini, N., & Irmansyah, T. (2024). Food estate management strategy in Humbang Hasundutan Regency, North Sumatra Province. *IOP Conference Series: Earth and Environmental Science*, 1302(1), 012103. <https://doi.org/10.1088/1755-1315/1302/1/012103>
- Tajuria, G., Gray, L., Warburton, L., Lambley-Burke, R., Burt, C., & Maidment, I. (2024). How can we grow research in community-based NHS and social care services (HANDLE)? *F1000Research*, 13, 422. <https://doi.org/10.12688/f1000research.145142.1>
- Wise, N. (2015). Pregnant adolescents, beliefs about healthy eating, factors that influence food choices, and nutrition education preferences. *Journal of Midwifery & Women's Health*, 60(4), 410–418. <https://doi.org/10.1111/jmwh.12275>
- Waskito, W., Irzal, I., & Ya, K. (2022). The adventure of formative assessment with active feedback in vocational learning: The empirical effect for increasing students' achievement. *Journal of Technical Education and Training*, 14(1), 39–48. <https://doi.org/10.30880/jtet.2022.14.01.005>

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