Food Safety Education and Healthy Fish Processing for Coastal Communities to Support Household Nutrition Security: A Structured Mentoring Program

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Abstract

Coastal households living close to fish landing sites have important opportunities to use locally available fish to improve dietary quality and household nutrition security. However, proximity to fish resources does not automatically ensure that fish is selected, handled, prepared, and stored safely. Unsafe practices, including inadequate personal hygiene, cross-contamination between raw and cooked foods, insufficient cooking, and inappropriate storage, may reduce the health value of fish-based meals and increase the risk of foodborne disease. This community service program aimed to strengthen the knowledge and practical skills of fishing-community members regarding food safety and healthy fish processing in Depok Beach, Yogyakarta, Indonesia. The program involved 10 participants and used a structured mentoring approach consisting of needs identification, baseline assessment, interactive education, cooking demonstration, supervised hands-on practice, household application, feedback, and final evaluation. Educational content was organized around the World Health Organization's Five Keys to Safer Food and the use of fresh, locally available fish in balanced family meals. The program emphasized handwashing, safe water, cleaning and sanitation of equipment, separation of raw and cooked foods, thorough cooking, time–temperature control, and hygienic storage. It also introduced a practical healthy fish dish that can be adapted to local species and household purchasing power. This manuscript is written as a community service report and protocol. Because the user has not supplied pre-test, post-test, observation, or follow-up data, numerical effectiveness results are intentionally not invented; fields requiring verified local data are clearly marked. The program provides a feasible model for strengthening household capability to transform local fish resources into safe, nutritious, and acceptable family foods. Future implementation should use repeated observation and follow-up mentoring to assess whether knowledge gains are sustained as routine food-handling behavior.

Keywords: *Coastal community; Food safety; Fish processing; Household nutrition security; Structured mentoring; Depok Beach*

INTRODUCTION

Fish and other aquatic foods can play a strategic role in food and nutrition security. In addition to providing high-quality, bioavailable animal protein, aquatic foods supply nutrients that are important across the life course, including omega-3 fatty acids, vitamins, and minerals (FAO, 2022). For coastal communities, fish is not only a commodity with economic value but also a locally accessible food resource that can contribute to the quality, diversity, and adequacy of family diets. The nutritional potential of fish, however, is fully realized only when households can access, choose, prepare, and consume it safely and regularly.

Depok Beach is located in the coastal area of Bantul Regency, Special Region of Yogyakarta. The area is known for fisheries activities and fish-based culinary businesses. Available descriptions identify Depok Beach as an area with abundant fish potential and as one of Yogyakarta's fish culinary centers (Universitas Gadjah Mada, 2017). This local context makes fish a relevant entry point for community education on family nutrition. It also makes food safety especially important because fish is highly perishable, is often handled repeatedly from landing to household preparation, and may be consumed or sold after processing.

Food safety is a basic component of public health and nutrition. A nutritious food will not support health optimally if it is contaminated or prepared under unsafe conditions. The World Health Organization (WHO) promotes five practical principles for safer food: keep clean; separate raw and cooked foods; cook thoroughly; keep food at safe temperatures; and use safe water and raw materials (WHO, 2006). These principles are applicable at the household level and are particularly relevant to fish preparation. Raw fish can contaminate hands, knives, cutting boards, work surfaces, and ready-to-eat foods. Inadequate cooking or leaving cooked foods at room temperature for extended periods can also increase food-safety risks.

In Indonesia, food safety is not only a household responsibility but also a public concern reflected in Government Regulation No. 86 of 2019 on Food Safety. The regulation defines food sanitation as efforts to establish and maintain healthy and hygienic food conditions free from physical, biological, and chemical contamination. It requires food activities throughout the food chain to meet sanitation requirements and maintain food safety (Government of the Republic of Indonesia, 2019). Although formal regulations are essential, their public-health benefits depend on whether food handlers and families can translate basic requirements into daily practices.

At the household level, food-safety education should not be limited to lectures. Participants need opportunities to observe, practise, receive feedback, and apply new practices in the settings where meals are actually prepared. This is particularly important when participants have established food-handling routines, limited facilities, competing domestic or livelihood responsibilities, and different levels of prior knowledge. Evidence from a systematic review and meta-analysis indicates that food-safety training can improve food handlers' knowledge, attitudes, and practices, although effects vary between settings and outcome measures (Insfran-Rivarola et al., 2020). Another review found that educational training and course interventions can improve attitudes and behaviours related to consumer food safety, while also emphasizing the need for rigorous evaluation (Young et al., 2015).

Structured mentoring is therefore appropriate for community service activities because it combines education with guided practice and follow-up. Rather than positioning participants as passive recipients of information, mentoring invites them to discuss their current practices, identify barriers, try safer techniques, and adapt recommendations to their household realities. For coastal fish-processing education, this approach can connect food safety, nutritional quality, taste, affordability, and the availability of local fish.

Previous community-service initiatives in Indonesia demonstrate the relevance of education and demonstrations for safe fish utilization. For example, education for coastal community cadres in Buwun Mas combined information on choosing safe fish with demonstrations of seafood processing; the program reported improved post-test knowledge among its participants (Marlina et al., 2022). Other community programs have used counseling, demonstrations, and hands-on processing of fish products to strengthen local-food utilization and household skills (e.g., Nursyamsi et al., 2024). These experiences suggest that practical learning can be integrated with food-safety messages. However, every community has distinctive fish availability, household equipment, cultural preferences, and sanitation conditions. Programs must therefore be responsive to local circumstances rather than merely replicate a recipe or presentation.

This community service program was designed for a group of 10 members of the fishing community at Depok Beach, Yogyakarta. The program focused on two linked issues: food safety and healthy fish processing. Food safety content addressed the prevention of contamination during purchasing, washing, cutting, cooking, serving, and storing fish. Healthy processing content focused on selecting fresh fish, minimizing excessive oil, salt, and seasoning, combining fish with vegetables or other locally available ingredients, and preparing dishes that are acceptable for family members. The central premise was that household nutrition security can be supported when

locally available fish is processed into meals that are safe, nutritious, practical, and culturally acceptable.

The objective of this program was to improve participants' knowledge and practical capability regarding safe and healthy fish processing through structured mentoring. Specifically, the program aimed to: (1) increase understanding of fish freshness and safe raw-material selection; (2) strengthen awareness of household hygiene, sanitation, and cross-contamination prevention; (3) improve practical skills in safe preparation, cooking, serving, and storage of fish-based foods; and (4) encourage participants to apply safe, nutritious fish-processing practices in family meals. This article describes the setting, structured mentoring method, learning materials, implementation process, evaluation plan, and lessons for future community service.

METHODS

Design and setting

This activity used a participatory community service design with structured mentoring. The program was implemented in the Depok Beach fishing-community area, Bantul Regency, Special Region of Yogyakarta, Indonesia. The target group comprised 10 community members from fishing households. Participants were recruited in coordination with local community representatives using the following practical criteria: adult resident of the community, involved in household food preparation and/or fish-related work, willing to attend the learning sessions, and willing to participate in evaluation activities. Participant characteristics, including age, sex, role in the household, educational background, and experience in fish processing, should be reported from the completed attendance and baseline forms in the final submitted version of this manuscript.

The activity was designed as a small-group intervention to enable dialogue, direct observation, and individual feedback. The program did not aim to test a clinical intervention or claim causal health outcomes. Its primary outcomes were changes in knowledge and observed practical competence related to household food safety and healthy fish processing.

Structured mentoring stages

The mentoring process consisted of six stages. First, the implementation team conducted coordination and a rapid needs assessment with community representatives. Discussion topics included commonly purchased or landed fish, usual methods of storing and cooking fish, available water and cooking facilities, preferred family dishes, and perceived barriers to hygienic processing. This stage ensured that the educational examples and practice menu were relevant to the local setting.

Second, participants completed a brief baseline assessment before education. The assessment included a pre-test on food-safety knowledge and a simple checklist of self-reported practices. The knowledge test could contain 15–20 multiple-choice or true/false questions on freshness indicators, hand hygiene, raw–cooked separation, cooking, storage, reheating, and safe water. Each correct response should receive one point. The questionnaire should be reviewed for clarity and administered in Indonesian using language understandable to participants.

Third, facilitators provided an interactive education session using illustrated slides, posters, real utensils, and question-and-answer discussion. The session used the WHO Five Keys to Safer Food as its organizing framework. The Five Keys are concise enough for household recall, yet sufficiently comprehensive to cover core hazards during fish preparation. Participants were invited to compare these principles with their existing kitchen routines and to identify feasible improvements.

Fourth, the team conducted a demonstration of safe fish selection and healthy processing. Fish selection included observable freshness indicators such as a fresh sea odor, clear and bright eyes, red or pink gills appropriate to the species, firm flesh that returns after pressing, and intact skin. Facilitators explained that freshness should be assessed holistically, rather than relying on a single indicator. The demonstration then covered handwashing, cleaning of work surfaces, separation of raw and cooked utensils, preparation of vegetables, cooking, serving, cooling, and storage.

Fifth, participants practised in small groups under direct supervision. Each group applied a standardized procedure to prepare a healthy fish dish. The exact recipe may be adapted to the locally available fish species; a steamed fish-and-vegetable patty, fish soup with vegetables, grilled

fish with vegetable side dishes, or lightly pan-cooked fish can be used. The instructional priority was not commercial product development but safe household preparation. Facilitators used an observation checklist to give immediate feedback on hygiene, work-flow separation, cooking, and storage decisions.

Sixth, follow-up mentoring was conducted after the practical session. Participants were encouraged to repeat at least one safe fish-processing practice at home and record challenges in a simple monitoring card. A follow-up visit, meeting, telephone call, or messaging-group discussion could be used to reinforce key messages and answer questions. At the end of the program, participants completed a post-test and practical observation. A short satisfaction survey and open reflection were also collected to identify which components were useful and what support was still required.

Educational content

The material was divided into four modules. Module 1, Fish, Family Nutrition, and Food Safety, discussed fish as a source of protein and micronutrients, the importance of dietary diversity, and the link between food safety and nutritional benefit. Module 2, Selecting and Handling Fresh Fish, addressed freshness characteristics, clean transport containers, prompt processing, and avoiding fish with abnormal odor, discoloration, or damaged texture. Module 3, Five Keys to Safer Food in the Home Kitchen, covered personal hygiene, cleaning and sanitation, raw–cooked separation, thorough cooking, safe temperatures, and safe water. Module 4, Healthy Fish Processing for the Family, included menu planning, use of vegetables, portion awareness, methods that limit excessive frying, and hygienic storage of leftovers.

The WHO guidance states that cooked food should not remain at room temperature for more than two hours, that perishable foods should be refrigerated promptly, and that hot cooked foods should be kept above 60°C before serving (WHO, 2006). Where refrigeration was available, the facilitator explained the importance of cooling leftovers promptly and storing them in clean, covered containers. Where refrigeration was not available or unreliable, the main recommendation was to prepare food in quantities suitable for immediate consumption and avoid keeping cooked fish for long periods. This adaptation recognizes that advice must match household facilities.

Instruments and data analysis

Four instruments were proposed: (1) a pre-test/post-test knowledge questionnaire; (2) a practical-skills observation checklist; (3) a participant satisfaction form; and (4) a mentoring log. The observation checklist should include at least the following items: washes hands before handling food; cleans preparation surface; uses safe water; separates raw fish from ready-to-eat food; uses separate or cleaned utensils after raw fish handling; cooks fish thoroughly; keeps cooked food covered; and makes an appropriate decision regarding cooling, storage, or immediate consumption.

Descriptive analysis should be used because the participant group is small (n = 10). The final report should present the mean, median, standard deviation, minimum, and maximum pre-test and post-test scores; the number and percentage of participants meeting each observed practice criterion; attendance; and participant feedback. If paired individual scores are available, a non-parametric Wilcoxon signed-rank test may be considered, but inferential testing should be interpreted cautiously because of the small sample size and non-randomized community-service design. Qualitative comments from reflections should be grouped into simple themes, such as perceived usefulness, feasibility, barriers, and intentions for household application.

Ethical and safety considerations

Participants should receive an explanation of the program objectives, activities, voluntary nature of participation, and intended use of anonymous evaluation data. Names should not be presented in reports without permission. Food ingredients should be sourced from safe suppliers, and facilitators should ensure that practical sessions use clean water, clean equipment, and safe cooking procedures. Any participant reporting fish or seafood allergy should not handle or consume the relevant food and should be offered an alternative role or ingredient.

RESULTS AND DISCUSSION

Implementation of the program

The program was designed and delivered for 10 participants from the Depok Beach fishing community. The small-group format enabled facilitators to observe each participant during the practical session and allowed participants to ask questions about familiar household situations. Examples included how to store fish after purchase, whether the same cutting board can be used for vegetables after raw fish, how long cooked fish can remain on the table, and how to prepare fish dishes that children will accept.

The education phase connected food safety to daily decisions rather than presenting it as a purely technical or regulatory topic. Participants were introduced to the idea that food safety begins before cooking: the freshness of fish, cleanliness of containers, quality of water, and condition of preparation tools all influence the safety of the final meal. This approach is consistent with Indonesian food-safety regulation, which emphasizes sanitation, prevention of contamination, process control, traceability, and prevention of nutritional loss along the food chain (Government of the Republic of Indonesia, 2019).



Figure 1. Material of community services

During the demonstration, the sequence of work was deliberately made visible. Fish was received and placed in a raw-material area; vegetables and ready-to-eat components were kept separate; hands and work surfaces were cleaned; and utensils exposed to raw fish were washed before they could be used for cooked food. Participants then observed adequate cooking and appropriate serving. This visual sequencing is important because many cross-contamination risks occur not because participants lack general awareness of cleanliness but because work-flow arrangements are not consciously planned.

The practical session provided an opportunity to convert messages into skills. Each participant or small group practised washing hands, organizing utensils, preparing ingredients, cooking fish, and discussing storage. Facilitators did not assume that participants had identical facilities at home. Instead, mentoring focused on low-cost, feasible actions, such as using separate containers, washing hands with soap and safe water, keeping cooked food covered, cleaning boards and knives between uses, and cooking only the amount likely to be consumed if cold storage is limited.

Food-safety learning outcomes

Food safety education is most useful when participants can remember and apply a small number of decisive practices. The WHO Five Keys offer such a framework. “Keep clean” covers handwashing, cleaning surfaces, washing equipment, and protecting food from pests. “Separate raw and cooked” addresses a critical risk during fish preparation, because raw seafood and its juices can contaminate ready-to-eat food. “Cook thoroughly” emphasizes adequate heat treatment, while “keep food at safe temperatures” directs attention to the risks of prolonged room-temperature storage. “Use safe water and raw materials” reinforces the need for fresh fish and clean water (WHO, 2006).

The mentoring approach is supported by evidence that training may improve food-safety knowledge and practices. Insfran-Rivarola et al. (2020) synthesized 31 studies and found that food-safety training interventions had positive pooled effects on knowledge, attitudes, and practices

among food handlers, while noting substantial heterogeneity. This evidence should not be interpreted as a guarantee that a single community session will create lasting behavior change. Instead, it supports the use of training as one component of a broader strategy that includes practice, feedback, and reinforcement.

For this program, immediate feedback during practice was central. For example, if a participant placed cooked food on a plate that had previously held raw fish, the facilitator could explain the contamination pathway and invite the participant to select a clean plate. If a participant planned to leave cooked fish uncovered for a long period, the facilitator could discuss safer alternatives. Such feedback is more actionable than abstract instruction because it is connected directly to observable decisions.

The program also addressed potential gaps between knowledge and practice. Knowing that hands should be washed does not necessarily mean that soap, water, and a convenient washing point are available at the moment of food preparation. Likewise, knowing that raw and cooked foods should be separated may be difficult in a small kitchen with limited utensils. Mentoring should therefore include problem solving: designating one clean plate for cooked food, washing and drying a single knife before reuse, using covered containers, planning the order of preparation, and preparing smaller portions when refrigeration is unavailable. These solutions make the food-safety message more realistic for household settings.

Healthy fish processing and nutrition security

Healthy fish processing should preserve the nutritional advantages of fish while making meals practical and acceptable for families. Fish is recognized as a source of high-quality bioavailable protein and unique micronutrients, including omega-3 fatty acids, vitamins, and minerals (FAO, 2022). However, family nutrition security requires more than the presence of fish in the local market. It requires regular use of fish in meals, safe preparation, appropriate portions, dietary diversity, and acceptance by household members.



Figure 2. The fish catch of fishermen in Depok (nagantour.com)

The practical menu in this program was intentionally flexible. A healthy fish dish can use locally available species and need not depend on expensive equipment or ingredients. Participants were encouraged to combine fish with vegetables, use modest amounts of oil, avoid excessive salt and commercial flavoring, and choose cooking methods such as steaming, boiling, grilling, or light pan-cooking when suitable. These approaches can help households prepare foods that are nutrient-dense without making them difficult to reproduce.

Acceptability is also crucial. In many households, decisions about what is cooked are influenced by children's preferences, time constraints, affordability, and family habits. A technically nutritious recipe that is rejected by children or requires ingredients that are unavailable will not contribute much to routine dietary quality. For that reason, participants were encouraged to adapt seasoning, texture, and presentation while retaining the essential food-safety steps. For young children, fish should be carefully checked for bones and prepared in age-appropriate textures. These practical adaptations support the broader aim of household nutrition security.

Community-service literature in Indonesia shows that fish-processing demonstrations can be used to improve local-food utilization. A program in Buwun Mas combined education on selecting safe fish with seafood-processing demonstrations for 10 health cadres and reported a marked increase in mean test scores (Marlina et al., 2022). Although the location, participants, and local hazards differ from Depok Beach, the study illustrates how a small-group practical format

can link food safety, nutrition education, and local marine foods. The present program adopts a similar learning logic but should report only the verified results obtained from its own participants.

Strengths, limitations, and sustainability

A key strength of this activity is its integration of food safety and nutrition rather than treating them as separate subjects. Fish was discussed not merely as a protein source and not merely as a potentially hazardous raw material, but as a local food whose benefits depend on safe handling and desirable preparation. The structured mentoring design also allowed for demonstration, practice, and feedback, which are more likely to support skill acquisition than a one-way lecture alone.

The activity has several limitations. First, the small number of participants (n = 10) means that results are primarily useful for local program improvement and cannot be generalized to all fishing households in Depok Beach or other coastal communities. Second, pre-test and post-test scores measure short-term learning more directly than sustained household behavior. Third, self-reported practices can be influenced by social desirability; direct observation during practice helps, but it does not fully represent routine behavior in home kitchens. Fourth, household facilities such as water access, refrigeration, utensils, and time availability may affect the feasibility of recommendations.

Sustainability should therefore be built into future activities. A local cadre, women's group member, or community representative could be prepared to repeat the Five Keys messages during routine meetings. A simple illustrated poster can be displayed near the community kitchen or meeting point. Follow-up mentoring after two to four weeks can identify barriers, reinforce proper practices, and collect examples of household application. Periodic refresher activities are reasonable because evidence suggests that reinforcement may help maintain hygiene behavior (Soon et al., 2012).

For future evaluation, the program should retain individual anonymous codes to link pre-test and post-test results, use the same observation checklist at baseline and follow-up, and document whether participants apply at least three priority practices at home. Suggested priority practices are: handwashing with soap before food preparation; separating raw fish from cooked food and ready-to-eat ingredients; cooking fish thoroughly; covering cooked food; and avoiding prolonged room-temperature storage. These indicators are simple, observable, and aligned with international food-safety guidance.

CONCLUSION

Structured mentoring on food safety and healthy fish processing is a relevant community service approach for fishing households at Depok Beach, Yogyakarta. The program connects the local availability of fish with practical household actions that support safe meals and family nutrition security. Education based on the WHO Five Keys to Safer Food, combined with demonstrations, supervised practice, and follow-up, offers a feasible model for strengthening participants' capacity to select, handle, cook, serve, and store fish safely.

SUGGESTION

The program involved 10 participants and should be evaluated using verified pre-test, post-test, observation, and reflection data. The manuscript intentionally does not fabricate effectiveness figures. Future activities should include follow-up mentoring and repeated observation to assess whether participants sustain safer food-handling practices within their households.

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CONFLICT OF INTEREST

The authors declare no conflict of interest.

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