

OPTIMIZATION OF MANGROVE UTILIZATION AS A FOOD RESOURCE AND STRENGTHENING THE ECONOMY OF COASTAL COMMUNITIES

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Abstract. The coastal area of Klawalu Village possesses abundant mangrove ecosystem potential; however, its utilization by the community remains limited to ecological functions and has not been optimized as a source of food, health products, or economic improvement. This community service program aimed to enhance community knowledge and skills in mangrove utilization through education, training, and mentoring approaches based on multidisciplinary collaboration. The implementation methods included socialization on the benefits of mangroves, training on mangrove-based food product processing, education on the use of mangroves as natural health ingredients, and assistance in product marketing strategies to support the coastal community's economy. The activities involved community groups, small and medium enterprises (SMEs), and village officials as primary partners. The results demonstrated an increase in community understanding regarding the potential of mangroves as a source of functional food and natural health ingredients, as well as improved skills in processing economically valuable mangrove-based products. In addition, this program encouraged greater public awareness of the importance of preserving mangrove ecosystems as sustainable natural resources. This community service initiative is expected to become a model for coastal community empowerment based on local potential that supports health, food security, and sustainable economic strengthening.

Keywords: coastal economy, community empowerment, functional food, mangrove

Abstrak. Wilayah pesisir Desa Klawalu memiliki potensi ekosistem mangrove yang melimpah, namun pemanfaatannya oleh masyarakat masih terbatas pada fungsi ekologis dan belum dioptimalkan sebagai sumber pangan, kesehatan, maupun peningkatan ekonomi masyarakat. Kegiatan pengabdian masyarakat ini bertujuan untuk meningkatkan pengetahuan dan keterampilan masyarakat dalam pemanfaatan mangrove melalui pendekatan edukasi, pelatihan, dan pendampingan berbasis kolaborasi multidisiplin. Metode pelaksanaan meliputi sosialisasi manfaat mangrove, pelatihan pengolahan produk pangan berbasis mangrove, edukasi pemanfaatan mangrove sebagai bahan kesehatan alami, serta pendampingan strategi pemasaran produk untuk mendukung ekonomi masyarakat pesisir. Kegiatan melibatkan kelompok masyarakat, pelaku UMKM, dan aparat desa sebagai mitra utama. Hasil kegiatan menunjukkan adanya peningkatan pemahaman masyarakat mengenai potensi mangrove sebagai sumber pangan fungsional dan bahan kesehatan alami, serta meningkatnya keterampilan masyarakat dalam mengolah produk berbasis mangrove yang bernilai ekonomis. Selain itu, kegiatan ini mendorong tumbuhnya kesadaran masyarakat terhadap pentingnya pelestarian ekosistem mangrove sebagai sumber daya berkelanjutan. Program pengabdian ini diharapkan dapat menjadi model pemberdayaan masyarakat pesisir berbasis potensi lokal yang mampu mendukung kesehatan, ketahanan pangan, dan penguatan ekonomi masyarakat secara berkelanjutan.

Kata Kunci: ekonomi pesisir, mangrove, pangan fungsional, pemberdayaan masyarakat

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INTRODUCTION

Indonesia's coastal regions possess enormous natural resource potential, including the mangrove ecosystem, which serves as coastal protection, provides habitat for marine biota, and is a source of food and natural health products for coastal communities. Indonesia is even recognized as the country with the largest mangrove area in the world, characterized by high



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biodiversity and significant economic potential when managed sustainably (Arifanti et al., 2022). Mangroves not only have ecological functions but also contain bioactive compounds that have the potential to be developed into functional foods and natural health products. Several mangrove species, such as *Sonneratia caseolaris*, *Avicennia marina*, and *Rhizophora apiculata*, are known to contain flavonoids, phenolics, tannins, and antioxidants that are beneficial for human health (Basyuni et al., 2021; Audah & Anisa, 2024). This potential creates opportunities for the development of mangrove-based processed products such as syrup, herbal tea, mangrove coffee, mangrove flour, mangrove sticks, and various other local food products with high economic value.

Klawalu Village, as one of the coastal areas, has abundant mangrove ecosystem potential. However, the utilization of mangroves by the community is still limited to environmental functions and has not been optimized as a food source or as a means of strengthening the local economy. The low level of community knowledge regarding mangrove processing techniques, lack of product innovation, and limited marketing strategies are factors contributing to the underutilization of mangrove potential. This condition is in line with research findings stating that coastal communities generally still utilize mangroves conventionally and have not yet developed non-timber mangrove forest products into value-added economic products (Mashur et al., 2025).

The development of mangrove-based products can serve as an alternative to support food security for coastal communities. Mangrove fruits and leaves are known to contain carbohydrates, fibre, minerals, and antioxidant compounds that can be utilized as alternative food ingredients and functional foods (Mulyatun, 2018). In addition, the diversification of processed mangrove products can create new business opportunities for coastal communities through the development of micro, small, and medium enterprises (MSMEs) based on local potential. Community empowerment programs through processing mangroves into economically valuable products have been proven to improve the skills, participation, and income of coastal communities (Sidauruk et al., 2024).

In efforts to optimize mangrove utilization, a collaborative approach involving various disciplines is required. The field of pharmacy plays a role in identifying the health benefits and bioactive compounds of mangroves, agribusiness supports marketing strategies and community business development, while animal husbandry can utilize mangrove waste as an alternative livestock feed and support the development of integrated coastal-based enterprises. This multidisciplinary approach is expected to create more effective and sustainable community empowerment. Based on these conditions, this community service program aims to optimize the utilization of mangroves as a food source and as a means of strengthening the economy of coastal communities in Klawalu Village through education, training, and assistance in processing mangrove-based products. This program is expected to improve the knowledge and skills of the community in utilizing local potential sustainably while also encouraging the improvement of coastal community welfare.

METHOD

This community service program was carried out using a participatory approach based on community empowerment combined with interdisciplinary collaboration involving the fields of pharmacy, agribusiness, and animal husbandry. This approach was selected to ensure that the transfer of knowledge and skills was not only theoretical in nature but also practical, applicable, and sustainable for the community. Through active community involvement, participants were encouraged to become directly engaged in every stage of the program so that the activities could provide long-term benefits and strengthen local community independence. The implementation stages began with problem identification and continued through planning, implementation, mentoring, and comprehensive program evaluation.

At the initial stage, the identification of community potential and needs was conducted through field observations, interviews, and Focus Group Discussions (FGD) to determine the level of eel fish utilization and the obstacles encountered in its processing and development.

This activity also explored the community's understanding of product diversification, marketing opportunities, and the economic potential of local resources. The results of this stage became the basis for designing programs that were aligned with the real conditions and needs of the community, thereby ensuring that the interventions implemented would be more targeted, effective, and capable of supporting sustainable community empowerment (Putra et al., 2020).



Figure 1. *Flow of the community service program implementation in Klawalu Village*

The next stage consisted of educational and socialization activities for coastal communities regarding the potential of mangroves as an alternative food source and a means of strengthening the local economy. The materials presented included the nutritional content and bioactive compounds found in mangroves, their health benefits, and opportunities for their utilization as economically valuable functional food products. In addition, the community was provided with an understanding of the importance of implementing hygiene, sanitation, and food safety standards in the processing of mangrove-based products. The educational activities were conducted interactively through lectures, discussions, and the use of visual media, making the material easier for participants to understand. This educational approach has proven effective in increasing community knowledge and awareness regarding the sustainable utilization of local resources (Hidayat et al., 2022).

The following stage involved training and direct hands-on practice in processing mangroves into value-added food products. The products developed included mangrove syrup, mangrove herbal tea, chips, mangrove flour, and various other processed products with the potential to become flagship products of coastal communities. At this stage, the pharmacy field played a role in providing knowledge related to bioactive compounds, health benefits, and the application of food safety principles, while the agribusiness field focused on business development strategies, product packaging, and marketing. On the other hand, the animal husbandry field contributed through the utilization of mangrove waste as an alternative feed ingredient and the development of integrated coastal-based business systems. This multidisciplinary collaboration became an innovative approach to producing economically valuable products while simultaneously supporting environmental sustainability (Sari et al., 2023).

After the training activities were completed, continuous mentoring and monitoring were carried out to ensure the implementation of the training outcomes by the community. The mentoring activities included product quality evaluation, improvement of production processes, packaging development, and strengthening the institutional capacity of coastal community business groups. In addition, the community received guidance regarding product quality standards and marketing strategies to ensure that mangrove-based products would be competitive in the market. Continuous mentoring has been proven to increase the success of community empowerment programs and maintain the consistency of product quality (Lestari et al., 2024).

The final stage of the program was program evaluation, which was conducted using both quantitative and qualitative approaches. Quantitative evaluation was carried out through pre-tests and post-tests to measure the increase in community knowledge, while qualitative evaluation was conducted through observations and interviews to identify improvements in skills and the economic impacts experienced by the community. The evaluation results were used as references for improving and developing future programs. Overall, this implementation

method not only enhanced community capacity in utilizing mangroves as an alternative food source but also encouraged the strengthening of the coastal community economy through the sustainable optimization of local potential (Rahmawati et al., 2021).

RESULT AND DISCUSSION

The implementation of training and mentoring activities in the program was carried out smoothly and received positive responses from the community, particularly from housewives, MSME actors, and coastal youth groups. This program was systematically designed to improve community knowledge and skills in utilizing mangroves as economically valuable food products with potential health benefits. The materials provided included the introduction of mangrove species that can be utilized, techniques for processing mangrove-based food products, drying and raw material processing methods, as well as hygienic packaging techniques that comply with food safety standards (Faoziyah & Issusilaningtyas, 2020; Khoirunnisa, 2020).

In addition to technical training, participants also received education regarding the development of local products through branding and marketing strategies. The materials covered product label design, determination of product identity and brand names, and the utilization of digital media as a simple and effective promotional tool. This approach aimed to ensure that the community would not only be capable of producing mangrove-based products with nutritional and health value, but also products with strong marketability and competitiveness in both local and regional markets (Andriani et al., 2024).

The implementation methods included direct demonstrations of the processing of mangrove products such as syrup, herbal tea, and other processed foods, as well as the presentation of attractive and marketable packaging prototype examples. Participants were allowed to practice each stage of the processing activities alternately while also evaluating the quality of the products produced. This mentoring process demonstrated that optimizing mangrove utilization requires multidisciplinary synergy involving aspects of pharmacy, food processing, agribusiness, and the strengthening of coastal community economies. Therefore, the entire series of community service activities was successfully implemented in accordance with the program plan outlined in Table 1.

Table 1. *Series of community service activities*

No	Times	Activities
1	08.00 – 08.15	Participant registration and opening ceremony with the coastal community of Klawalu Village
2	08.15 – 08.30	Opening remarks from the head of the community service team and Klawalu Village officials
3	08.30 – 08.50	Presentation on optimizing mangrove utilization as a food source and its economic potential for coastal communities
4	08.50 – 09.15	Education on nutritional content, bioactive compounds, and health benefits of mangrove-based product
5	09.15 – 10.00	Training on the production of processed mangrove products such as syrup, herbal tea, chips, and other food products
6	10.00 – 10.30	Training on product packaging techniques and strengthening the identity of mangrove-based MSME products
7	10.30 – 11.00	Socialization of digital marketing strategies through social media and marketplaces
8	11.00 – 11.30	Hands-on practice in mangrove product processing and product promotion simulation
9	11.30 – 12.00	Discussion session, program evaluation, closing ceremony, and documentation with participants

The materials presented in the training and mentoring activities of the program entitled *Optimization of Mangrove Utilization as a Food Source and Strengthening the Economy of Coastal Communities in Klawalu Village* were delivered through two main approaches. First, the materials were delivered theoretically through interactive lecture methods discussing the

potential of mangroves as an alternative food source, the nutritional content and bioactive compounds of mangroves, and strategies for utilizing local resources to support public health and improve the economy of coastal communities. Second, participants were provided with direct demonstrations of the processing of mangrove-based products, starting from the selection of raw materials, processing techniques, drying, filtering, and hygienic packaging methods that ensure product safety for consumption. In addition to receiving theoretical explanations, participants were also actively involved in practical processing activities to improve their technical skills and practical understanding of the production process.



Figure 2. Documentation of community service activities

The initial stage of the activities began with a planning process through the identification of mangrove potential in the coastal area of Klawalu Village and the preparation of concepts for developing mangrove-based food products. At this stage, analyses were conducted regarding the nutritional content and health benefits of mangroves, the selection of simple processing methods that could easily be applied by the community, and the determination of program objectives oriented toward improving food security and strengthening the community economy based on local potential (Hassan, 2014). The next stage involved product design, which included packaging design, preparation of product information labels, creation of logos, and visual elements reflecting the local identity of the coastal community. The design development process considered aspects of food safety, packaging attractiveness, consumer interest, and market suitability so that mangrove-based products would possess stronger competitive value in the market (Putri & Agustina, 2022).

During the production stage, participants directly practised processing mangroves into various food products such as mangrove syrup, herbal tea, mangrove flour, and other processed foods under the guidance of the implementation team. The production process used simple processing techniques that could easily be adopted by the community, followed by filtering, packaging, and product storage processes. In addition, simple organoleptic tests were conducted to evaluate product quality based on aroma, colour, taste, and the level of community acceptance of the resulting products (Ulfah et al., 2022). At the testing and evaluation stage, the products that had been developed were introduced to the coastal community as an effort to increase the utilization of mangrove-based local food products. The evaluation was conducted through questionnaires assessing aspects such as taste, texture, aroma, packaging, and community perceptions regarding the health benefits and economic opportunities of mangrove-based products. Furthermore, the implementation team also conducted observations regarding improvements in community knowledge, skills, and interest in developing mangrove-based businesses as part of the program success evaluation (Rahmiati et al., 2023).

The following stage involved product distribution and branding reinforcement, in which processed mangrove products were marketed using local identities that reflected the coastal potential of Klawalu Village. The products were packaged in a simple yet attractive and informative manner in accordance with food safety standards and were complemented with slogans emphasizing the importance of utilizing local resources to support community health and economic development. Promotional strategies were carried out through social media, local community networks, and initial marketing within the village environment to expand the market reach of mangrove-based products (Karina et al., 2024). Before the training activities were conducted, the community service team first collected preliminary data through the distribution of questionnaires to participants. The questionnaires aimed to identify the level of community knowledge regarding mangrove utilization, local food processing, and basic understanding related to MSME product marketing. The information obtained was then used as the basis for determining appropriate material delivery methods according to the needs and conditions of the community, thereby enabling the training process to be more effective and easier for participants to understand (Biddinika et al., 2024).



Figure 3. Socialization activities of the community service program

This program was a coastal community empowerment initiative implemented in Klawalu Village, East Sorong District, Sorong City, Southwest Papua. The activity represented a collaborative effort between the Muhammadiyah University of Education (UNIMUDA) Sorong, and Al-Irsyad University Cilacap (UNAIC) in developing the potential of coastal resources through a multidisciplinary approach involving various scientific fields. The implementation of the program was motivated by the vast potential of mangrove ecosystems in the coastal areas of Papua, which have not yet been optimally utilized by the local community. To date, mangroves have primarily been viewed only as protectors of coastal ecosystems, even though they possess substantial potential as alternative food sources, natural health ingredients, and economically valuable products. Various mangrove species are known to contain bioactive compounds, antioxidants, vitamins, minerals, and dietary fibre that can potentially be developed into functional food products and health products based on local resources (Shiraishi, Crook, & Yamamoto, 2020). Therefore, optimizing the utilization of mangroves is expected to support improvements in public health while simultaneously strengthening the economy of coastal communities sustainably.

The concept of functional food refers to food products that not only serve as sources of basic nutrition but also provide physiological benefits to the body and contribute to maintaining health and reducing the risk of certain diseases (Granato et al., 2020). In the context of coastal areas, mangroves possess significant potential as functional food sources because they contain various bioactive compounds such as flavonoids, tannins, antioxidants, vitamins, and minerals that are beneficial for maintaining body immunity, supporting health, and serving as alternative

food sources with high nutritional value (Mohanty et al., 2021). Through this community service activity, the implementation team provided education to the community regarding the importance of optimizing mangrove utilization as a food source and as a means of strengthening the economy of coastal communities. This utilization was carried out through the development of various mangrove-based processed products such as mangrove syrup, herbal tea, chips, mangrove flour, mangrove dodol, and other food products. The development of these products aimed to increase the added value of local resources, diversify community food consumption, and enhance the economic value of mangrove-based products (Rahmawati, Hidayati, & Kusuma, 2021).

Interdisciplinary collaboration among the fields of Pharmacy, Agribusiness, and Animal Husbandry became one of the main strengths of this program. The field of Pharmacy played a role in providing education regarding bioactive compounds, health benefits, food safety, and the potential of mangroves as functional food ingredients. The Agribusiness field contributed to business development strategies, product marketing, and strengthening coastal community MSMEs. Meanwhile, the Animal Husbandry field supported the utilization of mangrove waste as an alternative livestock feed ingredient and the development of integrated businesses based on coastal resources (Sari, Widodo, & Prasetyo, 2022). This multidisciplinary approach enabled the community to gain a more comprehensive understanding of mangrove utilization, from production processes to product marketing. The implementation of the community service activities was conducted through several stages, including socialization, product processing training, packaging and labelling training, and digital marketing. During the socialization stage, the community was introduced to the potential of mangroves as an alternative food source and the opportunities for developing the coastal community economy. This was followed by demonstrations and direct practice in product processing so that participants would be able to independently produce mangrove-based products (Yusuf, Lestari, & Aminah, 2020).

In addition to product processing training, participants also received education regarding packaging techniques and strengthening the branding of MSME products. Proper product packaging is essential for maintaining product quality, increasing consumer attractiveness, and extending the shelf life of food products (Winarno, 2021). In this activity, the community received training related to modern packaging techniques and the creation of informative, attractive product labels with local identity elements. To support the sustainability of community businesses, the community service team also provided digital marketing training through social media and marketplaces such as TikTok and Shopee. Digital marketing strategies are considered important because they can expand market reach and improve the competitiveness of local MSME products in today's digital economic era (Purwana, Rahmi, & Aditya, 2020).

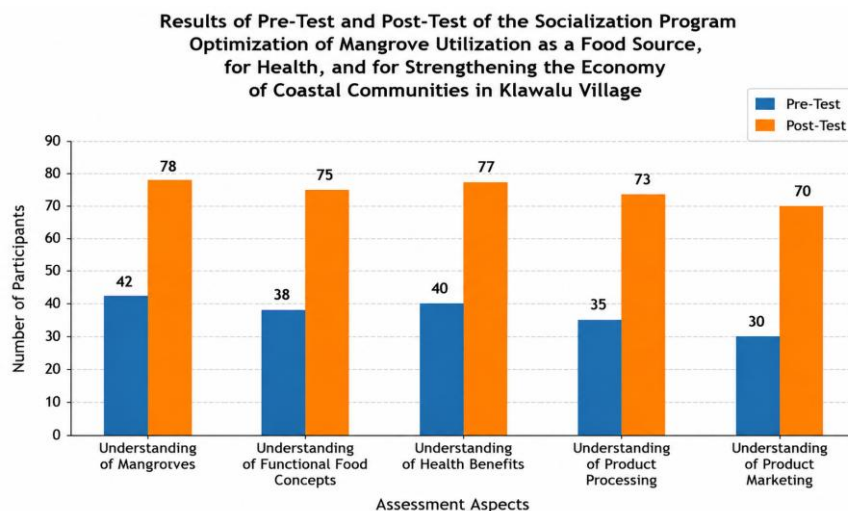


Figure 4. Graph of pre-test and post-test results involving 80 participants

The results of the activities indicated an increase in community knowledge regarding the benefits of mangroves as functional food sources and business opportunities based on local resources. The community also showed high enthusiasm for developing processed mangrove products as flagship coastal products. In addition to improving community skills, this program also opened new business opportunities and supported the sustainable strengthening of the coastal community economy. Overall, this community service activity demonstrated that collaboration between universities and communities can produce innovations based on local potential that provide benefits for public health and economic improvement. This program is expected to become an initial step toward the sustainable development of mangrove-based functional foods in the coastal areas of Southwest Papua.

Based on the pre-test and post-test graph results from the socialization activities in this program, there was a significant increase in community knowledge across all assessment aspects after the implementation of the community service activities. The evaluated aspects included understanding of mangroves, the concept of functional food, health benefits, product processing, and marketing of mangrove-based products. The pre-test results indicated that the community's initial level of knowledge was still relatively low. This was reflected in the number of participants who understood product marketing aspects, which was only 30 out of a total of 80 participants, while understanding of mangrove product processing reached only 35 participants. These conditions indicate that the coastal community of Klawalu Village previously had limited information regarding the utilization of mangroves as a food source and economic opportunity. The low level of initial understanding among coastal communities was also identified in the study by Mulyatun (2018), which stated that coastal communities generally still utilize mangroves only for ecological functions and have not optimally developed mangrove-based food potential.

After the implementation of the socialization and training activities, the post-test results showed significant improvements across all assessment indicators. Community understanding regarding the benefits of mangroves increased from 42 participants to 78 participants, while understanding of functional food concepts increased from 38 to 75 participants. Improvements were also observed in understanding the health benefits of mangroves, which increased from 40 to 77 participants. These findings indicate that the educational approach through interactive lectures, demonstrations, and direct practice was effective in improving community knowledge capacity. This finding is consistent with the study by Granato et al. (2020), which explained that functional food-based education can increase public awareness regarding the health benefits of local food ingredients containing bioactive compounds.

In the aspects of product processing and marketing, the increase in knowledge was also quite substantial. The number of participants who understood product processing techniques increased from 35 to 73 participants, while understanding of product marketing increased from 30 to 70 participants. These data indicate that the training activities not only improved theoretical understanding but also strengthened the practical skills of the community in developing mangrove-based MSME products. These findings are supported by the research of Purwana, Rahmi, and Aditya (2020), which stated that digital marketing training and MSME product branding development can improve the competitiveness of community businesses based on local potential.

The improvement in post-test results also demonstrated that the hands-on training method had a positive influence on participant understanding. In this activity, the community not only received theoretical material, but also became directly involved in the processing of mangrove products such as syrup, herbal tea, and mangrove flour. This participatory approach was considered effective in transferring knowledge and skills to the community. This finding is in line with the community service results of Sidauruk et al. (2024), which showed that practical mangrove processing training was able to improve community skills in producing economically valuable functional food products.

Furthermore, the increased understanding of health benefits indicates that the community has begun to recognize the potential of mangroves as a source of bioactive compounds that can support health. Several previous studies have reported that mangroves

contain flavonoids, phenolics, antioxidants, and antibacterial compounds that have the potential to be developed into natural food and health products (Basyuni et al., 2021). Therefore, the improvement in community understanding regarding the health benefits of mangroves serves as an important indicator in supporting the development of functional foods based on local resources. Overall, the graph results demonstrate that this community service program successfully improved the knowledge and skills of the coastal community in Klawalu Village regarding the utilization of mangroves as a source of food, health benefits, and local economic strengthening. The success of this program reinforces the idea that a collaborative multidisciplinary approach involving education, technical training, and business mentoring can become an effective strategy for sustainable coastal community empowerment based on local potential.

CONCLUSION

The community service activities successfully improved the knowledge, skills, and awareness of coastal communities in utilizing mangroves as alternative food sources, natural health ingredients, and economically valuable products through various socialization, training, and mentoring activities. This program encouraged the community to develop mangrove-based processed products such as syrup, herbal tea, and other food products that have the potential to serve as functional foods while also creating new business opportunities for coastal communities. In addition, these activities enhanced community understanding regarding the importance of preserving mangrove ecosystems as sustainable resources with both ecological and economic benefits.

Multidisciplinary collaboration among the fields of pharmacy, agribusiness, and animal husbandry became an important factor supporting the success of the program through an integrated approach covering health aspects, product processing, packaging, and digital marketing strategies. As a follow-up effort, continuous mentoring is needed for community groups and MSME actors in developing product innovations, improving product quality and legality, and strengthening digital-based marketing so that mangrove products can achieve broader competitiveness. Furthermore, cooperation among universities, local governments, and communities needs to be continuously strengthened to support program sustainability, the development of coastal community businesses, and mangrove conservation as part of efforts to maintain food security, public health, and sustainable economic strengthening in Klawalu Village.

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