Agrokreatif
Jurnal Ilmiah Pengabdian kepada Masyarakat
doi: https://doi.org/10.29244/agrokreatif.12.3.551-559

Juni 2026, Vol 12 (3): 551–559
ISSN 2460-8572, EISSN 2461-095X

Utilization of Catfish Waste for Fish Pellet Production by Elderly Women's Group in Mejono Village

(Pemanfaatan Limbah Ikan Lele untuk Pembuatan Pelet oleh Kelompok Wanita Usia Lanjut di Desa Mejono)

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Received Agustus 2025/Accepted November 2026

ABSTRACT

The dependency of fish farming on commercial feed has become a major issue due to its increasing cost, while the potential of utilizing local organic waste such as catfish (*Clarias sp.*) viscera and bone remains underexploited. These by-products are often discarded and contribute to environmental pollution. This community service activity aimed to educate and train elderly women from the Melati 2 group in Mejono Village, Kediri Regency, on the utilization of catfish visceral and bone waste as supplementary materials for alternative fish pellet production. Prior to the social outreach program, the student team conducted independent trials to determine a suitable feed formulation and efficient production method. The core activity was a social outreach program session attended by 50 participants, covering topics such as nutritional content, the benefits of waste utilization, feed formulation, and the pellet-making process. Evaluation was conducted using pre- and post-tests and analyzed through the Wilcoxon Signed Rank test, which showed a statistically significant improvement in participants' understanding ($p < 0.05$). The results demonstrate that the community can grasp both the concept and practical aspects of converting waste into value-added products.

Keywords: catfish bones, catfish visceral, community empowerment, elderly women, fish pellets

ABSTRAK

Kebutuhan pakan dalam budidaya ikan sangat bergantung pada produk pakan komersial yang harganya terus meningkat, sementara potensi pemanfaatan limbah organik lokal seperti jeroan dan tulang ikan lele (*Clarias* sp.) belum dimaksimalkan. Limbah tersebut kerap dibuang begitu saja dan berkontribusi terhadap pencemaran lingkungan. Kegiatan pengabdian masyarakat ini bertujuan untuk memberikan edukasi dan pelatihan kepada kelompok wanita usia lanjut Melati 2 di Desa Mejono, Kabupaten Kediri, mengenai pemanfaatan limbah jeroan dan tulang ikan lele sebagai bahan tambahan nutrisi dalam pembuatan pelet ikan alternatif. Sebelum sosialisasi, tim mahasiswa melakukan percobaan mandiri untuk memastikan komposisi dan metode produksi yang efisien dan layak. Kegiatan inti berupa sosialisasi diikuti oleh 50 peserta dan mencakup materi tentang kandungan nutrisi, manfaat limbah, formulasi pakan, dan proses pembuatan pelet. Evaluasi dilakukan melalui pretest dan posttest, serta dianalisis menggunakan uji Wilcoxon Signed Rank yang menunjukkan peningkatan pemahaman peserta secara signifikan ($p < 0,05$). Kegiatan ini menunjukkan bahwa masyarakat mampu memahami konsep dan praktik pengolahan limbah menjadi produk bernilai ekonomi.

Kata kunci: limbah jeroan lele, limbah tulang lele, pelet ikan, pemberdayaan masyarakat, wanita usia lanjut

INTRODUCTION

Kediri, located in East Java Province, is known as one of the centers of catfish (*Clarias* sp.) farming. Since 2013, the fisheries sector in Kediri has contributed to the Gross Regional Domestic Product (GRDP), showing a consistent annual growth of 1,91% (Harianto & Wardhani 2020). The annual catfish production in this region exceeds 16,280 tons, with the majority coming from small-scale household farms spread across various villages (BPS Jawa Timur 2023). Mejono is one of the villages in Kediri that has several small-scale household catfish farming, with each pond (measuring 2 x 8 m) containing up to 40.000 catfish.

The increasing production of catfish in Kediri also generates substantial amounts of processing

waste, particularly viscera, bones, and heads from harvesting and fish preparation. The edible portion of catfish meat accounts for only approximately 40% of its total body weight, leaving around 60% as non-edible parts. Based on the annual production of 16,280 tons, the potential non-edible fraction could reach approximately 9,768 tons annually. These by-products are often discarded, potentially contributing to environmental pollution and greenhouse gas emissions (Bhatia *et al*. 2025; Tchonkuang *et al*. 2023; To *et al*. 2019).

Feed is one of the main factors affecting the growth and survival of catfish, despite its cost steadily increasing. Feed costs represent the largest portion of production expenses, reaching up to 75% in catfish farming (Fahrizal & Ratna, 2019; Wardani *et al.* 2019). This high cost is largely due to the industry's dependence on imported raw materials for the production of commercial pellets (Yunaidi *et al.* 2019).

The potential utilization of catfish farming waste, such as visceral and bones, has not yet been fully optimized, even though these by-products contain essential nutrients such as protein, fat, vitamins, and minerals (Jimoh *et al*. 2021). Meanwhile, fish meal commonly used as the primary protein source in fish feed has become increasingly expensive and limited in availability (Putra *et al*. 2020).

Catfish bones have been shown to be a rich source of calcium, with levels reaching up to 8,400 mg per 100 g when processed into bone meal (Ratri *et al*. 2023). Supporting this, a study by Lawal *et al.* (2013) demonstrated that supplementing fish feed with 3% calcium significantly improved the growth of catfish fingerlings. The production of alternative fish feed using fish bone waste has previously been studied by Fitriyani *et al.* (2014), who explained that utilizing fish bone waste for pellet production is a practical application of the zero-waste concept. This approach successfully reduced up to 200 kg of waste per month while producing pellets with a proximate composition of 34.78% protein and 5.14% fat, meeting the quality standards of SNI-01-4087-2006 for catfish, SNI-01-7242-2006 for tilapia, and SNI 7473:2009 for gourami.

In addition to bones, the use of fish viscerals waste as a primary ingredient in feed production not only helps reduce environmental waste but also generates economic value for fishery businesses. With its high nutritional content, visceral-based pellets present great potential as a nutritious, economical, and eco-friendly feed alternative (Zuhria *et al.* 2025). Fish viscerals, such as gills, contain high levels of protein (41.4%) and fat (36%), making them a valuable source of energy and tissue-building components. Intestines are rich in carbohydrates (9.3%) and have moderate fat content (21.8%), making them a good source of additional energy despite their lower protein levels. Meanwhile, liver exhibits the highest protein (62.1%) and carbohydrate (63.1%) content, along with essential minerals and fiber. The combination of these three components can produce a nutritionally balanced feed while promoting the utilization of organic waste in a sustainable and environmentally friendly manner (Apex *et al*. 2024). Supporting this, a study by Hasan *et al.* (2020) demonstrated that fish viscera meal, combined with salted marine by-catches, can fully replace fishmeal in Indonesian river catfish diets without compromising growth, survival, or body composition, highlighting its potential as a complete and effective protein alternative in aquafeeds.

This community service activity aims to: a) Improve the knowledge of members of the Melati 2 group in Mejono Village regarding the nutritional content, raw materials, and techniques for producing alternative fish pellets from catfish offal and bone waste through a social outreach and demonstration program; and b) Identify the differences in knowledge levels between the pre-elderly and elderly age groups in understanding the material related to nutritional content, raw materials, and the process of making alternative fish pellets. It is expected that the member's understanding of these aspects will increase, empowering them to independently produce fish pellets.

IMPLEMENTATION METHODS

Activity Location, Schedule, and Participants

The activity was conducted in Mejono Village, Plemahan Sub-district, Kediri Regency, from June to July 2025. Attended by 50 individuals who are members of the Melati 2 group, divided into two age categories: pre-elderly (45–59 years) and elderly (>60 years).

Materials and Tools

The materials used in this activity were catfish visceral waste, catfish bone waste, fish meal, corn flour, rice bran, molasses, EM4 (Effective

Microorganisms), and water. The tools used included a chopper, pelletizer, blender, oven or sunlight as a drying method, mixing bowls, stove, and stirrer.

Implementation Methods

The stages of the implementation method consisted of social outreach program, training, technology application, monitoring and evaluation, and program sustainability. The social outreach program phase included the introduction of alternative fish feed made from catfish visceral and bone waste, its nutritional value, and its advantages compared to commercial fish feed. This session was conducted through presentations and interactive discussions with participants.

The training phase involved demonstrations on how to process catfish visceral and bone waste into fish pellets. This included steps such as material preparation, blending, mixing, steaming, pelletizing, and drying techniques using sunlight or oven. Participants were then given the opportunity to practice the pellet-making process directly under supervision.

The technology application stage was carried out by producing fish pellets in larger quantities to be used by the local fish farming community. A small-scale production unit was developed to enable continuous production and application of the formulated feed.

Monitoring and evaluation were conducted by assisting participants at each stage of the activity from preparation of raw materials, processing, to application in aquaculture feeding. Evaluation was carried out through pretest and posttest design to assess participant's understanding and skills in producing the pellets. Descriptive analysis using class intervals was performed with the aid of SPSS Statistic 27.

Program sustainability was pursued through a deep understanding of the outcomes and impacts that may not have yet met expectations. Efforts were made to improve existing methods, address any identified shortcomings, and enhance the effectiveness of the innovation. This included continuous support to participants, follow-up training sessions, facilitation of access to raw materials, and encouragement of collaboration with local fish farmers and stakeholders. By maintaining active communication and monitoring, the program aimed to ensure long-term adoption and independent replication of the pellet-making innovation within the community.

Data Collection, Processing, and Analysis Methods

Data collection was carried out using a pretest-posttest design to evaluate the effectiveness of the program. The pretest was carried out ahead of the social outreach program and demonstration sessions provided to the Melati 2 Group in Desa Mejono. Once the program had been delivered, a posttest was conducted to assess the improvement in participants' knowledge and skills related to the production of alternative fish pellets. Both the pretest and posttest consisted of five identical questions focusing on the nutritional content, raw materials, and procedures involved in producing fish feed from catfish visceral and bone waste.

The results from the pretest and posttest were processed using SPSS Statistics 27 and Microsoft Excel, and were presented in the form of graphs and tables to visually display any improvement in respondents' understanding. A significant difference in scores between the pretest and posttest was determined based on a p-value less than 0.05, indicating a statistically significant increase in knowledge after the program intervention.

RESULT AND DISCUSSION

Partner Profile

Melati 2 Group is an active community-based health post (Posyandu) for elderly women located in Dusun Mejono, Mejono Village, Plemahan Subdistrict, Kediri Regency (Figure 1). This group functions as a platform for elderly women to access basic health services, receive nutrition education, and engage in regular social support activities. Led by Mrs. Winarsih, a respected local figure committed to improving



Figure 1 Community partner group: Posyandu Melati 2 for elderly women in Mejono Village.

the wellbeing of elderly women, the group has expanded its focus beyond health to include social and economic empowerment initiatives, such as skills training and healthy food processing. In this activity, 50 elderly women participated actively throughout the event.

Social Outreach Program

Social outreach program served as a key component of the Community Service Program conducted in Mejono Village, Plemahan District, Kediri Regency (Figure 2). This initiative aimed to improve community awareness and knowledge particularly among members of the Melati 2 Group regarding the utilization of catfish visceral and bone waste as alternative raw materials for fish pellet production.A total of 50 participants from the Melati 2 Group, consisting of pre-elderly and elderly individuals with diverse occupational backgrounds such as housewives, farmers, livestock breeders, and micro-entrepreneurs, took part in this activity. Their varied experiences enriched the discussion and demonstrated the broad applicability of the presented innovations. Prior to the social outreach program, participants completed a pre-test to evaluate their baseline understanding of the topic.

Social outreach program was carried out through an interactive lecture combined with discussions and practical demonstrations to ensure clarity and engagement. After the material was delivered, a post-test was conducted to measure any improvement in knowledge. A significant increase in participants' scores indicated a positive response and effective information absorption. Topics covered during the social outreach program included the concept of alternative feed, nutritional content of visceral and bone waste, benefits of waste utilization in reducing pollution and lowering feed costs, and detailed procedures for producing pellets starting from raw material preparation, mixing, molding, and drying processes.

Demonstration

The demonstration session was conducted as part of the social outreach program to provide participants with a clear visual understanding of the process of converting catfish viscera and bone waste into alternative pellet feed (Figure 3). Although participants did not engage in direct hands-on practice, the presenters delivered a comprehensive explanation using visual aids to illustrate each stage of the pellet-making process from raw material preparation to the final pellet product. During the session, dried fish bones were shown to the participants, accompanied by a detailed explanation of how they were processed into fine bone meal using a grinder or blender. Likewise, catfish visceral waste was demonstrated in its processed slurry form. The base mixture used for pellet formulation consisted of catfish visceral waste, fish bone meal, fish meal, corn flour, tapioca flour, rice bran, molasses, EM4 (Effective Microorganisms), and water. These ingredients except for water, molasses, and EM4 were mixed in a 5:1 ratio (base ingredients to tapioca flour) and then stirred thoroughly until homogeneous.



a



b

Figure 2 a and b) Social outreach program on the utilization of catfish (*Clarias sp.*) visceral and bone waste for alternative pellet production.



Figure 3 Demonstration of the process of producing alternative fish pellets using catfish (*Clarias* sp.) viscera and bone waste as the primary ingredients.

The pelletizer used in the production process was introduced to the participants, including an explanation of its mechanism and function. The mixture was formed into pellets approximately 2 mm in diameter. The drying process was also described, noting two methods: sun-drying for 3–4 days and oven-drying at 50–60°C for several hours until the pellets reached the desired firmness and low moisture content (Bhagawati *et al.* 2019). Visual examples of the finished pellets, already packaged, were displayed to demonstrate the final product quality. The presenters also showcased pellet products that had been packed in transparent plastic bags, emphasizing that the pellets are not only suitable for personal use in household-scale fish farming but also hold economic potential for commercialization. This demonstration highlighted the practicality of utilizing local organic waste to produce alternative fish feed and reinforced the potential of such innovation to support sustainable and circular aquaculture practices.

Respondent's Knowledge Level Analysis

After carrying out the program, respondents showed an increase in knowledge regarding nutrition, raw materials, and the production techniques of alternative fish pellets. This improvement is evident from the rise in the average number of correct answers on the posttest. As shown in Figure 4, the average number of correct answers from 50 respondents during the pretest was 2.80, which increased to 4.46 in the posttest. These results indicate a significant enhancement in respondents' understanding after receiving material on the nutritional content, ingredients, and production techniques of alternative fish pellets made from catfish visceral and bone waste.

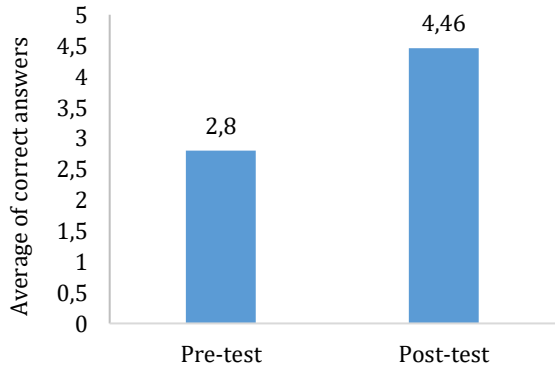

Figure 4 Diagram of the Average of Respondent's Correct Answers.

The improvement in respondents' understanding of nutritional content, raw materials, and the techniques of producing fish pellets enriched with catfish visceral and bone waste was further supported by the Wilcoxon Signed Rank Test. This non-parametric test was chosen because of the non-normal distribution of the data, as determined through normality testing. The results of the Wilcoxon Signed Rank Test, presented in Table 1, revealed a p-value of less than 0.05, indicating a statistically significant difference between the number of correct answers in the pretest and posttest. According to Gupta *et al*. (2023), a statistically significant difference ($p<0.05$) in a pretest-posttest design reflects the effectiveness of the program. The increase in the average number of correct answers from 2.80 to 4.46, along with the significant Wilcoxon test result, provides strong evidence that the materials delivered on nutritional content, raw ingredients, and the techniques of making fish pellets using catfish visceral and bone waste successfully enhanced respondents' understanding.

Differences in Knowledge Levels Between Pre-Elderly and Elderly Groups

The classification of elderly groups is based on the Kementrian Kesehatan RI (2020), which states that the elderly population is divided into two categories: pre-elderly (ages 45–59) and elderly (ages over 60). This aligns with the opinion of Dainy et al. (2016), who also define pre-elderly as individuals aged 45–59 years, while the elderly group includes those aged 60 and above. Differences in understanding between the pre-elderly and elderly groups from Kelompok Melati 2 can be seen in Figure 5. Based on the results, the average number of correct answers in the pretest was lower in the pre-elderly group compared to the elderly group. However, the average number of correct answers in the posttest showed that the pre-elderly group outperformed the elderly group. These findings suggest that the pre-elderly group was more receptive to the material related to nutritional content, raw materials, and the process of making fish pellets using catfish visceral and bone waste, despite having a lower average score on the pretest than the elderly group. This was explained by Guran *et al*. (2019) in their study, which showed that the pre-elderly group generally exhibits more optimal brain activity patterns that support better ability to learn new material compared to the elderly group.

Statistically, as presented in Table 2, the pretest results of both the pre-elderly and elderly groups did not show a significant difference, with a significance value (p-value) >0.05. A similar result was observed in the posttest, where no significant difference was found between the two groups (p-value > 0.05). Although the previous discussion mentioned that the elderly group tends to have limitations in receiving new material compared to the pre-elderly group, several factors according to Jeong *et al*. (2022) and Nugraha *et al*. (2023) such as facilitating them with social-emotional assistance (through group and peer learning), and the use of appropriate learning media, such as suitable audio and video materials, can improve the elderly group's understanding of newly presented material.

Challenges Faced

The challenge encountered were not limited to the social outreach program session but also emerged during the preparation and production stages of the fish pellets. One of the main issues was the drying process, which required time and specific environmental conditions. While oven drying is an option, its availability was limited, so sun-drying was primarily relied upon. This made the drying duration weather-dependent and could affect production efficiency.

Tabel 1 Statistical analysis results using Wilcoxon Signed Rank Test

Test statistics[a,c]					
	Z	Asymp. Sig. (2-tailed)	Monte Carlo Sig. (2-tailed)		
			Sig.	95% Confidence Interval	
				Lower bound	Upper bound
Total correct answers in post-test-total correct answers in pre-test	-4.962[b]	<0,05*	<0,05	<0,05	0,058

Information:
a. Wilcoxon Signed Ranks Test
b. Based on negative ranks.
c. Based on 50 sampled tables with starting seed 1314643744.
*significance at p<0.05

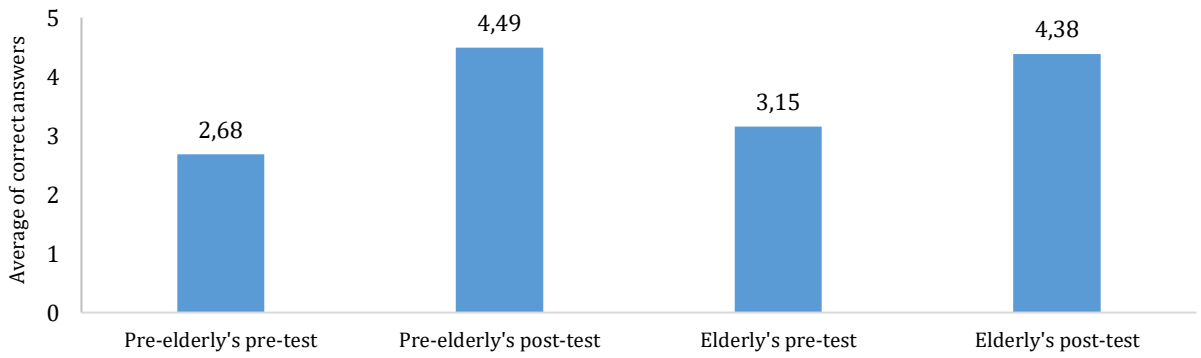

Figure 5 Comparison of the average number of correct answers between the pre-elderly and elderly groups.

Tabel 2 Statistical analysis results using Mann-Whitney U Test

Test statistics[a]							
	Mann-Whitney U	Wilcoxon W	Z	Asymp. Sig. (2-tailed)	Monte Carlo Sig. (2-tailed)		
					Sig.	95% Confidence interval	
						Lower bound	Upper bound
Total correct answers in pre-test	183,500	886,500	-1,319	0,187	0.240[b]	0,122	0,358
Total correct answers in post-test	221,000	312,000	-0,576	0,564	0.640[b]	0,507	0,773

Information:
a. Grouping Variable: Age Group
b. Based on 50 sampled tables with starting seed 2000000

Maintaining the correct composition and consistency of the mixture consisting of catfish viscera, bone meal, and other ingredients was also a critical step. Achieving a uniform blend that forms firm pellets without crumbling required attention to detail. Another notable constraint was the availability of equipment, particularly the pelletizer machine, which is generally not available at the household level. As a result, pellet formation could not be replicated independently by participants in their own homes. During the social outreach program itself, the absence of a hands-on practical session required presenters to rely heavily on detailed visual explanations to ensure participants fully understood each technical step.

Impact of the Activity

Despite the constraint, the social outreach program activity had a significantly positive impact on the knowledge and awareness of the community, particularly among the elderly women of the Posyandu Melati 2 group. Participants gained new insights into how organic waste, specifically catfish viscera and bone waste can be transformed into valuable raw materials for economical fish feed production.

The activity also fostered a spirit of innovation and local economic empowerment by introducing a simple production method that can be further developed at the household or small business group level. Additionally, this approach supports the *zero waste* principle by reducing organic waste from fish processing and optimizing its reuse as a beneficial product. In this way, the activity contributed not only to improved food and environmental literacy but also served as a stepping stone toward implementing circular economy practices within the local community.

Strategies for Sustaining the Program

The following step is to seek funding through community service grant schemes to provide the Melati 2 Group with an automatic pellet-making machine. This will offer more efficient access and hands-on experience in independently producing fish pellets. Additionally, ongoing monitoring will be conducted remotely to provide support in case the Melati 2 Group encounters any difficulties during the production of alternative fish pellets using catfish offal and bone waste.

CONCLUSION

The level of understanding among the Melati 2 group regarding the nutritional content, ingredients, and process of making alternative fish pellets from catfish bone waste showed a significant increase after the outreach program. This is evidenced by the increase in the average number of correct answers from 2.8 in the pretest to 4.46 in the posttest, along with statistical analysis results indicating a significant difference with a p-value <0.05, suggesting that the outreach successfully improved the participant's knowledge of the presented material. There was a difference in the average number of correct answers between the pre-elderly and elderly groups in understanding the nutritional content, ingredients, and process of making alternative fish pellets using catfish bone waste. However, this difference was not statistically significant ($p > 0.05$), indicating that both age groups had relatively similar abilities in comprehending the outreach material. Further research is needed to examine the effects of pellets containing catfish visceral and bone waste on the growth and yield of various fish species.

ACKNOWLEDGEMENTS

The authors would like to express their gratitude to Universitas Brawijaya for funding this community service activity through the 2025 Thematic Community Service Program. Special thanks are also extended to the Mejono Village Government, Plemahan District, Kediri Regency, and the Melati 2 Posyandu group for their support, cooperation, and active participation throughout the implementation of this program.

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