Jurnal Pengabdian UNDIKMA:
Jurnal Hasil Pengabdian & Pemberdayaan kepada Masyarakat
https://e-journal.undikma.ac.id/index.php/jpu/index
Email: pengabdian@undikma.ac.id

Vol. 7, No. 3 (August 2026)
E-ISSN : 2722-5097
Pg : 912-923

Corn Diversification through Training on Tuna Fish Bone Flour-Fortified Cookies in Pilolalenga Village, Gorontalo Regency

Faiza A. Dali*, Anton Kaharu, Rahim Husain, Silvana Apriliani
Universitas Negeri Gorontalo, Indonesia.
*Corresponding Author. Email: faizadali@ung.ac.id

Abstract: This community service program aims to enhance the knowledge and practical skills of members of the Karya Nyata Farmer Group, local housewives, and the Karang Taruna in local food diversification through the production of corn flour cookies fortified with tuna fish bone flour. The program introduced an innovative value-added food product utilizing locally available agricultural resources and fishery by-products while promoting local food diversification and the sustainable utilization of fishery waste. The activities were implemented through the Thematic Community Service Program (KKN Tematik I) of the State University of Gorontalo using a Participatory Action Research (PAR) approach. The implementation process included local potential identification, program planning, hands-on training, and program evaluation using pre-test and post-test assessments, participant response questionnaires, and organoleptic evaluation. Pre-test and post-test data were analyzed descriptively and presented as percentages. The participants' average knowledge score increased markedly from 41.8% in the pre-test to 85.8% in the post-test. Two cookie variants, chocolate and vanilla, were successfully produced and received favorable acceptance from the panelists. The chocolate variant achieved a higher overall acceptability score (4.36) than the vanilla variant (3.86). Overall, the program effectively improved participants' knowledge and practical skills in processing corn flour and tuna fish bone flour into acceptable value-added food products, thereby supporting local food diversification and promoting the sustainable utilization of fishery by-products.

Article History:
Received: 26-05-2026
Reviewed: 30-06-2026
Accepted: 14-07-2026
Published: 20-08-2026

Key Words:
Community Empowerment; Cookies; Corn Flour; Fish Bone Flour; Food Diversification.

How to Cite: A. Dali, F., Kaharu, A., Husain, R., & Apriliani , S. (2026). Corn Diversification through Training on Tuna Fish Bone Flour-Fortified Cookies in Pilolalenga Village, Gorontalo Regency. *Jurnal Pengabdian UNDIKMA*, *7*(3), 912-923. https://doi.org/10.33394/jpu.v7i3.21483

https://doi.org/10.33394/jpu.v7i3.21483

Introduction

Pilolalenga Village, Dungaliyo Subdistrict, Gorontalo Regency is an agricultural area where corn is the primary crop. The total area of corn fields in this village is 208.9 hectares, with an annual production of approximately 980.6 tons (BPS., 2024). However, most of the harvest is still marketed in the form of dried kernels, as shown in Figure 1a, so the economic value added obtained by farmers is relatively low and heavily influenced by price fluctuations during the peak harvest season. These conditions highlight the need to develop corn-based processed products that offer higher value added and can create business opportunities for rural communities. The utilization of local commodities into value-added products is known to enhance the economic value of raw materials while supporting the sustainable use of resources (Kopparapu et al., 2022).

Jurnal Pengabdian UNDIKMA:
Jurnal Hasil Pengabdian & Pemberdayaan kepada Masyarakat
https://e-journal.undikma.ac.id/index.php/jpu/index
Email: pengabdian@undikma.ac.id

Vol. 7, No. 3 (August 2026)
E-ISSN : 2722-5097
Pg : 912-923

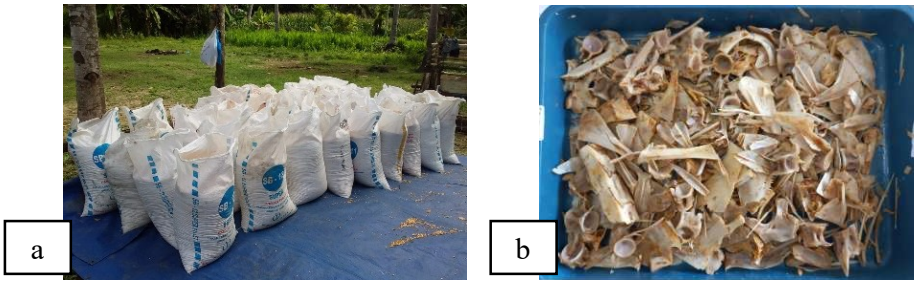

Figure 1. The potential of corn and fish bone waste: (a) shelled corn harvested by local communities; (b) fish bone waste as a food fortification ingredient

One form of food diversification with development potential is the use of corn flour as a raw material for cookies. This product is relatively easy to produce, has a fairly long shelf life, and is acceptable to various consumer groups. The use of corn flour in cookies also supports reducing dependence on imported wheat flour and promotes the utilization of local resources. Various studies report that corn flour can be used as a raw material for cookies with good consumer acceptance (Aini et al., 2025; Fariroh et al., 2024). Although increasing the proportion of corn flour may affect texture characteristics due to its lower gluten content compared to wheat flour (Adnan et al., 2025), corn-based cookie products still hold potential for development as value-added local foodse minimal paragraph in the introduction is three paragraphs.

In addition to its significant agricultural potential, Gorontalo also produces a considerable amount of fishery waste in the form of fish bones, as shown in Figure 1b. This waste is generally not yet being utilized optimally and has the potential to cause environmental problems. In fact, fish bones can be processed into a mineral-rich flour, particularly rich in calcium, making them a potential ingredient for food fortification. (Anggraeni et al., 2025) reported that tuna fish bone flour contains 21.36% calcium, while (Andhikawati et al., 2021) stated that marine fish bones generally have higher mineral content compared to freshwater fish. The use of fish bone flour in baked food products has also been reported to increase mineral content without significantly reducing sensory acceptability (Asikin et al., 2024). Additionally, cookies fortified with tuna fish bone flour still received good sensory acceptability ratings from panelists (Sitepu et al., 2023). The use of local calcium-rich food ingredients as a source of fortification is also recommended as a food-based strategy to help increase the population's calcium intake (Bourassa et al., 2022).

The combination of corn flour and fish bone flour in cookies is a food innovation that integrates the potential of the local agriculture and fisheries sectors into a product of both nutritional and economic value. However, the community of Pilolalenga Village still has limited knowledge and skills in corn-based food processing, the utilization of fishery by-products, the implementation of food processing sanitation, as well as product packaging and basic product marketing concepts.

Various studies have reported the use of corn flour as a raw material for cookies (Aini et al., 2025; Fariroh et al., 2024) as well as the use of fish bone flour as a source of mineral fortification in food products (Sitepu et al., 2023). However, community empowerment activities that integrate these two local ingredients into a single training program remain relatively limited. The innovation of this community service program lies in an integrated participatory intervention that combines local food technology transfer, GMP education, product packaging, basic marketing, and the utilization of fishery by-products (BPOM, 2012; Dali & Kaharu, 2025). This community service activity aims to provide knowledge and

Jurnal Pengabdian UNDIKMA:
Jurnal Hasil Pengabdian & Pemberdayaan kepada Masyarakat
https://e-journal.undikma.ac.id/index.php/jpu/index
Email: pengabdian@undikma.ac.id

Vol. 7, No. 3 (August 2026)
E-ISSN : 2722-5097
Pg : 912-923

practical skills to the residents of Pilolalenga Village through participatory training in the production of corn flour cookies fortified with fish bone flour as a value-added local food product while promoting the utilization of fishery by-products and local food diversification.

Method

The community service activity was conducted in Pilolalenga Village, Dungaliyo Subdistrict, Gorontalo Regency, as part of the 2026 Thematic Community Service Program of State University of Gorontalo. The training session was attended by 25 participants, consisting of members of the Karya Nyata Group, farmers' wives/housewives, and the Pilolalenga Village Youth Association.

The activity was implemented using the Participatory Action Research (PAR) approach, a community empowerment method that involves active community participation in the process of problem identification, planning, implementation, and evaluation of activities (Kemmis et al., 2014). This approach was chosen to encourage community involvement in the development of corn-based food diversification and the utilization of fishery waste into value-added food products. The implementation of the activities was carried out in four stages: needs identification and analysis, program planning, training implementation, and activity evaluation and reflection.

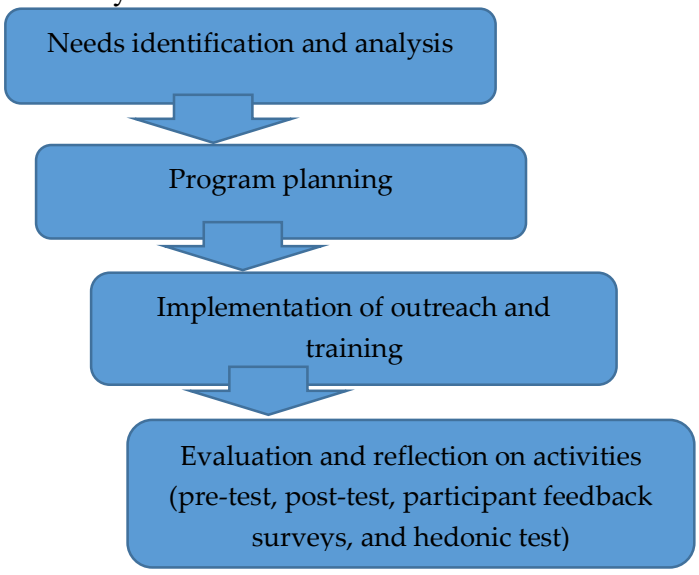

Figure 2. Stages of community service activity implementation

Needs Identification and Analysis

The identification phase was conducted through field observations and interviews with village officials and community members to assess the potential and challenges related to the utilization of corn and fishery byproducts in Pilolalenga Village. This phase also aimed to identify patterns in the utilization of corn harvests, the community's level of knowledge regarding local food diversification, and opportunities for developing food products based on local resources.

Program Planning

The planning phase was carried out in collaboration with the village government and target groups through the development of training materials, preparation of tools and supplies, and the establishment of an activity schedule. Additionally, educational materials

Jurnal Pengabdian UNDIKMA:
Jurnal Hasil Pengabdian & Pemberdayaan kepada Masyarakat
https://e-journal.undikma.ac.id/index.php/jpu/index
Email: pengabdian@undikma.ac.id

Vol. 7, No. 3 (August 2026)
E-ISSN : 2722-5097
Pg : 912-923

were prepared regarding local food diversification, the fish bone flour, food processing sanitation, and product packaging.

Training Implementation

The activities were carried out through outreach sessions and hands-on training on making fortified corn flour cookies using fish bone flour. The session began with a presentation on corn-based local food diversification, the utilization of fish bone waste as a food fortification ingredient, the application of Good Manufacturing Practices (GMP), and the packaging. Participants were then guided directly through the cookie-making process, from ingredient preparation, dough mixing, and molding to baking and product packaging. The ingredient formulations used in the production of corn flour cookies fortified with fish bone flour are presented in Table 1. The product was produced in two variants: vanilla and chocolate. The chocolate variant was made by adding 15 g of cocoa powder, while the vanilla variant used the base formulation without the addition of cocoa powder.

Table 1. Formulation of fortified corn flour cookies with fish bone flour

Ingredient	Amount (g)
Wheat flour	160
Corn flour	35
Fish bone flour	5
Butter	120
Powdered sugar	80
Egg yolks	30
Powdered milk	20
Cornstarch	20
Baking powder	2
Baking soda	1
Vanilla	1
Salt	1
Chocolate chips	50

The cookie-making process begins by mixing butter, powdered sugar, egg yolks, salt, and vanilla extract with a mixer until smooth. Next, the dry ingredients—consisting of all-purpose flour, corn flour, fish bone flour, cornstarch, powdered milk, baking powder, and baking soda—are mixed thoroughly. For the chocolate variant, cocoa powder is added to the dry ingredient mixture. The dry ingredient mixture is then gradually incorporated into the wet batter while stirring until homogeneous, forming a dough ready for shaping. After that, chocolate chips are added, and the dough is shaped into the desired forms and baked in an oven at 160°C for approximately 15 minutes until fully cooked. The baked products are cooled to room temperature, then packaged in labeled standing pouches as part of educational efforts on packaging.

Activity Evaluation and Reflection

The activity was evaluated using pre-test and post-test assessments and a participant satisfaction questionnaire. Knowledge improvement was measured using five statements rated on a four-point scale (1 = did not know/not yet able to 4 = highly understood/proficient). The average scores were converted into percentages and analyzed descriptively using Microsoft Excel. Participants' responses to the training were evaluated using a five-point Likert scale ranging from Strongly Dissatisfied to Strongly Satisfied. Although 25 participants attended the training, only 22 completed the questionnaire and were included in the satisfaction analysis, while three incomplete questionnaires were excluded. In addition, organoleptic evaluation of the chocolate and vanilla cookie variants was conducted

Jurnal Pengabdian UNDIKMA:
Jurnal Hasil Pengabdian & Pemberdayaan kepada Masyarakat
https://e-journal.undikma.ac.id/index.php/jpu/index
Email: pengabdian@undikma.ac.id

Vol. 7, No. 3 (August 2026)
E-ISSN : 2722-5097
Pg : 912-923

using the hedonic method according to BSN (2006) by 25 untrained panelists. The organoleptic evaluation used a five-point hedonic scale (1 = strongly dislike to 5 = strongly like). Samples were coded with random three-digit numbers, presented in random order, and the results were expressed as mean ± standard deviation.

Result and Discussion

Implementation of Outreach and Training on Local Food Diversification

The outreach and training activities were conducted in a participatory manner, involving members of the Karya Nyata Farmers' Group and housewives in Pilolalenga Village. The activities began with the presentation of materials on corn-based food diversification, the use of fish bone flour as a food fortification ingredient, as well as education on food processing sanitation and the application of simple Good Manufacturing Practices (GMP) to support the quality and safety of processed products (BPOM, 2012). The implementation of GMP is crucial for improving food quality and safety in home-based industries, ensuring that the products produced are of higher quality and safe for consumption (Dali & Kaharu, 2025).

The next stage involved a demonstration and hands-on practice of making cookies made from corn flour fortified with fish bone flour, covering the mixing of ingredients, shaping, baking, and packaging using labeled standing pouches. Throughout the activity, students provided direct guidance to ensure participants could follow each processing step independently. A participatory approach through hands-on practice allows participants to gain a more effective learning experience because they are actively involved in the entire process of the activity (Kemmis et al., 2014). The training activity went well and was met with high enthusiasm from the participants. This indicates that practice-based training has the potential to enhance the community's knowledge and skills in local food processing, as reported by (Kaugi et al., 2023), who found that food processing training can improve participants' knowledge, attitudes, and practices regarding food safety and processing. Documentation of the outreach and training activities for making fortified corn flour cookies with fish bone flour is presented in Figure 3.

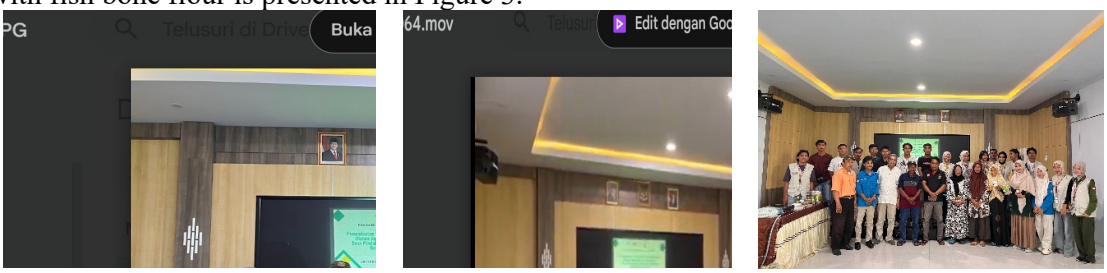

Figure 3. Outreach activities on local food diversification and the use of fish bone flour

Corn Flour Cookies Fortified with Fish Bone Flour

The products produced during the training consisted of two varieties: chocolate and vanilla. The resulting cookies had a relatively uniform shape, a brownish-yellow color, a distinctive aroma, and a crisp texture. The use of corn flour contributes to the product's color and texture characteristics, while the fortification with fish bone flour serves as a source of minerals, particularly calcium. The use of corn flour in cookie products is known to produce sensory characteristics that are still acceptable to consumers, even though the gluten content is lower than that of wheat flour (Aini et al., 2025).

Jurnal Pengabdian UNDIKMA:
Jurnal Hasil Pengabdian & Pemberdayaan kepada Masyarakat
https://e-journal.undikma.ac.id/index.php/jpu/index
Email: pengabdian@undikma.ac.id

Vol. 7, No. 3 (August 2026)
E-ISSN : 2722-5097
Pg : 912-923

The chocolate variant produces a darker color than the vanilla variant due to the addition of cocoa powder and the occurrence of non-enzymatic browning reactions during the baking process. The Maillard reaction is known to play a significant role in the formation of color, aroma, and distinctive flavor in flour-based food products that undergo heating (Qi et al., 2025). Meanwhile, the vanilla variant has a lighter color with a milder aroma.

The use of fish bone flour in small amounts is still capable of producing products with good texture without causing a dominant fishy odor. These results indicate that fish bone flour has the potential to be utilized as a fortification ingredient in food products based on local resources. These findings align with reports by (Asikin et al., 2024) and (Sitepu et al., 2023), which show that fortifying cookies with fish bone flour can enhance mineral nutritional value while maintaining good sensory acceptance.

The finished product is then packaged in a standing pouch labeled "Piloma Cookies" as a simple educational tool regarding packaging; this branding enhances the product's appeal and market value among consumers. The production process and the resulting cookies made from corn flour fortified with fish bone flour are shown in Figure 4.

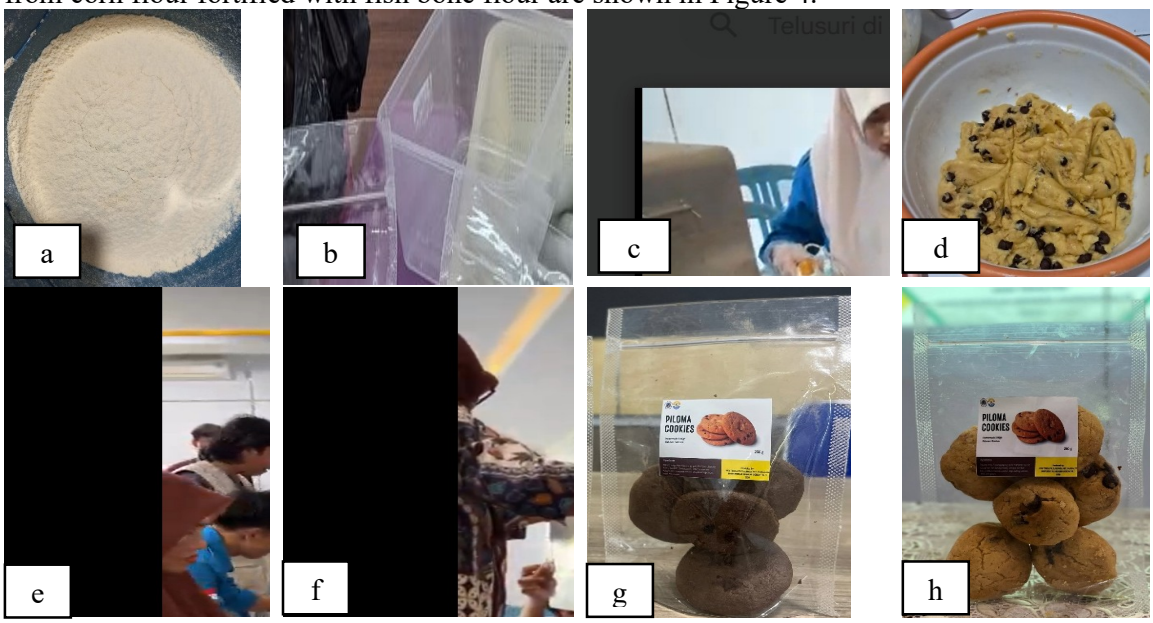

Figure 4. Production process and results of fortified corn flour cookies with fish bone flour: (a) corn flour; (b) fish bone flour; (c) mixing of ingredients; (d) cookie dough; (e) dough shaping; (f) baking process; (g) chocolate-flavored cookies; (h) vanilla-flavored cookies

Sensory Test Results of the Cookie Products

Sensory testing was conducted to determine the panelists' acceptance levels of the fish bone flour-fortified corn flour cookies in two flavor variants: chocolate and vanilla. The parameters observed included color, aroma, texture, taste, and overall acceptance using a 1–5 hedonic scale. The average hedonic test scores are presented in Figure 5.

Jurnal Pengabdian UNDIKMA:
Jurnal Hasil Pengabdian & Pemberdayaan kepada Masyarakat
https://e-journal.undikma.ac.id/index.php/jpu/index
Email: pengabdian@undikma.ac.id

Vol. 7, No. 3 (August 2026)
E-ISSN : 2722-5097
Pg : 912-923

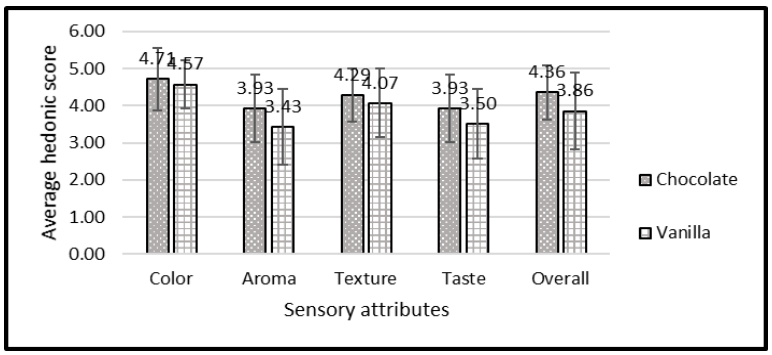

Figure 5. Average hedonic test scores for corn flour cookies fortified with fish bone flour

Based on the results of the hedonic test, both variants of corn flour cookies fortified with fish bone flour were generally rated as "liked" by the panelists, with average scores ranging from 3.43 to 4.71. The chocolate variant showed higher acceptance scores than the vanilla variant across all sensory parameters.

In terms of color, the chocolate-flavored cookies received the highest score of 4.71±0.83, while the vanilla-flavored cookies scored 4.57±0.65. The high level of preference for the color of the chocolate-flavored cookies is believed to be influenced by the addition of cocoa powder and chocolate chips, as well as the browning reaction that occurs during the baking process. The Maillard reaction between reducing sugars and protein amino groups produces melanoidin compounds that play a role in the formation of brown color (Qi et al., 2025). Additionally, heating in corn-based products is known to enhance non-enzymatic browning reactions, which contribute to reduced brightness and the formation of a more intense brown color (Rolandelli et al., 2021). Color is the first attribute observed by consumers and often serves as an initial factor in determining the acceptance of a food product. The results of this study align with those of (Carlos Claire & Peñalber, 2025), who reported that fortified corn-based cookies still received high color acceptance ratings from panelists. Similar findings were reported by(Sitepu et al., 2023), indicating that cookies fortified with tuna fish bone flour still received good ratings for the color attribute despite producing a slightly darker color.

The aroma parameter showed a value of 3.93±0.92 for the chocolate variant and 3.43±1.02 for the vanilla variant. The higher aroma value in the chocolate variant indicates that the addition of cocoa powder enhances panelists' acceptance of the product's aroma. The more dominant chocolate aroma is believed to play a role in masking the characteristic aroma of fish bone flour, which typically appears in fishery-based fortified products. According to (Liu et al., 2024), fishy odors in aquatic products generally originate from aldehydes, alcohols, sulfur compounds, and amines formed during handling and processing, while the use of specific flavors can be an effective strategy to reduce the perception of such fishy odors. In addition to coming from additives, the aroma of the cookies is also influenced by the natural volatile compounds in corn flour. (Prastiwi et al., 2026) reported that the characteristic aroma of corn is associated with the presence of volatile compounds such as dimethyl sulfide, 1-hydroxypropanone, 2-hydroxy-3-butanone, and 2,3-butanediol. These results are consistent with those of (Sitepu et al., 2023), who reported that the addition of tuna bone flour can produce a characteristic fishy aroma that results in a slightly lower (neutral) aroma score.

In terms of texture parameters, the chocolate variant scored 4.29±0.73 and the vanilla variant scored 4.07±0.92. These scores indicate that both products had a texture that was

Jurnal Pengabdian UNDIKMA:
Jurnal Hasil Pengabdian & Pemberdayaan kepada Masyarakat
https://e-journal.undikma.ac.id/index.php/jpu/index
Email: pengabdian@undikma.ac.id

Vol. 7, No. 3 (August 2026)
E-ISSN : 2722-5097
Pg : 912-923

well-received by the panelists. The crisp texture is believed to be influenced by the starch content in the corn flour, which results in a more brittle and crispy cookie structure after baking. (Adnan et al., 2025) reported that substituting corn flour in cookie formulations can affect gluten network formation, resulting in different textural characteristics compared to wheat flour-based cookies. Nevertheless, the use of fish bone flour in low amounts in this study did not have a negative impact on product texture acceptance. These results are supported by (Prastiwi et al., 2026), who stated that increasing the proportion of corn flour still produces cookies acceptable to consumers, although their crispness is influenced by differences in starch composition compared to wheat flour. Additionally, the reduction in moisture content during the baking process also contributes to the formation of a crisper texture.

In terms of taste, the chocolate variant scored 3.93±0.92, while the vanilla variant scored 3.50±0.94. These results indicate that the chocolate flavor was more effective at improving panelist acceptance than the vanilla flavor. The sweet character and stronger chocolate flavor are believed to balance the distinctive taste derived from fish bone flour, resulting in a more preferred flavor profile. (Liu et al., 2024) explain that the use of certain flavors can provide a masking effect on volatile compounds that contribute to the characteristic flavor of fishery products. Therefore, the addition of cocoa powder to the cookie formulation is believed to play a role in improving taste acceptance by the panelists. These findings align with those of (Sitepu et al., 2023), who reported that the addition of fish bone flour imparts a savory, fish-like flavor, yet the product remains within the range of consumer acceptability.

The overall acceptance score indicates that the chocolate variant received the highest score of 4.36±0.74, while the vanilla variant scored 3.86±1.03. These results suggest that, in general, the panelists preferred the chocolate cookies over the vanilla ones. The high overall acceptance of the chocolate variant is likely influenced by a more balanced combination of color, aroma, texture, and taste, resulting in sensory characteristics that better align with the panelists' preferences. These results align with (Hussain et al., 2022), who stated that the overall acceptance of cookies is highly influenced by the balance of key sensory attributes, namely color, aroma, taste, and texture. This finding is also supported by (Prastiwi et al., 2026), who reported that the use of corn flour in cookie formulations is still capable of producing products that are preferred by consumers.

Overall, the results of this study indicate that corn flour and fish bone flour have the potential to be developed as value-added local food ingredients in cookie products. The use of fish bone flour as a fortification ingredient has the potential to increase mineral content, particularly calcium, as reported by (Asikin et al., 2024) and (Anggraeni et al., 2025). The development of calcium-fortified foods is also in line with the recommendations of (Bourassa et al., 2022) regarding the importance of a food-based approach to increasing the public's calcium intake. In addition to improving the nutritional value of the product, the use of fish bone flour also supports the more sustainable and value-added processing of fishery byproducts. The distribution of panelists' preference percentages for the overall acceptance parameter is presented in Table 2 to support the average results of the hedonic test.

Table 2. Percentage of panelists regarding overall evaluation

Preference Level	A/Chocolate (%)	B/Vanilla (%)
Strongly like	50.00	35.71
Like	35.71	21.43
Neutral	14.29	35.71

Jurnal Pengabdian UNDIKMA:
Jurnal Hasil Pengabdian & Pemberdayaan kepada Masyarakat
https://e-journal.undikma.ac.id/index.php/jpu/index
Email: pengabdian@undikma.ac.id

Vol. 7, No. 3 (August 2026)
E-ISSN : 2722-5097
Pg : 912-923

Dislike	0	7.14
Strongly dislike	0	0

Based on the results of the overall acceptance assessment, the chocolate-flavored cookies showed a higher level of preference compared to the vanilla-flavored cookies. A total of 50.00% of the panelists stated they "really liked" the chocolate-flavored cookies and 35.71% stated they "liked" them, whereas for the vanilla-flavored cookies, the percentages of panelists who stated they "really liked" and "liked" them were 35.71% and 21.43%, respectively. The percentage of neutral ratings for the vanilla variant (35.71%) was higher than that for the chocolate variant (14.29%); in fact, 7.14% of panelists stated they did not like the vanilla variant. Conversely, no "dislike" or "strongly dislike" ratings were found for the chocolate variant. These results indicate that the fortification of fish bone flour in the cookie formulation is still well-accepted by panelists. These findings align with the research by (Sitepu et al., 2023), which reported that cookies with added tuna fish bone flour still achieved a good overall acceptance rate and have the potential to be developed as functional foods based on fishery byproducts.

The high level of acceptance for the chocolate variant is believed to be influenced by the more dominant characteristics of the chocolate's color, aroma, and taste, which help mask the distinctive aroma and flavor of the fishery-based fortifying ingredients. In addition to providing sensory characteristics that are more familiar to consumers, the chocolate flavor also plays a role in improving the overall balance of the product's sensory attributes. This is reflected in the results of the hedonic test, which showed that the chocolate variant received higher scores on all sensory parameters compared to the vanilla variant. These results align with (Liu et al., 2024), who stated that the use of certain flavors can reduce the perception of undesirable aroma and taste in fishery-based products, as well as (Hussain et al., 2022), who reported that the overall acceptance of cookies is highly influenced by the harmony of color, aroma, taste, and texture attributes that align with panelists' preferences.

Evaluation of Participants' Level of Understanding and Responses

The evaluation results indicate an increase in participants' understanding following the training. The average pre-test score of 41.8% increased to 85.8% on the post-test. These findings suggest that a training approach combining information sessions, demonstrations, and hands-on practice is effective in strengthening the community's knowledge and skills regarding food processing using local resources.

Participants' responses indicated a high level of satisfaction with the training implementation. The highest ratings for the clarity of the training materials and practical guidelines suggest that the combination of printed modules and direct mentoring effectively supported knowledge transfer and participants' understanding of the cookie-making process. These findings are consistent with Kaugi et al. (2023), who reported that participatory training enhances community knowledge, skills, and confidence.

Table 3. Participant responses to the training on fortified corn flour cookies made with fish bone flour

No	Evaluation Aspect	Strongly Dissatisfied (%)	Dissatisfied (%)	Neutral (%)	Satisfied (%)	Strongly Satisfied (%)
1)	Training material is easy for participants to understand	0.00	0.00	0.00	9.09	90.91
2)	Practical guidelines help	0.00	0.00	0.00	9.09	90.91

Jurnal Pengabdian UNDIKMA:
Jurnal Hasil Pengabdian & Pemberdayaan kepada Masyarakat
https://e-journal.undikma.ac.id/index.php/jpu/index
Email: pengabdian@undikma.ac.id

Vol. 7, No. 3 (August 2026)
E-ISSN : 2722-5097
Pg : 912-923

	participants understand the cookie-making process					
3)	The presentation of the material was engaging and communicative	0.00	0.00	0.00	27.27	72.73
4)	The cookie-making process was easy to practice	0.00	0.00	0.00	36.36	63.64
5)	The training provided new knowledge	0,00	0.00	0.00	27.27	72.73
6)	Participants feel more confident making products independently	0.00	0.00	0.00	27.27	72.73
7)	The duration of the activity is considered adequate	0.00	0.00	0.00	18.18	81.82
8)	The training activity benefits the participants	0.00	0.00	0.00	27.27	72.73

n = 22 respondents (three incomplete questionnaires were excluded from the analysis)

Conclusion

The community service activity conducted through the University of Gorontalo's Thematic Community Service Program I in Pilolalenga Village successfully provided the community with knowledge and skills in processing fortified corn flour cookies made with fish bone flour as a value-added food product based on local resources. The success of the activity was demonstrated by an increase in participants' average scores from 41.8% on the pre-test to 85.8% on the post-test, as well as the high level of positive feedback from participants regarding the training materials and practical sessions. The cookies produced—both the chocolate and vanilla variants—were well-received by the panelists, with preference levels ranging from "liked" to "very liked," and the chocolate variant receiving a higher acceptance rate. This activity demonstrates that the utilization of local corn and fish bone flour has the potential to support food diversification while increasing the value-added of agricultural resources and fishery by-products at the community level. Moving forward, continued guidance is needed regarding product variation development, packaging, and marketing aspects to support the sustainability of household food businesses based on village potential.

Recommendation

Future programs should provide mentoring on packaging, digital marketing, and obtaining P-IRT and Halal certifications to improve the commercialization and consumer acceptance of fortified corn flour cookies made with tuna fish bone flour.

Acknowledgements

The authors would like to express gratitude to Universitas Negeri Gorontalo for its support in carrying out community service activities through the Thematic Community Service Program (KKN) Period I of 2026, based on the Rector's Decree No.

Vol. 7, No. 3 (August 2026)
E-ISSN : 2722-5097
Pg : 912-923

650/UN47/HK.02/2026 dated April 2, 2026, and the Community Service Implementation Contract Agreement No. 628/UN47. D1/PM.01.01/2026 dated April 8, 2026.

References

Adnan, M., Butt, M. S., Pasha, I., & Shahid, M. (2025). Development of cookies from wheat-yellow/white maize composite blends and their physical and sensory evaluation. *PLoS One*, *20*(6), 1–17. https://doi.org/10.1371/journal.pone.0326532

Aini, N., Sustriawan, B., Olivia, N. ., & Mela, E. (2025). Sensory profile, preference and nutritional value of gluten-free cookies made from corn flour, sweetened with sucrose and coconut crystal sugar. *Food Research*, *9*(3), 292–302.

Andhikawati, A., Junianto, Permana, R., & Oktavia, Y. (2021). Nutritional Composition Of Fish For Human Health. *Marinade*, *04*(02), 76–84.

Anggraeni, A. N., Solichah, K. M., & Puspitasari, D. (2025). Development of processed tuna fish bone flour nuggets (Thunnus sp) and analysis of calcium content. *JIPANG*, *07*(02), 49–59.

Asikin, A. N., Kusumaningrum, I., & Hidayat, T. (2024). Chemical characteristics of butter cookies with knife-fish (Chitalla sp.) bone flour addition as a healthy snack of high calcium. *Food Research*, *8*, 78–83. https://doi.org/10.26656/fr.2017.8(2).046 Abstract

Bourassa, M. W., Abrams, S. A., Belizán, J. M., Boy, E., Cormick, G., Quijano, C. D., Gibson, S., Gomes, F., Hofmeyr, G. J., Humphrey, J., Kraemer, K., Lividini, K., Neufeld, L. M., Palacios, C., Shlisky, J., Thankachan, P., Villalpando, S., & Weaver, C. (2022). Interventions to improve calcium intake through foods in populations with low intake. *ANNALS OF THE NEW YORK ACADEMY OF SCIENCES*, *1511*, 40–58. https://doi.org/10.1111/nyas.14743

BPOM. (2012). *BPOM (The Indonesian Food and Drug Administration). Good food production practices for home industries. Jakarta, Indonesia: BPOM*.

BPS. (2024). *Dungaliyo Subdistrict in Figures 2024*. Gorontalo Regency Statistics Office, Gorontalo, Indonesia.

BSN. (2006). *SNI 01-2346-2006: Guidelines for organoleptic testing. Jakarta, Indonesia: National Standardization Agency of Indonesia*.

Carlos Claire, S., & Peñalber, M. R. (2025). Cookies fortified with corn-based sagip nutri powder. *Journal of Chemistry and Nutritional Biochemistry*, *6*(2), 1–15.

Dali, F. A., & Kaharu, A. (2025). Community outreach on Good Manufacturing Practices for dried Anchovy (Stollephorus sp.) processing in Katialada Village, Kwandang Subdistrict. *Nanggroe : Jurnal Pengabdian Cendikia Nanggroe*, *4*(10), 150–155. https://doi.org/10.5281/zenodo.14930973

Fariroh, I., Harsanti, R. S., Munandar, Denna Eriani Sundahri, S., & Usmadi, U. (2024). Processing and packaging of cookies produced from local corn flour in Jubung Village, Jember Regency. *Kumawula*, *7*(1), 88–97. https://doi.org/10.24198/kumawula.v7i1.50849

Hussain, S., Alamri, M. S., Mohamed, A. A., Ibraheem, M. A., Qasem, A. A. A., Shamlan, G., & Ababtain, I. A. A. (2022). Dough performance and quality evaluation of cookies prepared from flour blends containing Cactus (Opuntia ficus-indica) and Acacia (Acacia seyal) gums. *Molecules*, *27*, *7217*, 1–17. https://doi.org/10.3390/molecules27217217

Kaugi, R. W., Kariuki, J. G., Odongo, A. O., Koech, M. J., & Njoroge, H. C. (2023). Impact of food hygiene and safety training on knowledge, attitude, and practices of food

Vol. 7, No. 3 (August 2026)
E-ISSN : 2722-5097
Pg : 912-923

hygiene and safety practices among food handlers in boarding schools of Embu County, Kenya. *International Journal of Community Medicine and Public Health*, *10*(12), 4660–4668. https://doi.org/10.18203/2394-6040.ijcmph20233760

Kemmis, S., McTaggart, R., & Nixon, R. (2014). *The Action Research Planner: Doing Critical Participatory Action Research*. Springer. Singapore. https://doi.org/10.1007/978-981-4560-67-2

Kopparapu, N. K., Duan, Y., Huang, L., & Katrolia, K. (2022). Review on utilisation of corn gluten meal , a by-product from corn starch industry for production of value-added products. *International Journal of Food Science and Technology*, *57*, 5592–5599. https://doi.org/10.1111/ijfs.15541

Liu, L., Zhao, Y., Zeng, M., & Xu, X. (2024). Research progress of fishy odor in aquatic products: From substance identification, formation mechanism, to elimination pathway. *Food Research International*, *178*. https://doi.org/10.1016/j.foodres.2023.113914

Prastiwi, A. P., Karyantina, M., & Suhartatik, N. (2026). Characteristics of cookies substituted with sweet corn (Zea mays L) flour with the variation of baking time. *Agrobioteknologi*, *3*(1), 22–29.

Qi, Y., Wang, W., Yang, T., Ding, W., & Xu, B. (2025). Maillard reaction in flour product processing: mechanism, impact on quality, and mitigation strategies of harmful products. *Foods*, *14*, *2721*, 1–26. https://doi.org/10.3390/foods14152721

Rolandelli, G., Favre, L. C., Mshicileli, N., Vhangani, L. N., Farroni, A. E., van Wyk, J., & Buera, M. del P. (2021). The complex dependence of non-enzymatic browning development on processing conditions in maize snacks. *LWT*, *147*, 111636. https://doi.org/10.1016/j.lwt.2021.111636

Sitepu, G. S. B., Andayani, S. N., Setiabudi, G. I., Maharani, M. D. K., & Panjaitan, F. C. A. (2023). Healthy cookies : nutritious food innovation through fortification by-products of Tuna (Thunnus sp .) fish bone flour. *Advances in Tropical Biodiversity and Environmental Sciences*, *7*(2), 55–62. https://doi.org/10.24843/ATBES.v07.i02.p03

