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Utilization of Melinjo Skin Waste into Flakes and Stock: Training and Evaluation of Product Acceptance in Karangtawang Village, Kuningan, West Java

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Abstract

This community service activity aims to address the issue of melinjo peel and leaf waste in Karangtawang Village, Kuningan Regency, through the application of zero waste food processing technology. The target partner for this activity is the Mujursari Farmer Group. The implementation methods include surveys, counseling, technical training on product manufacturing, and mentoring. The products developed are based on optimization research for broth formulations based on melinjo waste (peels and leaves) as well as gnemon flakes. The results indicate effective technology transfer, where the community is capable of producing broth variants with the best formulation (90% melinjo peel : 10% leaves) which received high sensory acceptance. This program is expected to increase the economic value of the waste by up to IDR 15-20 million per month and support sustainable agriculture.

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INTRODUCTION

Karangtawang Village, Kuningan District, Kuningan Regency, West Java, is a region with great potential for developing products based on agricultural waste and food loss from the melinjo chip industry. As the largest melinjo production center in West Java, this village produces tens of tons of melinjo per month, most of which is processed into chips and emping. However, this production process leaves behind melinjo peel waste (30-40% of the total fruit weight) and young melinjo leaves that have not been utilized optimally (Rahayu et al., 2021).

Currently, melinjo peel waste is more often discarded onto agricultural land or burned, even though data from the Indonesian Ministry of Health states that melinjo has high nutritional content such as protein (4.5 g/100 g), carbohydrates (20.7 g/100 g), potassium (200 mg), and antioxidant compounds like beta-carotene (1,744 mcg) and vitamin C (7 mg) (Kemenkes RI, 2018). Meanwhile, young melinjo leaves, traditionally used as a flavoring in West Javanese cuisine, are also frequently wasted due to a lack of processing innovation (Rujiyanti et al., 2020).

In terms of potential, Karangtawang Village possesses abundant natural resources in the form of melinjo peel and leaf waste that can be processed into value-added products such as Melinjo Peel Powdered Broth and Gnemon Flakes. The powdered broth has the potential to become a natural flavoring alternative to MSG, while gnemon flakes can be developed as a healthy snack or food topping.

This product diversification training from melinjo waste is expected to transfer practical knowledge and skills to the Karangtawang Village community, while simultaneously contributing to reducing the volume of organic waste by-products from the emping industry. The specific objectives of this Community Service activity are: (1) To determine product formulations (stock and flakes) with organoleptic characteristics acceptable to panelists; and (2) To provide intensive training to target partners regarding the technology for processing melinjo peel and leaf waste into economically valuable food products.

METHOD

2.1 Population and Sample

The population in this service activity comprises the residents of Karangtawang Village, Kuningan District, Kuningan Regency, the majority of whom work as farmers and melinjo emping processors. The selected sample resides around the emping production center where the Mujursari Farmer Group is located, to ensure the technology transfer process is easier and more directed. Sample selection was conducted based on *convenience sampling*, namely samples that are easily accessible, have abundant availability of waste raw materials, and are close to the service location. The training sample consists of members of the Mujursari Farmer Group and housewives who are emping artisans, totaling 44 people (with a core representative group of 16-20 people for intensive training).

2.2 Evaluation Instruments

The evaluation instruments used are questionnaires consisting of a perception questionnaire regarding the melinjo peel broth product (*Gnemon Broth*) and *Gnemon Flakes*, as well as an evaluation questionnaire on the training implementation. Each questionnaire consists of 10 statements using a Likert scale (1 = strongly dislike/strongly disagree to 5 = strongly like/strongly agree). This evaluation aims to measure community acceptance of product innovation and the effectiveness of the training methods provided.

2.3 Activity Implementation Stages

a. **Initial Survey Stage** A survey was conducted to determine the condition of the activity location in Karangtawang Village, the daily volume of melinjo peel and leaf waste generation, and the economic condition of the community. This aims to allow the team to design processed food products that the community can make using available raw materials (melinjo peels and leaves) and easily accessible equipment.

b. **Target Group Determination Stage** The target audience for the melinjo broth and flakes making training is the Mujursari Farmer Group and housewives who process emping. The reason for selecting this group is to provide additional skills (product diversification) so that their emping production waste is not wasted, but can be processed into saleable products that increase family income.

c. **Product Trial Stage (Preliminary Research)** The product trial stage was carried out at the Agricultural Product Processing Technology Laboratory before being introduced to the community. Referring to preliminary research (Nurhaliza et al.), optimization of the melinjo waste-based broth formulation was conducted to obtain the best sensory profile. Three formulations were tested:
   - **Formulation A1:** 90% Melinjo Peel + 10% Melinjo Leaves
   - **Formulation A2:** 50% Melinjo Peel + 50% Melinjo Leaves

- **Formulation A3:** 10% Melinjo Peel + 90% Melinjo Leaves

Based on preliminary organoleptic tests, Formulation A1 showed the highest overall acceptance score (2.84 on a scale of 4), particularly excelling in color and *aftertaste* parameters. The results of this trial served as the basis for drafting the standard operating procedure (SOP) for powdered broth production which would be taught to the Karangtawang Village community.

d. **Material Preparation Stage** Training materials were designed in the form of presentations and practical guide modules (*booklets*) containing: the urgency of *zero waste*, the nutritional content of melinjo peels, how to make *Gnemon Flakes*, and how to make Powdered Broth (flouring, spice mixing, packaging). The implementing team also prepared *flyers* to be distributed to participants, as well as prepared raw materials (fresh melinjo peels and leaves) and equipment (blender, roasting pan/oven, sieve) for demonstration.
e. **Melinjo Broth and Flakes Making Training Stage** The training stage was carried out at the Karangtawang Village Meeting Hall. The training consisted of three sessions:
   - **Session 1:** Delivery of material on the circular economy potential of melinjo waste by the lecturer team.
   - **Session 2 (Demonstration):** Practice of making Powdered Broth using the best formulation (A1: 90% peel, 10% leaves) and making *Gnemon Flakes*. The stages included: washing, size reduction, drying, flouring, seasoning mixing (onion, salt, sugar), and packaging.
   - **Session 3:** Sensory evaluation by participants (simple hedonic test) and questionnaire filling. Participants were asked to taste the products and provide assessments on taste, aroma, and saleability.

f. **Monitoring and Mentoring Stage** Monitoring and mentoring were conducted post-training to ensure participants could apply the knowledge and skills obtained independently. The service team monitored production consistency and provided consultation if partners encountered technical obstacles (e.g., problems with the drying process during the rainy season) or marketing obstacles

2.4 Data Analysis

Data analysis was carried out using quantitative descriptive methods by displaying questionnaire result data (product perception and training evaluation) in tabular form and discussing the information contained in the table. The software used for data recapitulation was Microsoft Excel. This analysis is used to conclude the success of the service program.

2.5 Research and Service Ethics

Permission for the implementation of community service activities has been requested from the Head of Karangtawang Village and the Chairperson of the Mujursari Farmer Group. Subsequently, information was provided to the community interested in participating in the training. Community participation is voluntary. When about to take part in the training, it was conveyed that there would be an evaluation requiring the inclusion of identity. If participants are willing, they are welcome to fill it out; if not, they can fill it out anonymously. Training participants were informed that the data is only used for program evaluation purposes.

RESULTS AND DISCUSSION

3.1 Panelist Demographic Analysis and Consumer Profiling

Sensory evaluation involved 21 untrained panelists from the community in three villages in Kuningan: Babakan, Jatinunggal, and Pasawahan. The panelist composition consisted of 6 males (28.57%) and 15 females (71.43%). This dominance of female participants aligns with the study by Hadiansyah et al. (2023).

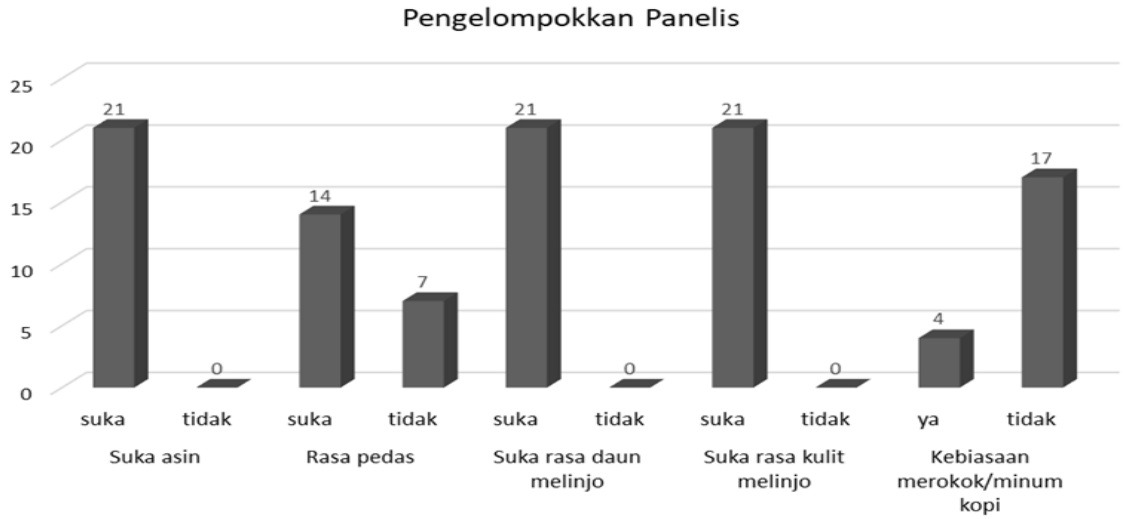

Figure 1. Panelist Data Characterization

Further characterization indicated that 100% of the panelists liked salty tastes, melinjo leaves, and melinjo peels. As many as 85.71% of panelists liked spicy tastes, while only 19.05% had smoking or coffee-drinking habits. This high level of familiarity can be a double-edged sword in the context of sensory evaluation. High familiarity with the raw materials may induce positive bias in the assessment. However, the low proportion of panelists with smoking and coffee-drinking habits (19.05%) has a positive impact on the validity of the results. Based on the ISO 8589 guidelines adopted in the Indonesian National Standard, smoking and caffeine consumption can interfere with gustatory and olfactory abilities for 2-4 hours. Nevertheless, the panelist preparation protocol in this study could still be strengthened. The latest international standards recommend stricter controls on factors such as the time of the last meal, water consumption, and the psychological condition of panelists before testing.

3.2 Sensory Performance Evaluation of Dual-Component Formulations

Research and development of melinjo leaf + melinjo peel-based broth produced 3 broth formulations: 90% melinjo peel + 10% melinjo leaves (A1), 50% melinjo peel + 50% melinjo leaves (A2), and 10% melinjo peel + 90% melinjo leaves (A3). These three formulations were tested in a sensory test involving 21 untrained panelists. The sensory test evaluated several test variables including color, aroma, taste, texture, and aftertaste.

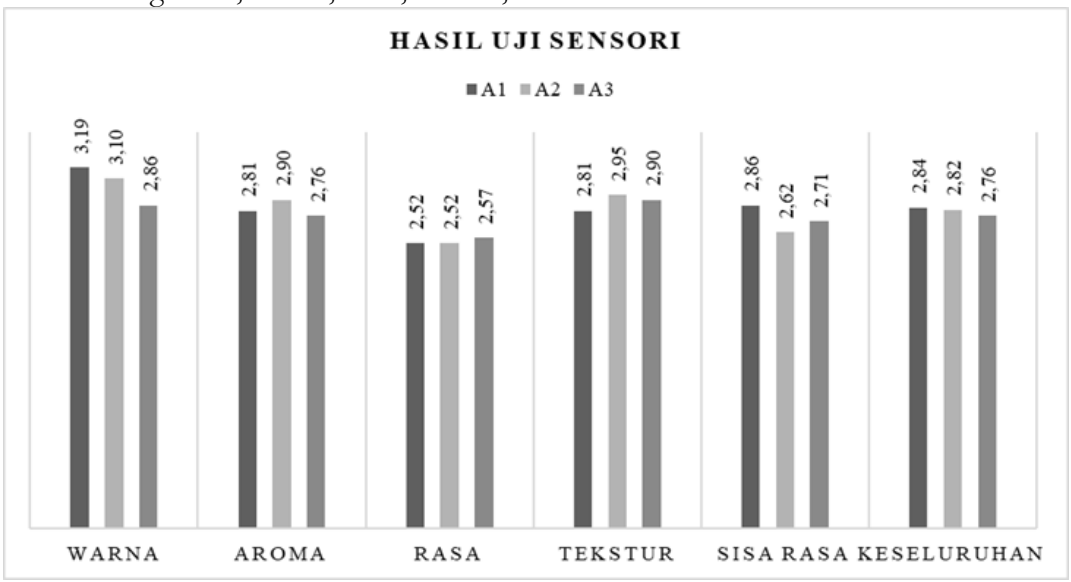

Figure 2. Sensory Evaluation Results

The three broth formulations evaluated showed interesting sensory profiles. Formulation A1 (90% melinjo peel + 10% melinjo leaves) obtained the highest score (2.84), followed by A2 (50% melinjo peel + 50% melinjo leaves) with a score of 2.82, and A3 (10% peel + 90% leaves) with a score of 2.76. Although the numerical differences were relatively small (0.02-0.08 points), each formulation showed superiority in different attributes. Formulation A1 excelled in color (3.19) and aftertaste (2.86). The dominance of melinjo peel produced a characteristic red color that was visually attractive. Research by Suhardi et al. (2022) in the *Journal of Food Technology and Industry* explains that visual attributes have a strong correlation with overall acceptance, especially in traditional Indonesian products. Meanwhile, Formulation A2 showed superiority in aroma (2.90) and texture (2.95). It can be concluded that the research successfully developed three dual-component broth formulations based on melinjo waste with consistent acceptability among consumers. Formulation A1 (90% melinjo peel + 10% melinjo leaves) obtained the highest sensory score (2.84), followed by A2 (50% peel + 50% melinjo leaves) with a score of 2.82, and A3 (10% peel + 90% melinjo leaves) with a score of 2.76.

CONCLUSION

The community service program involving the training of melinjo waste processing into powdered broth and *gnemon flakes* was successfully implemented in Karangtawang Village, Kuningan. This activity provided a concrete solution for handling agricultural waste while creating new economic opportunities for the Mujursari Farmer Group. The product formulation development results indicated that the variant with a composition of 90% melinjo peel and 10% leaves (A1) was the most preferred by the community, demonstrating high market potential without compromising sensory quality. This intervention successfully introduced circular economy principles at the village level. For program sustainability, future activities should focus on shelf-life testing, nutritional analysis, and assistance in obtaining Home Industry Food Production Certificates (SPP-IRT) to support wider commercialization.

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