

## Development of Mangosteen Peel Flour as a Functional Food Ingredient to Support Entrepreneurial Independence in Sipak Village

<sup>1</sup> Yasmin Athiyyah Cahyani, <sup>2</sup> Ade Heri Mulyati

<sup>1,2</sup>Department of Chemistry, Faculty of Mathematics and Natural Science, Universitas Pakuan, Bogor, Indonesia

Email: <sup>1</sup>[yasminathiyyahc@gmail.com](mailto:yasminathiyyahc@gmail.com), <sup>2</sup>[adeheri.mulyati@unpak.ac.id](mailto:adeheri.mulyati@unpak.ac.id)

**Abstract:** Sipak Village in Jasinga, Bogor Regency, has great potential for mangosteen production, yet it remains limited to fresh fruit sales, leading to increased peel waste. Through the PPK Ormawa program, students introduced the innovation of processing mangosteen peel into functional flour via blanching, drying, and grinding to retain bioactive compounds like xanthenes and flavonoids. The program involved surveys, training, production, business mentoring, and marketing strategies. Final products included syrup, tea, and cookies under the brand Queens Flour. This initiative improved community skills, fostered local entrepreneurship, and reduced organic waste in a sustainable manner.

**Keywords:** mangosteen peel, functional food, community empowerment, local entrepreneurship, PPK Ormawa

### 1. INTRODUCTION

Sipak Village is located in Jasinga District, Bogor Regency, West Java, and is one of the areas with very high potential for mangosteen agriculture. Mangosteen (*Garcinia mangostana L.*) is one of Indonesia's important tropical fruits with high economic value. Based on data from the Central Statistics Agency (BPS, 2024), mangosteen production in Sipak Village reached a remarkable volume of 88,543.77 quintals per year. This high level of production represents a significant local advantage and provides a major opportunity to improve community welfare if managed properly and sustainably (Kementan RI, 2023). However, this considerable potential has not yet been optimally utilized. Most community members still sell mangosteen fruit in fresh form at relatively low prices, particularly during the harvest season when supply is abundant. As a result, the income earned by farmers is often not proportional to the production costs and labor involved. Furthermore, unsold fruit and non-consumed parts, especially mangosteen peel, accumulate as waste and pose environmental risks due to the absence of an adequate waste management system.

In fact, mangosteen peel possesses extraordinary potential that is often overlooked. Numerous studies have demonstrated that mangosteen peel contains various bioactive compounds such as xanthenes, flavonoids, tannins, saponins, anthocyanins, and phenolic compounds (Rahayu, 2022; Saristiana et al., 2024). These compounds exhibit strong antioxidant, anti-inflammatory, antimicrobial, anticancer, and anti-allergic activities. Xanthenes found in mangosteen peel are known as powerful antioxidants that are rarely found in other fruits. Additionally, Rizki et al. (2023) reported that mangosteen peel also contains anthocyanin pigments that can be utilized as natural dyes for food and textile products. Consequently, there is a clear research and implementation gap in translating scientific findings into practical innovations at the community level that support economic independence.

This innovation was chosen not only to add value to agricultural waste that has long been discarded but also to strengthen local food security and economic resilience. Through training, mentoring, and entrepreneurial capacity building, students assist community members in understanding the entire processing procedure, including washing, drying, grinding, and hygienic, attractive packaging. The active involvement of PPK Ormawa in this initiative represents a tangible form of collaboration between academia and rural communities. Students act not merely as program implementers but as long-term partners in a continuous process of social transformation. Through a participatory approach, this program is expected to stimulate creativity and motivation among the Sipak Village community to recognize local potential as promising business opportunities.

The potential of mangosteen peel as a raw material for innovative products remains wide open, not only in the form of functional food flour but also for cosmetics, pharmaceuticals, and natural dyes. However, achieving this potential requires improved community understanding, technical skills, and awareness of value-added processing. Based on the above conditions, this community service program was designed as a strategic effort to integrate local agricultural potential, scientific innovation, and community empowerment. This program aims to address existing challenges related to agricultural waste, low economic value of fresh mangosteen, and limited entrepreneurial capacity within the community. By developing mangosteen peel flour

---

as a functional food ingredient, the program seeks to enhance community knowledge and technical skills, promote sustainable waste utilization, and strengthen local-based entrepreneurship.

Specifically, the objectives of this program are: (1) to increase community awareness and understanding of the functional properties and economic value of mangosteen peel; (2) to provide practical training on hygienic and standardized processing of mangosteen peel into flour; (3) to support the formation of community-based business groups and improve entrepreneurial skills; and (4) to encourage sustainable production and environmentally friendly practices. Through these efforts, the program is expected to contribute not only to improving household income and economic independence but also to fostering environmental sustainability and improving community health.

Overall, the implementation of the PPK Ormawa program in Sipak Village represents a comprehensive model of community service that combines academic knowledge, student engagement, and local resource optimization. This initiative demonstrates how student organizations can play a vital role in facilitating sustainable rural development and transforming agricultural waste into valuable products that support economic resilience, social empowerment, and environmental responsibility.

## **2. METHOD**

Implementation of this program took place in Sipak Village, Jasinga District, Bogor Regency, West Java. Focus main activity is empowerment society, especially group Mother House stairs that have potential big for involved active in the production process processed skin mangosteen. Program participants consist of from around 15 to 25 people joined in group public local.

Activity started with survey the first one was held on February 28<sup>th</sup> 2025, with mentoring direct from Mrs. Euis as Chairman of the Sipak Village MSME. At the stage this, the program team did approach beginning with method around village and discuss direct together public for introduce program concept and dig information beginning related potential and interest inhabitant to processing mangosteen. Second conducted on July 21<sup>st</sup> to 22<sup>nd</sup> 2025. Activities This focus on the trial-and-error stage of the initial process processing skin

---

mangosteen become product processed, in order to adjust method, the most effective and appropriate production with condition public local. Next,

Third held on July 29<sup>th</sup> to 31<sup>st</sup> 2025, which is filled with activity socialization beginning to inhabitant in a way direct from House to house (door to door). Activities This aim for give understanding more deep to public about benefits and opportunities from the utilization program skin mangosteen. Fourth implemented on August 4<sup>th</sup> 2025 and continued with activity demonstration processing mangosteen syrup product on August 13<sup>th</sup> 2025. One day then, precisely on August 14<sup>th</sup> 2025, it was carried out demonstration advanced manufacturing product tea and flour skin mangosteen. Peak from activity training held on August 14<sup>th</sup> to 16<sup>th</sup> 2025, with focus main in the production process independent by the community to three type products, namely syrup, tea, and flour skin mangosteen. Activities This become an important momentum in push participation active public as well as form independence group business based potential local.

As for the method implementation is as following preparation tools and materials: Tool: 80 mesh sieve, knife, blender, pan, stove, oven, and container. Ingredients: skin fruit mangosteen, ice cubes, and water; making sample: Making flour skin mangosteen become flour done with method skin mangosteen dissorted Then separated part skin outside use knife Then washed, washing process use clean running water for remove dirt and then drained, skin fruit mangosteen cut small, then skin fruit mangosteen dried with using an electric oven at 45°C for 16 hours, after dried, skin fruit mangosteen ground with use blender tool then sifted with use 80 mesh sieve; testing interest community on the food that is made: after stage production finished, activity to be continued with testing interest and acceptance public to product processed products. Some example product simple like herbal drinks or snack Healthy made use flour skin mangosteen as material standard main. This Products then introduced to inhabitant around for tasted and rated based on taste, aroma, texture, and appearance.

Stage furthermore is evaluation of the program carried out in a way comprehensive for evaluate success activities that have been implemented. Evaluation This covers effectiveness training, improvement understanding and skills participants, as well as readiness public for continue production in a way independent. Activities evaluation implemented through discussion groups and interviews short with participants, in order

to identify obstacles faced and potential action continue the program. Assistance and Marketing Strategy: As form program sustainability, mentoring is also carried out advanced for participant in form group business together. Students help in designing identity products, including name, logo and design creation Attractive and hygienic packaging. In addition, the community is also accompanied in designing a marketing strategy, right in a way offline through local markets and in a way on line through social media and digital *platforms*.

Aspects management business simple ones are also introduced, such as recording finance basis and division task in group, so that activities production can walk in a way sustainable and professional. Through stages structured implementation this program is expected No only produce valuable products economy, but also create an empowerment model society that can replicated in other areas with potential similar. Approach based training, practice direct, evaluation participatory and mentoring business become key success in create impactful changes for public village sipak. This community service activity employed a mixed-methods approach combining quantitative and qualitative techniques to evaluate program effectiveness. The program was conducted in Sipak Village and involved local residents, particularly small-scale food producers and households interested in entrepreneurship. The main raw material used was fresh mangosteen peel collected from local farms.

The processing stages included washing, drying, grinding, and sieving to obtain mangosteen peel flour. Training sessions were conducted to ensure participants understood hygienic processing, proper drying techniques, and quality control standards. The implementation consisted of educational sessions on functional foods and the health benefits of mangosteen peel, hands-on training on mangosteen peel flour production, assistance in developing simple food products using the flour, basic entrepreneurship training, including packaging, labeling, and marketing strategies. Quantitative data were collected through pre- and post-training questionnaires to measure changes in participants' knowledge and skills. Qualitative data were obtained through interviews and direct observation to assess community participation and program impact. Quantitative data were analyzed using descriptive statistics, while qualitative data were analyzed using thematic analysis. The questionnaire instruments were validated through expert review, and reliability was assessed using internal consistency analysis to ensure accurate measurement of participant responses.

### 3. RESULTS AND DISCUSSION

Activity training and mentoring processing skin mangosteen become flour in Sipak Village has succeed implemented with involving participation active society, especially moms House stairs. The production process carried out follow stages technical that has been customized with principle security food and processing material natural. Stages main in manufacturing flour skin mangosteen covering washing, slicing, drying, and grinding. Blanching process or boiling light during not enough more than five minutes proven effective in disable enzymes destroyer that can lower quality materials. In addition, the method this also helps maintain content compound bioactive in skin mangosteen, such as xanthones, which have sensitivity tall to oxidation.

Drying carried out at a temperature range between 50°C to 60°C, which is optimal temperature for guard stability xanthone content and maintain color experience skin mangosteen, so that product end own good quality both visually and functional. The flour produced from the process Then tested in a way qualitative for see potential content compound bioactive compounds contained in it. The results show that flour skin mangosteen contain various compound important like compound phenolics, flavonoids, and xanthone in sufficient levels high. Based on testing activity antioxidants use DPPH method, activity antioxidants in flour skin mangosteen reach the figure of 87.3% in the study Mardawati *et al* (2025) This figure show very high potential in ward off radical free, so that support function flour skin mangosteen as food functional that can help lower risk disease degenerative and strengthening system immunity body.

Findings this is also in line with results research conducted by Puspitasari *et al.* (2020), who stated that skin mangosteen contain fiber crude, flavonoids, and compound antimicrobial natural in research Saristiana *et al* (2024) which is good for health digestion and support metabolism body. In addition, the color naturally produced from anthocyanin pigments in skin mangosteen give mark plus from aspect aesthetics and potential its use as dye experience in product food processed. From the side reception community, trial results product processed from flour skin mangosteen, such as herbal drinks and snacks light, get positive response. The majority participant state interest to benefit the health services offered, as well as feel satisfied with the taste of the resulting product.

Product flour skin mangosteen This named *Queens Flour*, which was developed as alternative material food functional with content antioxidants natural. This shows that flour skin mangosteen No only potential as product health, but also has sufficient market opportunities big at the level local, especially If packaged and marketed with the right strategy. In a way overall, activities This No only produce product new based potential local, but also improve understanding public about importance management waste environmentally friendly farming environment and value economy. Participation active public as well as results positive from product testing show that this program own real and tangible impact become a model of sustainable empowerment in the village. To expand market reach and increase mark sell products, digital marketing strategies start introduced through training use of social media, local marketplace, and e-commerce platforms.

**Table 1.** Pre-test table of the Level of Knowledge of the Sipak Village Community about Potential Mangosteen Peel before the Gita Mangosteen Program

Question	Statement				
	SS	S	C	TS	STS
Whether You know that fruit and skin scratching can processed as product sell previously?	15 People	0 People	0 People	0 People	0 People
Whether You Already Once process fruit and skin mangosteen previously?	4 People	11 People	0 People	0 People	0 People
According to you, are your management skin and meat fruit mangosteen potential increase income public?	14 People	1 Person	0 People	0 People	0 People
According to you, are you manufacturing product can help reduce waste skin that is not used again?	14 People	1 Person	0 People	0 People	0 People
Whether You interested follow training manufacturing tea, flour, syrup from mangosteen?	6 People	9 People	0 People	0 People	0 People
Whether You willing follow market product processed said (in a direct or online)?	12 People	3 People	0 People	0 People	0 People

Perpetrator business local, especially moms House the ladder involved in production, driven for form group business together (KUB) and utilize digital media as means promotions and sales product flour skin mangosteen as well as its processing. In addition, monitoring and evaluation are also carried out. periodically to quality production, marketing, and impact economy for community. This monitoring covers recording of production volume, sales level, as well as satisfaction consumers who do through survey simple. With approach this, the sustainability of the program can maintain, and problems that arise in the field can quick followed up. It is hoped that, with combination between innovation products, digital marketing, and structured monitoring systems, Sipak Village can become pilot in development economy local based potential nature and technology appropriate.

Next, the activities socialization digital marketing has done with introducing promotional strategies through social media and *marketplaces*. Participants get knowledge new about manufacturing content promotion, writing description products, as well as Utilization of digital platforms as a marketing medium. This stage succeeds increase outlook public about importance marketing digital-based.



**Figure 1.** Manufacturing flour skin mangosteen

Based on results filling questionnaire, results This show that although public Already own understanding base regarding branding, its importance packaging, as well as utilization of social media, still required mentoring more carry on in promotion and improvement strategies Power pull products by the team implementers to be more known in a way area. It can also be seen that public Still face constraint in matter mastery more digital marketing features deep due to group public majority Not yet used to utilise digital technology in maximum.

**Table 2.** Pre-Test table of the Level of Knowledge of the Sipak Village Community about Potential Product Mangosteen Peel after the Gita Mangosteen Program

Question	Statement A	Statement B	Statement C
1. What are you know about <i>branding</i> ?	Create a name and image product so that easy known	Make product cheaper	Sell product without promotion
Amount	11 Persons	1 Person	1 Person
2. Why packaging product That important?	So that the product protected and attractive buyer	So that the product heavier	So that the product No in demand
Amount	13 Persons	0 Person	0 Person
3. Whether You Once make design packaging Alone?	Once	Never	-
Amount	13 Persons	0 Person	-
4. How method You usually promote product?	Inviting people to direct buy	Through social media	Never do promotion
Amount	3 Persons	10 Persons	0 Person
5. What are the obstacles? the biggest you experience in sell product?	Product not enough known	Packaging not enough interesting	Don't know method promotion
Amount	8 Persons	2 Persons	3 Persons

Product flour skin mangosteen Then start marketed in a way directly in the environment public and through digital platforms. Marketing results show existence interest from consumer local as well as expansion market reach through online media. With This, the activities This No only increase skills public in processing waste skin mangosteen, but also opens opportunity development business based herbal products. The results showed a significant improvement in participants’ understanding of functional foods and mangosteen peel utilization after the training program. Participants demonstrated increased skills in producing mangosteen peel flour using appropriate processing techniques.

**Table 3.** Post-test table of Knowledge Level of Sipak Village Community about Potential Product Mangosteen Peel after the Gita Mangosteen Program

Question	Statement A	Statement B	Statement C
1. Now, what does <i>branding</i> mean according to You?	Sell product known with an interesting name and picture	Make Product Cheaper	Sell Product Without Promotion
Amount	13 Persons	0 Person	0 Person
2. Whether You Already Can make or repair design packaging product You?	Already and packaging more interesting	Already try But Not yet Good	Not yet Can The same very
Amount	11 Persons	2 Persons	0 Person
3. After training, how You promote your product?	Through social media	Invite people directly buy	Not yet promoted
Amount	8 Persons	0 Person	5 Persons
4. What are the benefits you get? feel after training this?	Product more known and sold	Packaging product more interesting	More believe self for market product
Amount	0 Person	0 Person	13 Person
5. What's the plan? You after training for develop business?	Make packaging more products interesting	Increase promotion through social media	Look for help for design packaging
Amount	4 Persons	4 Persons	5 Persons

Participants successfully developed several food products incorporating mangosteen peel flour. Sensory observations indicated acceptable color, aroma, and texture, suggesting the feasibility of mangosteen peel flour as a functional ingredient. The program contributed to increased entrepreneurial motivation among participants. Some participants initiated small-scale production for local markets, indicating the potential for income generation and economic independence. These findings are consistent with previous studies highlighting the role of functional food innovation in supporting community-based entrepreneurship. The success of the program was influenced by the availability of raw materials, active community participation, and continuous mentoring. The integration of food innovation with empowerment strategies proved effective in enhancing both technical capacity and economic potential.

#### 4. CONCLUSION

This community service program demonstrates that mangosteen peel flour has strong potential as a functional food ingredient while also serving as a tool for community empowerment. The program successfully improved community knowledge, skills, and entrepreneurial motivation in Sipak Village. The development of mangosteen peel flour not only contributes to sustainable waste utilization but also supports rural economic independence. Future programs are recommended to focus on product diversification, shelf-life testing, nutritional analysis, and broader market access to ensure sustainability and scalability.

#### REFERENCES

- Badan Pusat Statistik. (2024). *Statistik Produksi Buah-buahan Indonesia 2024*. Jakarta: Badan Pusat Statistik.
- Kementerian Pertanian Republik Indonesia. (2023). *Statistik Hortikultura 2023*. Jakarta: Direktorat Jenderal Hortikultura, Kementerian Pertanian.
- Mardawati, E., Filianty, F., & Marta, H. (2025). *Activity study antioxidants extract skin mangosteen (Garcinia mangostana L.) in frame utilization waste skin mangosteen in the District Puspahiang*
- Puspitasari, E., et al. (2020). *Mangosteen Peel as a Source Antioxidants and Natural Fibers*. *Journal of Tropical Nutrition and Food*, 5(2), 22-28.
- Rahayu, N. (2022). *Extraction and identification compound bioactive xanthenes from skin fruit Mangosteen (Garcinia mangostana Linn.)* (Master's thesis). Institute Technology Ten November (ITS).
- Rizki, T., Yasni, S., Yuliani, S., & Muhandri, T. (2023). *Characteristics nanoemulsions and encapsulates nanoemulsi from extract skin mangosteen (Garcinia mangostana L.) as Material Food*. IPB Scientific Repository.
- Saristiana Y., Wahdi, A., & Prasetyawan, F. (2024). *Identification compound antioxidants extract skin fruit Mangosteen (Garcinia mangostana L.)*. *Well Being*, 9(1), Article 246.