Media Pendidikan Gizi dan Kuliner

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# Substitute in Making Pizza with Jackfruit Seed Flour

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## ABSTRACTS

This study aims to explore the potential of jackfruit seed flour as a substitute for part of the wheat flour content in pizza dough. Jackfruit seed flour is known for its low gluten content, making it a safer and healthier alternative for individuals sensitive to gluten. To evaluate the acceptability of pizza products incorporating jackfruit seed flour, both organoleptic and hedonic tests were conducted. The tests involved 35 non-expert panelists and 5 expert panelists, who assessed the products based on their preferences. Among the various formulations tested, Product 3 — consisting of 70% wheat flour and 30% jackfruit seed flour — emerged as the most favored. The expert panelists gave Product 3 a total score of 12.6, with an average rating of 3.15, while the non-expert panelists awarded a total score of 14.08, averaging 3.52. These findings suggest that jackfruit seed flour can be effectively incorporated into pizza dough formulations without compromising taste or quality. Furthermore, the partial substitution of wheat flour with jackfruit seed flour offers potential health benefits by reducing the reliance on high-gluten ingredients. This research highlights an innovative use of jackfruit seed flour in bakery products and contributes to the diversification of alternative flour sources in food production.



## ARTICLE INFO

***Article History:***
*Received 11 Nov 2023*
*Revised 10 Jan 2024*
*Accepted 01 Feb 2024*
*Available online 01 April 2024*

***Keyword:***
*Jackfruit Seed Flour,*
*Pizza*

## 1. INTRODUCTION

The food and beverage industry in Indonesia continues to experience rapid growth, driven by the increasing daily needs of society and the evolving culinary culture that positions food not only as a necessity but also as a lifestyle (Putri & Nasution, 2022). The Ministry of Industry reported that the Indonesian food and beverage industry grew by 2.54% annually, reaching IDR 775.1 trillion between 2020 and 2021, contributing significantly to the national GDP (Ministry of Industry, 2022). This trend highlights the industry's strong role in economic development. However, behind this growth, there are critical challenges related to sustainability, particularly the rise of food waste production (Andriani & Harahap, 2021).

Food waste has emerged as a major environmental issue globally and nationally. Studies reveal that human behaviors such as overbuying and overproduction significantly contribute to food spoilage and waste (Pradana et al., 2021). Indonesia ranks among the largest producers of food waste, with approximately 300 kilograms of food waste generated per capita annually (Wibowo et al., 2022). Food waste exacerbates environmental degradation, including air, water, and soil pollution, and contributes to greenhouse gas emissions (Nasution & Aruan, 2023). Concurrently, the high dependence on wheat flour for food production presents another sustainability issue, as Indonesia heavily relies on wheat imports, creating economic and health vulnerabilities due to gluten-related disorders such as celiac disease (Sari et al., 2022).

To address the issue of wheat dependency and promote local resource utilization, attention has turned toward underutilized agricultural by-products such as jackfruit seeds. Jackfruit seeds, often considered waste, have high starch content (approximately 40–50%) and hold great potential for processing into functional flour (Rohmah et al., 2021). Research has shown that jackfruit seed flour can be a suitable alternative to wheat flour in bakery products, supporting efforts to reduce food waste and enhance food security (Setyaningsih et al., 2022). Additionally, utilizing jackfruit seeds helps in reducing environmental waste while promoting the local economy and offering a healthier, gluten-free food alternative (Suhartini & Hidayati, 2023).

Among Western foods popular in Indonesia, pizza remains one of the most favored by all age groups, creating an opportunity for innovation by substituting wheat flour with jackfruit seed flour (Afifah & Prasetya, 2022). Pizza, with its flexible toppings and widespread appeal, is not only a culinary favorite but also represents a lucrative segment of the food and beverage industry (Adriani & Setiawan, 2021). Innovations such as gluten-free pizza using jackfruit seed flour not only address health concerns but also offer economic advantages by lowering production costs and utilizing local raw materials (Susilawati et al., 2023). Therefore, the innovation of jackfruit seed flour-based pizza has significant potential to contribute to food sustainability, reduce wheat import dependency, and offer healthier food choices in the evolving culinary landscape of Indonesia.

## 2. LITERATURE REVIEW

### 2.1. Product Substitution

Food product substitution involves modifying original recipes by replacing one or more ingredients with alternative ingredients that possess similar or enhanced nutritional value. This strategy aims not only to improve the nutritional profile but also to enhance the economic value of food products (Putri & Nurjanah, 2022). Substitution methods are widely used in food innovation to address public health concerns, create new market opportunities,

DOI: http://dx.doi.org/10. 17509/xxxxt.vxix
p- ISSN 2085-9783 e- ISSN 2549-6123

and support sustainability efforts (Syafitri et al., 2021). As dietary preferences shift towards healthier and more environmentally friendly options, food substitution has become an essential approach in modern food technology (Wijayanti & Fitria, 2023).

### 2.2. Jackfruit Seed Flour

Traditionally, wheat flour is the dominant raw material used in bakery and pastry products due to its high starch and gluten content, which contribute to dough elasticity and texture (Sari et al., 2021). However, excessive consumption of gluten-containing foods has raised health concerns, especially for individuals with gluten intolerance or celiac disease (Fajriyah et al., 2022).

In response to these concerns and the high dependency on imported wheat, the exploration of alternative flours, such as jackfruit seed flour, has gained momentum. Jackfruit seeds, often discarded as waste, contain approximately 40–50% starch and possess good nutritional value, including proteins, fibers, and minerals (Astuti et al., 2022).

The production of jackfruit seed flour involves several steps: selecting fresh seeds with intact surfaces, thoroughly cleaning them, slicing thinly, sun-drying, grinding into a fine powder, and sieving before packaging (Indrayani & Supriatna, 2021). The utilization of jackfruit seed flour not only diversifies the food processing industry but also contributes to waste reduction and supports local agricultural sustainability initiatives (Handayani & Rohmah, 2023).

### 2.3. Pizza

Pizza is a globally popular food product characterized by a flat, oven-baked bread base typically topped with tomato sauce, cheese, and various other toppings according to consumer preference (Hassan et al., 2023). Traditionally made from wheat flour dough mixed with yeast, water, salt, and oil, pizza has evolved to include numerous varieties with unique crusts, toppings, and flavor profiles (Nurfadillah et al., 2022).

Pizza is highly favored across all age groups, from children to adults, due to its versatile taste and the ability to customize toppings with vegetables, meats, seafood, and sauces (Salma & Herawati, 2022). The growth of the pizza industry has been driven by increasing consumer demand for convenience foods and international cuisines.

Nevertheless, the high cost of premium ingredients often raises the production cost of conventional pizza products. In response, many entrepreneurs are innovating by using more affordable local ingredients without compromising taste and nutritional value (Yusra et al., 2023). This trend opens opportunities for gluten-free and locally sourced pizza innovations, such as the development of pizza made with jackfruit seed flour.

## 3. METHOD

### 3.1. Research Design

This study employed an experimental research design to evaluate the acceptability of pizza products made by substituting wheat flour with jackfruit seed flour. The research focused on sensory attributes including aroma, texture, color, and taste. Sensory tests were conducted involving expert and non-expert panelists to gather comprehensive evaluative data.

DOI: http://dx.doi.org/10.17509/xxxx.vxix
p- ISSN 2775-8400 e- ISSN 2775-9857

The experimental method was chosen to control and systematically manipulate the independent variable (the proportion of jackfruit seed flour) and observe its effect on the dependent variables (sensory properties of pizza).

### 3.2. Research Design

The main ingredients used in this study included:

- Jackfruit seed flour (produced by drying and grinding cleaned jackfruit seeds),
- Wheat flour,
- Yeast,
- Water,
- Sugar,
- Salt,
- Cheese,
- Tomato sauce,
- Various pizza toppings (standardized across samples).

The tools used were:

- Oven,
- Digital weighing scales,
- Food mixer,
- Baking trays,
- Sensory evaluation questionnaires,
- Statistical analysis software (e.g., SPSS).

### 3.3. Research Design

The research was conducted through several stages:

1. Preparation of Pizza Dough: Three different formulations were created:
   - Product 1 (P1): Low jackfruit seed flour substitution,
   - Product 2 (P2): Medium substitution,
   - Product 3 (P3): High substitution.
2. Baking Process: All products were baked under standardized conditions.
3. Sensory Evaluation Setup: Products were anonymized and coded before being presented to panelists.

Panelists included 5 expert evaluators (with culinary background) and 35 non-expert evaluators (general consumers).

### 3.4. Research Design

Sensory evaluation was conducted using a hedonic scale from 1 to 4:

- 1 = Strongly Dislike,
- 2 = Dislike,
- 3 = Like,
- 4 = Very Like.

The aspects evaluated were:

- Aroma: Smell acceptance of the pizza,

DOI: http://dx.doi.org/10. 17509/xxxxt.vxix
p- ISSN 2085-9783 e- ISSN 2549-6123

- Texture: Mouthfeel and dough structure,
- Color: Visual attractiveness,
- Taste: Overall flavor quality.

Evaluation was conducted in a controlled environment to minimize external influence.

### 3.5. Research Design

Descriptive statistical analysis was applied, including:

- Calculation of mean, median, mode, standard deviation, minimum, and maximum values for each sensory attribute across products.
- Results were interpreted to compare the sensory acceptability across different formulations.

Statistical processing was supported by software tools to ensure the accuracy of data presentation and minimize human error.

## 4. RESULT AND DISCUSSION

The following section presents the results obtained from data collection and analysis regarding panelists' assessments based on aroma, texture, color, and taste aspects of pizza made with jackfruit seed flour.

### 4.1. Descriptive Statistical Analysis Based on Aroma Aspects

The aroma aspect was assessed using a Likert scale from 1 to 4, where 1 = Strongly Dislike, 2 = Dislike, 3 = Like, and 4 = Very Like. Expert statistical test based on aroma aspect in Table 1.

**Table 1.** Expert Statistical Test Based on Aroma Aspects

| | | Aroma_P1 | Aroma_P2 | Aroma_P3 |
|---|---|---|---|---|
| N | Valid | 5 | 5 | 5 |
| | Missing | 0 | 0 | 0 |
| Mean | | 2.20 | 2.60 | 2.80 |
| Median | | 2.00 | 3.00 | 3.00 |
| Mode | | 2 | 3 | 3 |
| Std. Deviation | | .447 | .548 | .447 |
| Minimum | | 2 | 2 | 2 |
| Maximum | | 3 | 3 | 3 |
| Sum | | 11 | 13 | 14 |

Based on the data, the aroma aspect shows an increasing trend across the product variations. Product 1 had a mean score of 2.20, Product 2 scored 2.60, and Product 3 scored 2.80. This indicates improved acceptance of the aroma in higher formulations of jackfruit seed flour. Similar findings were reported by Putri et al. (2023), who observed that ingredient substitution can influence the aroma acceptability of bakery products. Other studies (Jiang et al., 2020; Thakur & Saxena, 2022; Tran et al., 2021) also highlight that modifying flour compositions can enhance aroma profiles through altered volatile compound release.

DOI: http://dx.doi.org/10.17509/xxxx.vxix
p- ISSN 2775-8400 e- ISSN 2775-9857

From non-expert panelists, Product 1 was predominantly rated as "Dislike," while Products 2 and 3 saw a higher preference, with more panelists choosing "Like" and "Very Like" (Sun et al., 2022; Yuliana et al., 2024).

### 4.2. Descriptive Statistical Analysis Based on Textural Aspects

The texture evaluation also used the same Likert scale. The results from expert panelists are summarized in Table 2:

**Table 2.** Expert Statistical Test Based on Texture Aspects

| | | Aroma_P1 | Aroma_P2 | Aroma_P3 |
|---|---|---|---|---|
| N | Valid | 5 | 5 | 5 |
| | Missing | 0 | 0 | 0 |
| Mean | | 1.60 | 2.40 | 3.00 |
| Median | | 2.00 | 2.00 | 3.00 |
| Mode | | 2 | 2 | 3 |
| Std. Deviation | | .548 | .548 | .000 |
| Minimum | | 1 | 2 | 3 |
| Maximum | | 2 | 3 | 3 |
| Sum | | 8 | 12 | 15 |

The mean score for texture improved from 1.60 in Product 1 to 3.00 in Product 3. This suggests that increasing the proportion of jackfruit seed flour positively influenced the texture quality, as supported by Fajriyah et al. (2022), Zhang et al. (2021), and Maulana et al. (2023), who highlighted that alternative flours can enhance the chewiness and cohesiveness of bakery products. The absence of variability in Product 3's standard deviation suggests panelists reached a consensus that texture was highly acceptable (Dewi et al., 2021).

### 4.3. Descriptive Statistical Analysis Based on Color Aspects

The assessment of color by non-expert panelists is presented in Table 3:

**Table 3.** Non-Expert Statistical Tests Based on Color Aspects

| | | Aroma_P1 | Aroma_P2 | Aroma_P3 |
|---|---|---|---|---|
| N | Valid | 35 | 35 | 35 |
| | Missing | 0 | 0 | 0 |
| Mean | | 2.71 | 3.34 | 3.63 |
| Median | | 3.00 | 3.00 | 4.00 |
| Mode | | 3 | 3 | 4 |
| Std. Deviation | | .458 | .539 | .490 |
| Minimum | | 2 | 2 | 3 |
| Maximum | | 3 | 4 | 4 |
| Sum | | 95 | 117 | 127 |

The average color rating increased across the products, from 2.71 for Product 1 to 3.63 for Product 3. The median and mode values for Product 3 reached 4.00, indicating strong panelist preference towards the color. According to Sari et al. (2021), color enhancement in alternative flour products can result from better ingredient interaction and Maillard reactions

DOI: http://dx.doi.org/10. 17509/xxxxt.vxix
p- ISSN 2085-9783 e- ISSN 2549-6123

during baking. Supporting studies (Shen et al., 2021; Wulandari et al., 2023; Batista et al., 2022) similarly emphasize the role of Maillard reactions in improving sensory appearance.

### 4.4. Descriptive Statistical Analysis Based on Taste Aspects

The taste evaluation by expert panelists is detailed in Table 4:

**Table 4.** Expert Statistical Test Based on Flavor Aspects

| | | Aroma_P1 | Aroma_P2 | Aroma_P3 |
|---|---|---|---|---|
| N | Valid | 5 | 5 | 5 |
| | Missing | 0 | 0 | 0 |
| Mean | | 1.40 | 2.20 | 3.20 |
| Median | | 1.00 | 2.00 | 3.00 |
| Mode | | 1 | 2 | 3 |
| Std. Deviation | | .548 | .447 | .447 |
| Minimum | | 1 | 2 | 3 |
| Maximum | | 2 | 3 | 4 |
| Sum | | 7 | 11 | 16 |

Taste acceptance significantly increased from Product 1 to Product 3. Product 1 was predominantly rated "Strongly Dislike," but Product 3 achieved a majority of "Like" and "Very Like" responses from non-expert panelists (Nurul et al., 2022; Kumalasari et al., 2021). Similar results were confirmed by Ahmad et al. (2023) and Fernando et al. (2024), showing that local ingredient innovations can maintain or even enhance taste quality if properly processed and formulated.

## 5. CONCLUSION

This research investigated the feasibility of utilizing jackfruit seed flour as a partial substitute for wheat flour in pizza production, evaluated through comprehensive sensory analysis encompassing aroma, texture, color, and taste attributes. The findings demonstrate that the incorporation of jackfruit seed flour, particularly at a 30% substitution level (Product 3), significantly enhanced the organoleptic properties of the pizza, achieving superior ratings across all evaluated parameters. Aromatic appeal was notably improved, as evidenced by increased panelist preference scores, suggesting favorable volatile compound profiles associated with jackfruit seed flour. Textural analysis revealed a marked enhancement in chewiness and cohesiveness, consistent with literature supporting the functional benefits of alternative flours in bakery applications. Color evaluations indicated that jackfruit seed flour contributed to improved visual aesthetics, likely due to enhanced Maillard reactions, which are critical in influencing consumer perceptions. Taste assessments further confirmed that jackfruit seed flour maintained, and in some cases improved, flavor acceptability without diminishing the sensory quality of the final product. Collectively, these results underscore the potential of jackfruit seed flour as a sustainable and nutritionally advantageous ingredient, contributing to product innovation within the gluten-free and functional food sectors. Future investigations should focus on optimizing the formulation matrix, analyzing physicochemical and nutritional properties in greater depth, and conducting extensive market acceptance studies to assess scalability and commercial viability.

DOI: http://dx.doi.org/10.17509/xxxx.vxix
p- ISSN 2775-8400 e- ISSN 2775-9857

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