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Local Food Diversification: Study On The Substitution Of Rice Flour With Breadfruit Flour In Roti Berre'

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ABSTRACT

Breadfruit (*Artocarpus altilis*) is a local food ingredient with high potential to be developed as a substitute in processed products, including traditional foods. One of the typical culinary products that is still in demand today is Roti Berre', a traditional cake from South Sulawesi that is usually made using rice flour. This study was conducted by replacing some of the rice flour with breadfruit flour to support food diversification and to increase the added value of local products. The purpose of this study was to examine the characteristics and the level of acceptance of Roti Berre' made from breadfruit flour, reviewed from the aspects of taste, aroma, color, texture, and overall appearance. The method used was an experiment with four treatment variations (TS100, TS75, TS50, TS25), which were tested by 25 untrained panelists using a hedonic scale. The results showed that the TS25 treatment (25% breadfruit flour) was a substitution that approached the quality of Roti Berre', while the use of 100% breadfruit flour (TS100) was less popular. Thus, the use of 25% breadfruit flour can be an innovative alternative without changing the distinctive taste of Roti Berre', while also opening up opportunities for local food development.

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1. INTRODUCTION

Ethnic gastronomy has a role in shaping tourist satisfaction and destination attractiveness within the framework of cultural tourism (Utomo, et al 2025; Ningsih, et al 2025). Breadfruit plants are widespread throughout the Indonesian archipelago, including Sumatra, Java, Nusa Tenggara, Sulawesi, Maluku, and Papua. Data from the Central Statistics Agency (BPS) in 2020 showed that breadfruit production in South Sulawesi increased significantly, reaching 115,932 quintals (Fadlurrahman, 2023). The National Research and Innovation Agency (BRIN) emphasized that breadfruit has significant potential as an alternative staple food that can replace dependence on imported foods such as rice and wheat (Badan Riset dan Inovasi Nasional (BRIN), 2023). The management and utilization of breadfruit as a food ingredient can make a significant contribution to improving national food security and adding economic value to local communities. Breadfruit can be used as a traditional food source, processed into gaplek (cassava chips), snacks, and flour (Basrin, 2020).

Breadfruit flour is made from dried breadfruit that has been ground into flour. The texture is similar to rice flour, but its colour is pale yellow. This flour also has a fairly high nutritional content. Breadfruit flour has a relatively high nutritional content. One hundred grams of breadfruit flour contains 78.9 g of carbohydrates, 3.6 g of protein, 0.8 g of fat, a moisture content ranging from 2-6%, 47.6 mg of vitamin C, 58.8 mg of calcium, 165.2 mg of phosphorus, and 1.1 mg of iron (Fadlurrahman, 2023). To extend shelf life, facilitate distribution, and expand its use to suit a more practical lifestyle, the production of breadfruit flour as a semi-finished product is highly recommended (Fadlurrahman, 2023).

Breadfruit flour has been widely used in food products, in line with efforts to diversify local food sources as an alternative to wheat flour and rice flour. Previous research has shown that breadfruit flour can be successfully used as a substitute in processed food products, including bread, and is acceptable to consumers, although the optimum formulation of breadfruit flour is 30% breadfruit flour and 70% wheat flour (Yenny et al., 2024).

Research results show that breadfruit flour cannot completely replace wheat flour due to the lack of gluten content in breadfruit flour. Furthermore, breadfruit flour has a distinctive aroma, which significantly influences the final product modified with the addition of breadfruit flour (Anggraeni STJ & Ayuasih, 2024). Substituting 20% breadfruit flour in sweet bread produces the best quality bread with a distinctive breadfruit aroma, smooth texture, and good rise rate (Herlina, 2017). Based on this, an approach is needed to utilize breadfruit flour as a raw material in making cake and bread products that do not require gluten and are able to disguise the distinctive aroma of breadfruit flour (Anggraeni STJ & Ayuasih, 2024).

Roti Berre' is a traditional bread product from South Sulawesi that has a simple shape with a soft but somewhat dense texture. Unlike modern bread that rely heavily on fillings or toppings, Roti Berre' emphasizes its soft texture and distinctive aroma from natural ingredients, such as the aroma of yeast and bananas used in its making (Irwan, 2025). These unique characteristics make roti berre' a product that has strong cultural and social value among the people of South Sulawesi. This product can be easily found in cake shops and traditional markets in Makassar City and in other regencies. The word "berre' "means rice in the Bugis language because this bread is made from a mixture of rice flour and glutinous rice flour, with the addition of kepok bananas (*Musa paradisiaca*), salt, sugar, yeast, and water (Irwan, 2025). The ingredients in Berre' offer a variety of health benefits. Rice flour is rich in carbohydrates, iron, calcium, protein, and vitamin C. Glutinous rice flour does not contain any sugars. Not only is it a source of energy, it also reduces the risk of heart disease, supports bone health, and aids digestion. The content of kepok banana helps improve digestion,

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prevents constipation, treats stomach ulcers, and maintains eye health.

Rice flour is a milled product made from rice, white in colour, neutral in aroma, easy to digest and hypoallergenic. One hundred grams of rice flour contains 80 g of carbohydrates, 7 g of protein, 94 mg of phosphorus, 75 mg of potassium and 23 mg of magnesium. Rice flour, with its high amylose content, is suitable for making bread.

Breadfruit flour contains fewer calories than rice flour, with calories ranging from 79 to 136 per 100 grams, while rice flour has around 350 calories. Breadfruit flour also contains fewer carbohydrates, only around 10-33%, while rice flour contains 80-90%. However, breadfruit flour is richer in fibre (1.25-2.26%) and protein, which can reach up to 22%, while rice flour has lower fibre and protein. Breadfruit flour also contains very little fat, between 0.21-0.65%, slightly lower than rice flour. Furthermore, breadfruit flour contains important minerals such as calcium and phosphorus, as well as vitamin C, which are not found in rice flour, making it more nutritious and good for overall health (Fauziana et al., 2025).

Various studies have shown that breadfruit flour can be used as a partial substitute for wheat flour or rice flour in the production of processed products such as bread, cakes, and other snacks, with varying substitution levels ranging from 20-30%. Breadfruit flour is gluten-free, which affects the final texture of the product. This flour also provides a distinctive aroma and unique flavour that influence the product's organoleptic properties (Yusuf et al., 2022). Nevertheless, breadfruit flour plays a role in increasing fibre content, providing additional benefits for digestive health and having lower calories than rice flour, making it a suitable choice for the development of functional foods and healthy diets.

According to the literature review, there is no research specifically evaluating the substitution of breadfruit flour in Roti Berre', particularly in terms of physical characteristics, sensory characteristics, and consumer preferences, which can be indicators of product acceptance. Therefore, this research is crucial to fill this gap and contribute to local food diversification and regional economic development, particularly in South Sulawesi, through innovative processed products based on local raw materials.

Based on this explanation, this study was conducted to test the use of breadfruit flour in Roti Berre', which uses rice flour as the main ingredient. Therefore, this study aims to develop breadfruit as an alternative local food source by utilizing breadfruit flour as a substitute in traditional products with high cultural value, such as Roti Berre'.

2. LITERATURE REVIEW

2.1. Overview of Rice Flour

Rice flour is a gluten-free flour that is widely used in cake and bread products in Indonesia, especially as the main ingredient that provides texture and a source of energy. However, in terms of nutritional content, especially protein and fibre, rice flour is still relatively low compared to several other flours (Nuraisyah et al., 2018).

Rice flour consists of approximately 79.9% carbohydrates, which are the primary source of energy. The protein content in rice flour is relatively low, at 7.83%. Furthermore, rice flour also contains water (11.42%), ash or minerals (0.44%), crude fat (0.41%), and crude fibre (0.53%). The starch component in rice flour is quite dominant at 69.62%, with amylose as part of the starch at 26.07%. The high carbohydrate content makes rice flour ideal as an energy source, while its low protein and fat content indicate that rice flour is not a significant source of protein and fat (Nuraisyah et al., 2018).

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2.2. Overview of Breadfruit Flour

Breadfruit flour is a processed product made from dried and finely ground breadfruit (Artocarpus altilis), making it an alternative local flour ingredient that is increasingly being developed in Indonesia. Breadfruit flour is quite nutritious, with high carbohydrate, moderate protein, and low-fat content, along with fibre and several essential minerals such as calcium, phosphorus, and iron, which contribute to its nutritional value (Fauziana et al., 2025).

A study on the quality of pukis cakes with red bean flour and breadfruit flour substitutes indicated that this substitution significantly increased fibre and protein content and was well-received by panellists in terms of taste and texture (Chrestella et al., 2020). Meanwhile, the use of breadfruit flour as a substitute for wheat flour in breadmaking has been shown to partially replace wheat flour while maintaining consumer-satisfying sensory results (Yenny et al., 2024).

Furthermore, the potential of breadfruit flour as a local functional food ingredient is also comprehensively reviewed, with an emphasis on its good nutritional content and various innovative applications in food products (Noviasari et al., 2023). Research on the formulation of a mixture of wheat flour and breadfruit flour on water content, ash content, and sensory results of crispy brownies shows an optimal formulation that produces a product with the best characteristics (Shabrina, 2024). In a study of making chocolate steamed cake with breadfruit flour substitution, it was found that substitution of up to 25% breadfruit flour provided an increase in nutritional content while being well-accepted sensorily (Anggraeni STJ & Ayuasih, 2024).

The development of breadfruit flour with cowpea flour in making cupcakes also confirms the promising potential for substitution, with chemical and sensory parameters that support

product acceptance (Yusuf et al., 2022). A study by Fadlurrahman (2023) on traditional Apang Bugis cakes with breadfruit flour substitution also showed that the addition of breadfruit flour affected sensory and physicochemical characteristics, opening up opportunities for diversification of traditional cake products with local ingredients. Furthermore, research by Manggawa et al. (2019) strengthens the understanding that breadfruit flour as a partial substitute for wheat flour in cakes can increase nutritional content and remain acceptable to consumers. A study by Herlina confirmed that substitution of 20% breadfruit flour in making sweet bread provided the best results in terms of volume, aroma, and texture.

Studies on breadfruit flour substitution in various bakery products such as pukis, bread, chocolate steamed cakes, and cupcakes have shown that breadfruit flour has great potential as an alternative ingredient for cakes and bread. Breadfruit flour not only increases nutritional content, especially fibre and protein, but also maintains good sensory acceptance. These studies confirm that breadfruit flour not only contributes to the nutritional value of products but also enriches the variety of textures and flavours that can attract consumers.

However, most studies have focused on initial formulation and sensory acceptance without addressing the development of breadfruit flour in traditional cake products known to the people of South Sulawesi. Therefore, this study aims to utilize local food sources in traditional cake products that are characteristic of a region.

2.3. Overview of Roti Berre'

Roti berre' is a culinary heritage from Makassar that holds high cultural and traditional value. This bread differs from modern bread because it prioritizes simplicity of taste and texture, without additional fillings or excessive toppings, but is served with brown sugar sauce (Irwan, 2025). Roti Berre' has a soft, slightly dense texture and a balanced sweet taste, as well

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as a distinctive aroma from the ingredients used. Consumption of Roti Berre' is generally closely associated with local customs as a breakfast food or snack to accompany drinks such as tea and coffee. In some areas, such as Parepare, this bread even replaces rice served with chicken curry (Ali, 2024).

This traditional bread is made from a mixture of rice flour, banana, sugar, and yeast, which gives it its distinctive aroma. Roti Berre' is made by first mixing all the ingredients and then fermenting them for 30-60 minutes. The mixture is then poured into a round mold, like a pancake mold, and baked. Roti Berre' is then served with brown sugar sauce.

From a cultural and culinary perspective, Roti Berre' represents the sustainability of local traditions amidst the tide of food modernization. This bread is more than just food, but also part of the preservation of cultural and social values that are part of the community's heritage. With its enduring popularity, Roti Berre' reflects the community's attachment to an authentic culinary identity and offers the potential for developing traditional food products that can be more widely introduced without losing their cultural essence (Patangai, 2024).

Research on the modification of Roti Berre' has been conducted by Hertiana et al. (2019) using various fats in making Roti Berre'. The results of the study showed that the variation of fat in making Roti Berre' significantly affects consumer acceptance. This finding strengthens the belief that consumers can accept changes in ingredients in their traditional cake products, so that the approach to modifying Roti Berre' by using breadfruit flour can show optimal results.

3. METHODS

This study using an experimental method to determine the characteristics of Roti Berre' produced with the addition of breadfruit flour and the panelists' preference for the Roti Berre' product with breadfruit flour substitution. Data collection and product production were conducted at the Bosowa Polytechnic Hedonic Lab from April to June 2025.

Data collection was carried out in two stages. The first stage was the manufacture of products using 4 treatments, namely TS100 (100% Breadfruit Flour), TS75 (75% breadfruit flour), TS50 (50% breadfruit flour), TS25 (25% breadfruit flour). The standard recipe used in this study was 150g rice flour, 75g glutinous rice flour, 20g granulated sugar, 3g yeast, 90g kepok banana, 1g salt, and 250ml water. The process of making Roti Berre' can be seen in the following chart.

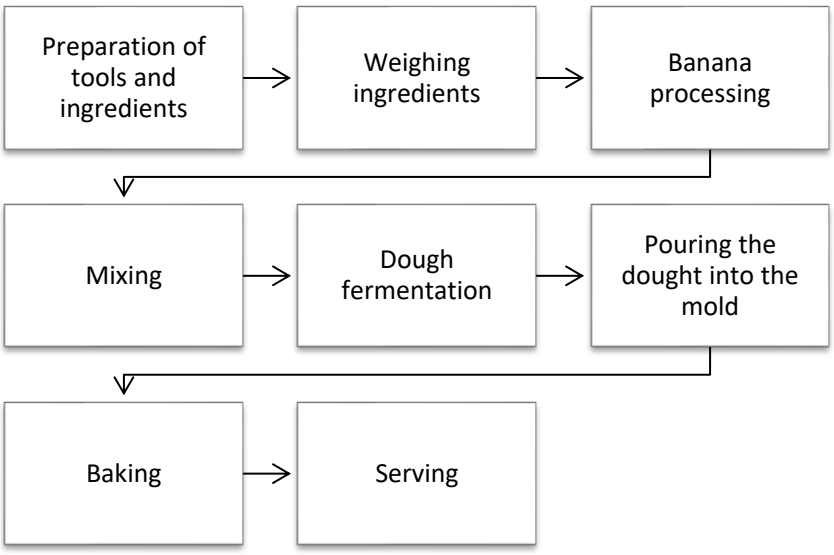


Figure 1. Procedure Chart for Making Roti Berre'

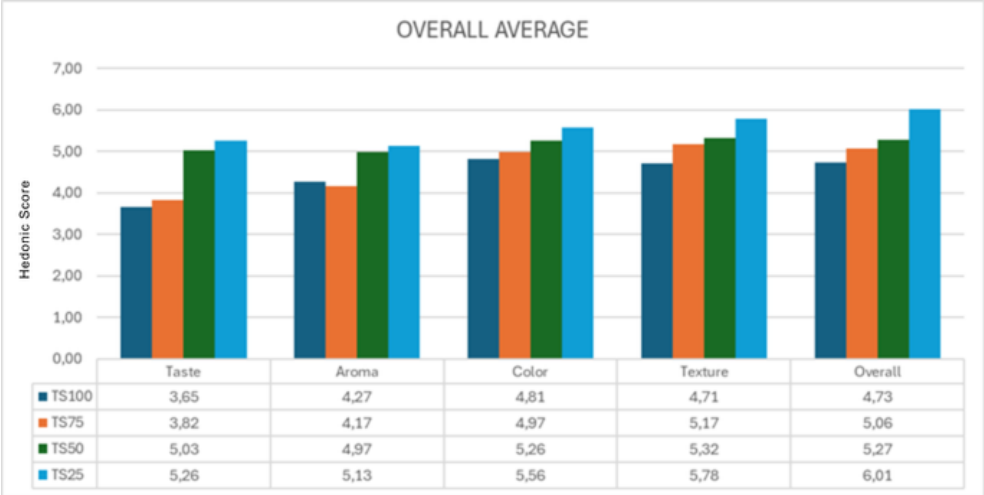
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The products that have been made are presented to the panelists to be assessed using a questionnaire that includes 7 hedonic scales with the provisions of Very Like = 7, Like = 6, Somewhat Like = 5, Indifferent/Neutral = 4, Somewhat Dislike = 3, Dislike = 2, and Very Dislike = 1 (Setyaningsih et al., 2018).

The panelists in this study were untrained. The number of untrained panelists ranged from 20 to 35 (Setyaningsih et al., 2018). In this study, 25 untrained panelists, who were students at Bosowa Polytechnic, were involved. The data were then analyzed to determine the panelists' preference scale based on the average value. The results were presented in a bar chart and described based on the range of values, allowing for further conclusions to be drawn.

4. RESULTS AND DISCUSSION

The following are the results obtained based on the data from the preference level test for 25 panelists.



	Taste	Aroma	Color	Texture	Overall
TS100	3,65	4,27	4,81	4,71	4,73
TS75	3,82	4,17	4,97	5,17	5,06
TS50	5,03	4,97	5,26	5,32	5,27
TS25	5,26	5,13	5,56	5,78	6,01

Figure 2. Results of Panelist Assessment through the Level of Preference Test for Berre' Bread with Breadfruit Flour Substitution

The overall average diagram above shows the results of the hedonic test of Roti Berre' with various levels of substitution of rice flour with breadfruit flour, namely TS100 (100% breadfruit flour), TS75 (75% breadfruit flour), TS50 (50% breadfruit flour), TS25 (25% breadfruit flour) on five assessment parameters, namely taste, aroma, color, texture, and overall appearance.

Overall, for the five assessment aspects measured, 25% breadfruit flour (TS25) showed the highest results across all parameters, particularly texture and overall appearance. Conversely, the greater the amount of breadfruit flour used, the lower the panelists' ratings, although they were still considered acceptable. The use of 100% breadfruit flour (TS100) tended to produce the lowest scores across all parameters. These results indicate that substituting rice flour with breadfruit flour in Roti Berre' can achieve a 25–50% substitution of rice flour without significantly reducing panelist preferences.

This finding opens opportunities for developing innovative breadfruit flour applications in traditional products. Based on the results of the study of the characteristics of Roti Berre', it can be concluded that the proportion of breadfruit flour and rice flour significantly affects the characteristics of Roti Berre'. In the TS100 treatment (100% breadfruit flour), the bread shows a strong breadfruit flavor, dark brown color, sharp breadfruit aroma, not chewy but the texture of the resulting Roti Berre' remains soft. The more rice flour is added, such as in TS75 and TS50, the distinctive taste of breadfruit in Roti Berre' begins to diminish, the color of the

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bread becomes lighter, and the texture becomes lighter with slightly better development. With the TS25 treatment, the characteristics of the bread are increasingly close to Roti Berre' made from rice flour, with a more similar taste, color, and absence of breadfruit aroma due to the balance of rice flour, a chewy texture, and optimal development.

The level of acceptance of Roti Berre', partially replaced by breadfruit flour, in terms of taste, texture, aroma, color, and overall appearance, showed that the TS25 treatment (with 25% breadfruit flour) achieved the highest average score in the hedonic test. In terms of taste, TS25 was considered closest to the original taste of bread made from pure rice flour, with a sweet taste. In terms of texture, panelists also gave the highest rating to TS25 because of its chewy texture. In terms of aroma, TS25 was superior because it produced an aroma very similar to Roti Berre'. In terms of color, TS25 was chosen because its appearance was almost identical to the control, influenced by the still dominant rice flour content. Overall, it can be concluded that the TS25 formulation was most acceptable to panelists and most closely resembled the characteristics of the original Roti Berre'. These results are in line with previous research (Manggawa et al., 2019), which found that the breadfruit flour mixture has strong characteristics in terms of taste, aroma, color, and texture.

These results also indicate a decreased in the acceptance rate of products containing more than 75% breadfruit flour. The TS100 and TS75 treatments showed weaknesses in terms of soft texture, strong aroma, and suboptimal development of Roti Berre'. In contrast, the TS50 and TS25 treatments tended to improve bread quality. The flavor became more neutral, the breadfruit aroma was reduced, the texture was lighter and chewier, and the product appearance was more attractive. The TS25 treatment was considered the most promising formulation because it produced bread with a texture, appearance, and taste that most closely resembled the characteristics of bread in general and was more acceptable to consumers without completely losing the local identity of bread flour.

5. CONCLUSION

This study proves that substituting rice flour with breadfruit flour significantly affects the organoleptic properties of Roti Berre'. The higher the proportion of breadfruit flour, the stronger the aroma and distinctive taste of breadfruit, but the texture tends to be less desirable and product development decreases. This is consistent with the panelists' assessment results, which showed that the TS25 treatment, or the use of 25% breadfruit flour, received the highest scores in terms of texture, appearance, and consumer acceptance. This finding implies that although panelists still accept breadfruit flour in making Roti Berre' , their preference level tends to decrease with the addition of breadfruit flour. This study is still limited to the use of breadfruit flour without the addition of other flours. Future research can use breadfruit flour with the addition of other raw materials in making Roti Berre' to increase public acceptance of the use of breadfruit flour.

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