Tropical Small Island Agricultural Management (TSIAM)

Journal Home: https://ojs3.unpatti.ac.id/index.php/tsiam

Volume 6	Edition 1	Juni (2026)	DOI: 10.30598/tsiam.2026.6. 1.10	Pages: 10 - 24

Potential of Breadfruit (Artocarpus altilis) Flour from Maluku as a Sustainable Substitute for Wheat Flour in Cookies

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Keywords: *chemical characteristics; cookie formulation; sensory evaluation; wheat flour subtitution*

ABSTRACT

Indonesia's dependence on wheat imports as a raw material for wheat flour continues to increase, whereas the use of breadfruit flour (Artocarpus altilis) as an alternative remains limited. This study, titled Application of Breadfruit Flour (Artocarpus altilis) as a Substitute for Wheat Flour in Cookie Production, aims to evaluate the chemical characteristics of breadfruit flour from Maluku and assess the chemical and sensory characteristics of cookies formulated with wheat flour and breadfruit flour. The research methods include proximate analysis of breadfruit flour sourced from three different locations (Latuhalat, Arui Bab, and Lat Dalam) and cookie formulations with 0%, 20%, 40%, and 60% breadfruit flour substitution. Moisture, carbohydrate, protein, fat, and ash content, along with sensory evaluation using the hedonic method, by 30 panelists. Breadfruit flour has a high carbohydrate content (77.16% - 84.51%) but a lower protein content compared to wheat flour. The cookie formulation with 40% breadfruit flour substitution exhibited the best chemical characteristics, with moisture, protein, carbohydrate, and ash contents ranging from 2.8% to 3.16%, 6.81% to 7.03%, 18.44% to 18.61%, 70.01% to 70.36%, and 1.37% to 1.75%. The sensory evaluation results revealed that the panelists preferred cookies made with breadfruit flour from Latuhalat, with the highest scores in aroma (3.515), texture (3.284), color (3.58), and taste (3.25). Breadfruit flour can be used as a substitute for wheat flour to produce cookies with favorable chemical and sensory characteristics, particularly in a formulation comprising 60% wheat flour and 40% breadfruit flour. Furthermore, breadfruit flour holds potential as a local food source to enhance food security.

INTRODUCTION

Food is a fundamental human necessity that should be available to the population across all age groups [1–3]. In Indonesia, wheat imports have been steadily increasing to be processed into flour as a basic ingredient for making cakes, cookies, and other foods [4,5]. Efforts to reduce dependence on wheat imports continue to be promoted, and one alternative is to use local food that can be made into flour as a source of carbohydrates[6,7].

Among the different local foods in Indonesia, breadfruit production continues to increase, but the use of fresh breadfruit is limited due to the low shelf life [8]. Converting breadfruit into flour can improve utilization, particularly in the context of producing wheat flour [9].

Breadfruit has a good nutritional composition, thereby increasing food and nutritional securit. Some of the nutrients include complex carbohydrates, protein, fiber, water, minerals, and vitamins [10,11]. Breadfruit with a wet weight of 100 g contains 35.5% carbohydrates, 0.1% protein, 1.21% ash content, 35.5% phosphorus, 0.2% lipid, 0.21% calcium, 0.0026% iron, 61.8% water content, and 2% fiber[12].

European society often uses breadfruit as a staple food because it contains carbohydrates with a texture and taste like bread [13,14]. In Indonesia, breadfruit is divided into two varieties, namely Bangkok with the characteristics of larger fruit and smooth peel as well as Java with the characteristics of smaller fruit, soft peel, and small thorns [15,16] . According to Palijama et al. (2017)[17], in Maluku, especially Tial Village, Central Maluku Regency, there are three varieties of breadfruit based on fruit size, fruit shape, and leaf position known as stone, prickly, and cotton. Several results showed that breadfruit could also be made into flour for processed food purposes, including wet noodles, nuggets, and cookies [18–20]. Flour is a semi-finished product potentially stored for a long time and is easy to mix[21]. Newly developed food products with poor taste and low sensory characteristics are generally less in demand by consumers. Therefore, research has been conducted on the sensory characteristics of breadfruit flour from several breadfruits[22]. The results show that breadfruit from Maluku, specifically Latuhalat, Arui Bab, and Lat Dalam Villages, could be processed into flour with sensory characteristics as consumer assessment. These include aroma rated by panelists/consumers as slightly liked (2.72 - 2.88), hedonic quality with breadfruit scent (3.23 - 3.49), texture in the slightly liked to liked category (2.95 - 3.32), slightly smooth to smooth texture. The color was in the slightly liked to liked category with the hedonic quality described as a brownish yellow to yellowish white. Further research has been conducted to test the chemical characteristics of breadfruit flour and then apply to make cookies as a substitute for wheat flour. Cookies are to be consumed by local people and toddlers with stunting. Cookies are dry cakes that taste sweet, small in shape, and generally made from wheat flour. These small-sized oven-baked products are made from wheat flour with the addition of lipids, sugar, and other additional ingredients[20]. This research analyzed cookies made using breadfruit flour substitute from three different locations in Maluku to determine the chemical and sensory characteristics.

This research aimed to determine the chemical characteristics of breadfruit flour from Maluku; determine the chemical characteristics of cookies made from breadfruit flour as a substitute for wheat flour; select cookies with the best chemical characteristics; and determine the best sensory characteristics of cookies made from three types of breadfruit flour.

METHODS

Materials

The main ingredient used in this research was breadfruit flour made from breadfruit from Latuhalat, Arui Bab, and Lat Dalam Villages. The chemicals for analysis included H_2SO_4, NaOH, HCl, and boric acid (H_3BO_3). Furthermore, other ingredients were wheat flour (kompas), margarine (blueband), eggs, powdered sugar (semut), and vanilla. The tools used were a cabinet dryer, slicer, sieve, oven, blender, mixer, basin, brush, spatula, spoon, scale, and molding container.

Breadfruit Formulation

Breadfruit flour production for three treatments started with peeling, washing, and reducing the size using a slicer, then arranged in a container and put into a cabinet dryer. The sample was subsequently dried at a temperature of 50 °C for 24 hours. After drying, it was removed and smoothed using a blender, filtered to produce clean, smooth breadfruit flour, and ready for a chemical test.

Formulation of Cookies from Breadfruit Flour Substitute

Formulation of cookies started with preparing the tools and weighing the ingredients according to needs. The implementation stage started by mixing ingredients of 200 g butter and 250 g powdered sugar using a mixer until a homogeneous cream was formed. Subsequently, 1 egg (50 g) was added, and beaten using a mixer until the mixture was even.

a. The first formulation was 100% wheat flour (500 g)
b. The second formulation was 80% wheat flour: 20% breadfruit flour
c. The third formulation was 60% wheat flour: 40% breadfruit flour
d. The fourth formulation was 40% wheat flour: 60% breadfruit flour

The dough was stirred until smooth, soft, and easy to shape then the finishing stage was the molding process. The molded cookie dough was put into the oven for the baking process at a temperature of 150 °C for 20 minutes. The cooked cookies were removed from the oven and cooled at room temperature for ± 1 - 2 hours to continue with the test process.

Methods

The first research design was single-factor CRD with the object being flour processed from breadfruit at three planting locations in Maluku namely Latuhalat, Arui Bab, and Lat Dalam Villages. Each treatment was repeated four times, hence the experimental unit was 3 x 4 = 12, with the following mathematical model:

$$\boldsymbol{Y}ij = \mu + \alpha i + \varepsilon ij$$

Where:

$\boldsymbol{Y}$ij = observation value on the observed experimental unit
μ = general average value
αi = effect of breadfruit flour type treatment
εij = experimental error

The second research design used factorial CRD, consisting of two factors. The first was cookies comprising wheat and breadfruit flour formulation with four formulation levels. The second was breadfruit flour derived from three different locations with three replications. Therefore, the experimental unit was 4 x 3 x 3 = 36, with the mathematical model:

$$\boldsymbol{Y}ijk = \mu + \alpha i + \beta j + (\alpha\beta)ij + \varepsilon ijk$$

Where:

$\boldsymbol{Y}$ijk = observation value in the experimental unit of the k-th replication that received a combination of the i-th level of factor A and the j-th level of factor B
μ = general average value
αi = effect of wheat flour composition: breadfruit flour
βj = effect of the type of breadfruit flour at different locations
(αβ)ij = interaction effect
εijk = experimental error

Data Analysis

The chemical characteristics of breadfruit flour and cookies were measured through proximate tests including carbohydrate, protein, lipid, ash, and water content (Horwitz, 2005). Meanwhile, the sensory characteristics of cookies were measured through organoleptic assessments (hedonic and hedonic quality tests) from 30 semi-trained panelists.

Chemical analysis data from breadfruit flour were statistically tested using a single factor Completely Randomized Design (CRD) with four replications. Data from wheat and breadfruit flour formulation cookies were statistically tested using Factorial CRD with three replications. The test data were statistically processed using analysis of variance at a confidence level of α = 0.05 through software (Minitab v 20) to determine whether there was an effect. A further test would be conducted using the Tukey test with a treatment level of 95% or α = 0.05 when an effect was found.

RESULTS AND DISCUSSION

Chemical Characteristics of Breadfruit Flour

The results of the study showed that sujun flour from different locations (Latuhalat, Arui Bab, and Lat Dalama) had different chemical composition values. As seen, the resulting water content was 8.04%, 11.13%, and 13.61%, ash content was 2.45%, 3.45%, and 3.83%, fat content was 3.89%, 3.15%, and 1.55%, protein content was 3.05%, 4.86%, and 4.54%, and carbohydrate content was 84.51%, 77.21%, and 77.16%, respectively. (Gambar 1-5)

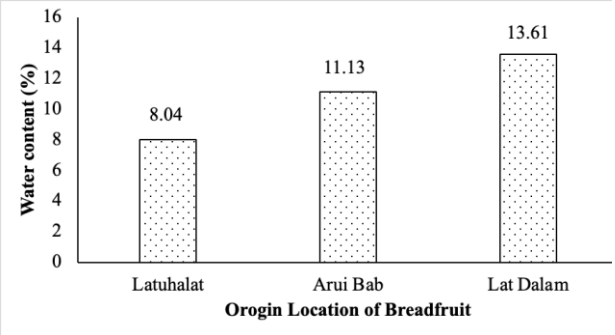

Figure 1. Water Content of Breadfruit Flour

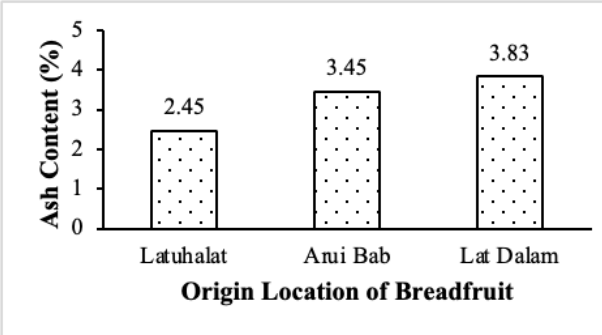

Figure 2. Ash Content of Breadfruit Flour

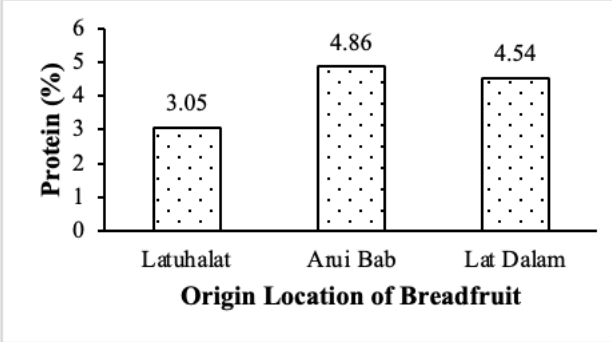

Figure 3. Protein Content of Breadfruit Flour

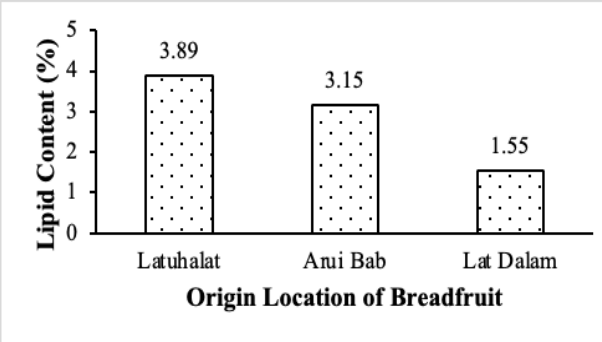

Figure 4. Lipid Content of Breadfruit Flour

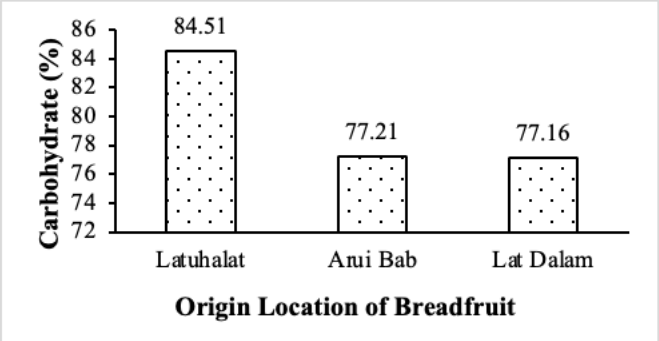

Figure 5. Carbohydrate Content of Breadfruit Flour

Chemical Characteristics of Cookies Formulated with Wheat and Breadfruit Flour

The chemical characteristics of breadfruit flour from three different locations in Maluku were not significantly different from those of wheat flour based on SNI. This implies that breadfruit flour can be used to replace wheat flour in the production of cookies (dry cakes). Four formulas were tested namely (1) 100% wheat flour compared to 0% breadfruit flour, (2) 80% wheat flour compared to 20% breadfruit flour, (3) 60% wheat flour compared to 40% breadfruit flour, and (4) 40% wheat flour compared to 60% breadfruit flour. Subsequently, the differences in the chemical characteristics of cookies from each type of breadfruit flour were observed.

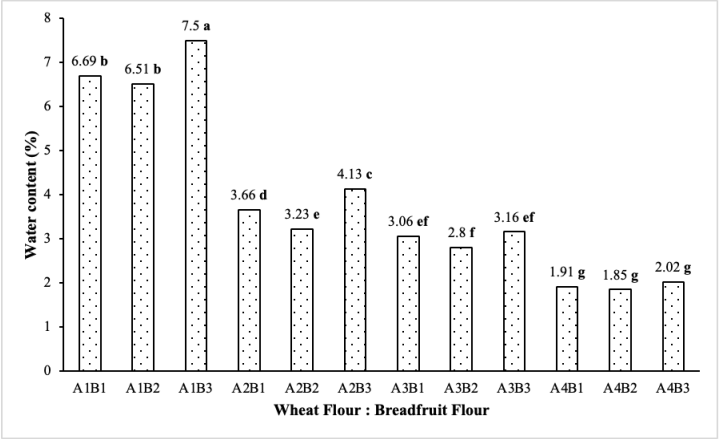

Figure 6. Water Content of Cookies Formulated with Wheat and Breadfruit Flour

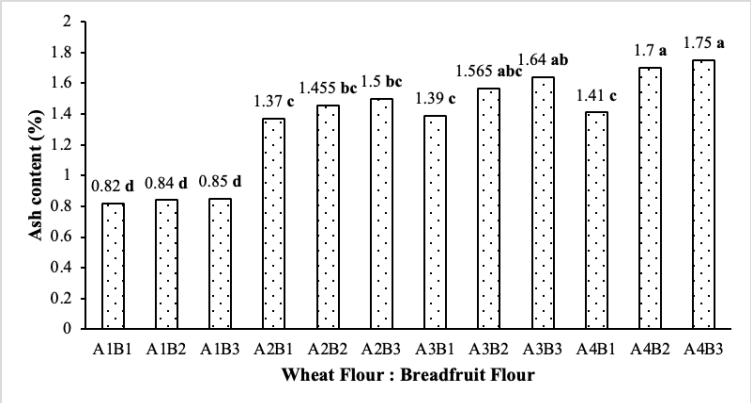

Figure 7. Ash Content of Cookies Formulated with Wheat and Breadfruit Flour

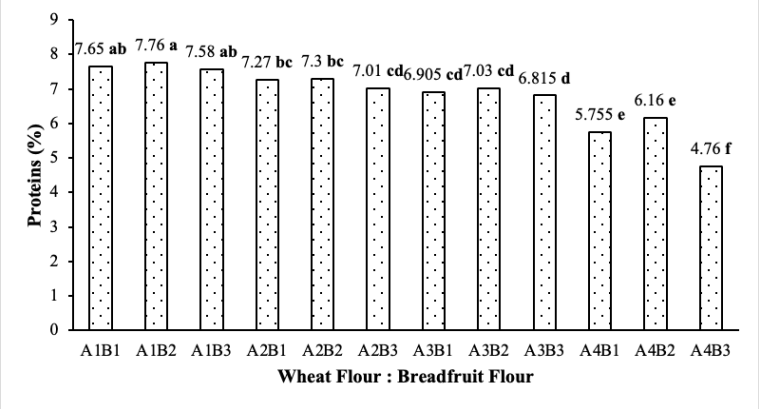

Figure 8. Protein Content of Cookies Formulated with Wheat and Breadfruit Flour

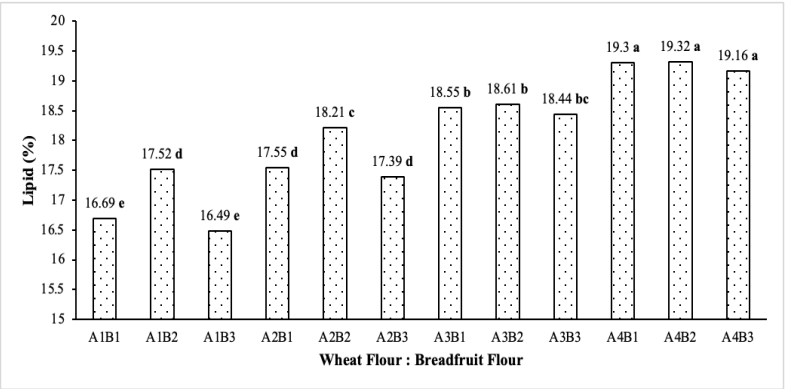

Figure 9. Lipid Content of Cookies Formulated with Wheat Flour and Breadfruit Flour

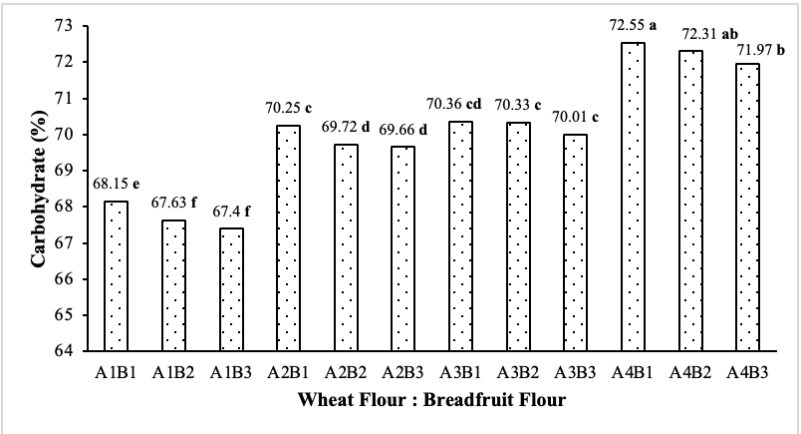

Figure 10. Carbohydrate Content of Cookies Formulated with Wheat and Breadfruit Flour

Sensory Characteristics of Cookies Formulated with Wheat and Breadfruit Flours

The best sensory characteristics for cookies were determined by selecting one treatment considered to have better chemical characteristics than the others. The treatment selected was a 40% breadfruit flour substitution formulation which had a water content of 2.80 - 3.16%, ash content of 1.39 - 1.64%, protein content of 6.81 - 7.03%, lipid content of 18.44 - 18.61%, and carbohydrate content of 70.01 - 70.36%.

Table 1. Cookie Aroma Based on Differences in Types of Breadfruit Flour

Breadfruid Location	Hedonic	Hedonic Quality
Latuhalat	3.045 [a]	3.515 [a]
Arui Bab	2.445 [c]	2.815 [b]
Lat Dalam	2.90 [b]	3.1 [ab]

Source: Data Processing (2024)

Table 2. Cookie Texture Based on Differences in Types of Breadfruit Flour

Breadfruit Location	Hedonic	Hedonic Quality
Latuhalat	3.518 [a]	3.284 [a]
Arui Bab	3.0985 [ab]	2.98 [ab]
Lat Dalam	2.8985 [ab]	2.75 [b]

Source: Data Processing (2024)

Table 3. Cookie Color Based on Different Types of Breadfruit Flour

Breadfruit Location	Hedonic	Hedonic Quality
Latuhalat	3.36 [a]	3.58 [a]
Arui Bab	2.96 [ab]	2.88 [b]
Lat Dalam	2.78 [b]	3.18 [ab]

Source: Data Processing (2024)

Table 4. Cookie Taste Based on Different Types of Breadfruit Flour

Breadfruit Location	Hedonic	Hedonic Quality
Latuhalat	3.38 [a]	3.25 [a]
Arui Bab	2.54 [b]	2.86 [b]
Lat Dalam	2.84 [b]	3.13 [ab]

Source: Data Processing (2024)

Discussion

In this study, the breadfruit flour analyzed was for its water, ash, fat, protein and carbohydrate content. The water content of breadfruit flour ranged from 8.04% - to 13.61%. Based on the ANOVA test, there was a significant difference between treatments (Figure 1), where flour from Latuhalat Village had a lower water content compared to those from Arui Bab and Lat Dalam Villages. The range obtained is within the Indonesian National Standard (SNI) maximum limit of 14%. This indicates that the water content is still in the low category, hence the resulting flour is safe to be stored for a long time. The ash content of breadfruit flour from Latuhalat, Arui Bab, and Lat Dalam Villages ranges from 2.45% to 3.83%. The ANOVA test results in Figure 5 show that flour from Latuhalat Village had a lower ash content (2.45%) different from the others. The ash content of flour from Arui Bab and Lat Dalam Villages also showed a difference. Based on SNI, the maximum ash content of wheat flour is 0.70% (BSN, 2009)[23]. This implies that the ash content data of breadfruit flour from the three locations has exceeded SNI. According to Sabatini et al. (2021)[26], the ash content of breadfruit flour is higher than that of wheat flour, namely 3.94%[27] vs 0.49[28]. Protein content of breadfruit flour from

Latuhalat, Arui Bab, and Lat Dalam Villages in Maluku ranges from 3.05% to 4.86%. The ANOVA test results in Figure 3 show that there was a difference between treatments. Flour from Latuhalat Village had a lower protein content (3.05%) compared to Arui Bab (4.86%) and Lat Dalam (4.54%). The two-breadfruit flour originating from Southwest Maluku Regency also showed differences. The protein content of wheat flour based on SNI is a minimum of 7% (BSN, 2009)[23]. Compared to SNI, the protein content value of breadfruit flour is still below the minimum standard for wheat flour.

The lipid content of breadfruit flour from Latuhalat, Arui Bab, and Lat Dalam Villages ranged from 1.55% - to 3.89%. The ANOVA test results in Figure 4 show that there was a difference between treatments where flour from Latuhalat Village had a higher lipid content (3.89%) compared to Arui Bab (3.15%) and Lat Dalam (1.55%) Villages. The variation between the three breadfruit flour treatments is presumably due to differences in varieties and different planting locations[24]. As stated by (Feliana et al., 2014) the differences in the lipid content of cassava flour can be caused by the influence of varieties, planting locations, and harvest age[25]. Compared to the lipid content of wheat flour based on the 2020 TKPI (Food Composition Table) at 1% (Kemenkes RI, 2020), the three-breadfruit flour produced has a higher content. The carbohydrate content of breadfruit flour ranged from 77.16% - to 84.51%. More specifically, the carbohydrate content of flour from Latuhalat Village significantly differs from the other two locations. Meanwhile, there was no significant difference between flour from the two locations namely Arui Bab and Lat Dalam Villages, Southwest Maluku Regency. The absence of significant difference is presumably due to relatively similar environmental conditions and soil organic matter. According to (Ratnayake et al., 2013), the fraction of soil organic matter can affect the availability of plant carbohydrates. Soil litter contributes to plant-derived sugars in agricultural land. Data in Figure 2 show differences between treatments, but the three-breadfruit flour have a relatively high carbohydrate content. This implies that flour can be used as a substitute for wheat or rice with a carbohydrate content of 77.20% and 80%, respectively (Kemenkes RI, 2020).

The analysis results for the water content of cookies substituted with and without breadfruit flour are presented in Figure 6, which ranges from 1.85% - 7.50%. Generally, the water content of cookies from each formulation did not show a significant difference. The higher the concentration of breadfruit flour as a substitute for wheat flour, the lower the water content. This is presumably because the water content of breadfruit flour is lower (8.05% - 13.61%) than wheat flour (14%). Another cause is the higher sugar (carbohydrate) content in breadfruit flour, which has the hygroscopic property of attracting water. The SNI limit for the water content of cookies (BSN, 2009)[23] is a maximum of 5%. Therefore, all cookie treatments with wheat and breadfruit flour formulations are in accordance with the SNI, except for the

control, which had a higher content. This indicates that cookies made from breadfruit flour substitute can have a long shelf life and are not easily damaged.

Ash content is a parameter that describes the mineral content of a material. As shown in Figure 7, the ash content of cookies substituted with and without breadfruit flour ranged from 0.82% - 1.75%. The ash content value of cookies without breadfruit flour substitute was lower and showed a significant difference compared to those substituted. Cookies made using breadfruit flour from Latuhalat had lower ash content values and varied significantly compared to the other two villages. This difference is presumably due to the different ash content of breadfruit flour. According to (Tuapattinaya et al., 2021), the ash content value is influenced by the presence of mineral content in raw materials. The maximum limit for ash content in cookies according to BSN (2009)[23] is 1.5. This implies that the ash content of breadfruit flour substitute from Latuhalat Village is in accordance with SNI.

Protein is one of the determining factors in the quality requirements of cookies. According to BSN (2009)[23], the protein content requirement for cookie quality is at least 6%. As shown in Figure 8, the protein content of cookies substituted with or without breadfruit flour ranged from 4.76% - 7.76%. The protein content of cookies is greatly influenced by flour as the main raw material. In general, the protein content of wheat flour is higher than breadfruit. Wheat flour contains gluten and Alifianita & Sofyan (2022)[29] stated that high gluten content affects the protein content of a product. Previous research has shown that the protein content of breadfruit flour has a lower value than wheat, hence the substitution of breadfruit flour with a higher concentration of wheat flour will reduce the protein content of cookies. Compared to the SNI for cookies, which stipulates a minimum protein value of 6%, the formulation of 40% breadfruit flour and 60% wheat flour fulfills the minimum requirements (6.32% - 6.98%). Meanwhile, the formulation of 60% breadfruit flour with 40% wheat flour was below the standard (4.76% - 5.16%).

The shortening effect of lipids on baked goods such as cookies and bread make the product more delicious and crispier[30]. As shown in Figure 9, the lipid content of cookies substituted with or without breadfruit flour ranges from 16.49% - 19.32%. Aside from the primary material of wheat and breadfruit flour, other additional ingredients including milk, eggs, and butter are used as a lipid source, making the resulting cookies have a high lipid content. A higher lipid content was observed in breadfruit flour substitution treatment. The higher the concentration of breadfruit flour, the greater the lipid content of cookies. This is because the lipid content of breadfruit flour from Latuhalat, Arui Bab, and Lat Dalam Villages is higher compared to wheat flour. The minimum lipid content allowed in cookies based on (BSN, 2009)[23] is 9.5%. This implies that cookies produced from all treatments fulfill and even exceed the SNI requirement.

As shown in Figure 10, the carbohydrate content of cookies substituted with and without breadfruit flour ranged from 67.4% - 72.55%. Generally, the carbohydrate content of all treatments is quite good. The higher the concentration of breadfruit flour as a substitute for wheat flour, the greater the carbohydrate content. This is presumably because the carbohydrate content of breadfruit flour is relatively higher compared to wheat flour. Due to the high carbohydrate content of 70.36%, cookies obtained from the formulation of 40% breadfruit flour and 60% wheat flour can be used as PMT (Additional Food Provision) for toddlers with stunting. Every 1 g of carbohydrate consumed will produce 4 kcal of energy. This means that 70.36% of carbohydrates will produce 281.44 kcal. Therefore, by consuming 100 g of cookies (5 cookies), the energy needs of toddlers can be fulfilled to up about 20 - 25%.

The panelists preference level for the aroma ranged from slightly liked (2.44) for cookies made using breadfruit flour substitute from Arui Bab Village to liked (2.90 & 3.04) for the other two treatments. Statistical analysis using ANOVA test indicated differences in the three treatments. The panelists value for the hedonic quality of cookie aroma ranged from 2.86 (slightly breadfruit-scented) for cookies made using breadfruit flour substitute from Arui Bab Village to 3.10 & 3.52 (breadfruit-scented) for the other two treatments. Statistically, there were differences between treatments as shown in Table 1. The aroma of cookies made using breadfruit flour substitute from Latuhalat and Lat Dalam Villages did not show significant differences, but both were different from the Arui Bab Village sample. Panelists liked the aroma of cookies substituted with breadfruit flour up to 40%, except for those made using breadfruit flour substitute from Arui Bab Village, which had a low preference level. This shows that panelists prefer cookies with breadfruit aroma. The aroma of breadfruit is quite distinctive and can be maintained despite being subjected to a heating process into flour using a temperature of 50°C for 24 hours and into cookies through a baking process at a temperature of 150°C for 20 minutes.

The panelists preference level for the texture of cookies made using breadfruit flour substitute ranged from 2.92 - 3.06. In terms of texture, cookies made using breadfruit flour from Arui Bab and Lat Dalam showed no significant difference, but both were different from the Latuhalat Village sample which fell in very much like (3.48) category. The panelists value for the hedonic quality of cookie texture ranged from 2.78 (slightly smooth texture) to 3.26 (smooth texture). Statistically, there was a difference between treatments (Table 2). In terms of hedonic quality, the texture of cookies made using breadfruit flour substitute from Arui Bab and Lat Dalam villages did not show significant differences, but both were different from the Latuhalat Village sample, which was smoother. Consumers also prefer cookies from Latuhalat villages, because breadfruit flour has a higher lipid content (3.89%) compared to those from the other two villages (1.55% - 3.15%). Lipids can provide important sensory properties to food products such as color, taste, texture, and smell which have an impact on overall consumer

acceptance. According to Natesan & Kim (2021)[30], the function of lipids in food includes keeping cakes longer lasting, playing a role in making cookies softer in texture, and maintaining moisture.

The panelists preference level for the color was slightly liked (2.78 & 2.96) for cookies made using breadfruit flour substitute from Arui Bab and Lat Dalam. Statistical analysis sing ANOVA test showed that there was no significant difference between the two treatments. Meanwhile, cookies formulated using breadfruit flour substitute from Latuhalat Village were preferred by the panelists (3.36). Panelist values for the hedonic quality of cookie color ranged from 2.88 (brownish yellow) in cookies formulated using breadfruit flour substitute from Arui Bab Village to yellowish white (3.18 and 3.58) in the other two villages samples. Statistically, there were differences between treatments as shown in Table 3. In terms of hedonic quality, the color of cookies made using breadfruit flour substitute from Arui Bab and Lat Dalam Villages did not show any significant differences, but both were different compared to the Latuhalat Village sample. Cookies formulated using breadfruit flour substitute from Latuhalat Village showed a whiter color. This is in accordance with the color of the raw materials, namely breadfruit flour from Latuhalat Village, which is whiter than those from Arui Bab and Lat Dalam Villages [22]. The color of breadfruit flour from Latuhalat Village is closer to the color of wheat flour. This explains why panelists prefer the color of cookies formulated using breadfruit flour substitute from Latuhalat Village.

The panelists preference level for taste was slightly liked (2.54 and 2.84) for cookies formulated using breadfruit flour substitute from Arui Bab and Lat Dalam. Statistical analysis using the ANOVA test showed that there was no significant difference between these two treatments. Meanwhile, both were different from cookies made using breadfruit flour substitute from Latuhalat Village which were preferred by the panelists (3.38). Cookies formulated using breadfruit flour substitute from Arui Bab Village had a hedonic quality panelists value of 2.86 (slightly tastes of breadfruit). For the other 2 treatments, the panelists accorded an assessment of scores of 3.13 and 3.25 (tastes of breadfruit). Statistically, there was a difference between treatments (Table 4). In terms of hedonic quality, the taste of cookies formulated using breadfruit flour substitute from Latuhalat and Lat Dalam Villages did not show a significant difference, but both differ from Arui Bab Village samples which had reduced taste of breadfruit. The taste of breadfruit remains significant despite subjecting cookies to several heating processes.

CONCLUSION

Based on the results, the following conclusions were made; the chemical characteristics of breadfruit flour from Latuhalat, Arui Bab, and Lat Dalam Villages include water content of 8.04% - 13.61%, carbohydrate content of 77.16% - 84.51%, protein content of 3.05% - 4.86%, lipid

content of 1.55% - 3.89%, and ash content of 2.45% - 3.83%. The chemical characteristics of cookies made from breadfruit flour from Maluku as a substitute for wheat flour include water content of 1.85% - 4.13%, ash content of 1.37% - 1.75%, protein content of 4.76% - 7.3%, lipid content of 17.39% - 19.32%, and carbohydrate content of 69.66% - 72.55%. The best chemical characteristics of cookies were found in the formulation of 60% wheat and 40% breadfruit flour with a water content of 2.8% - 3.16%, ash content of 1.39% - 1.64%, protein content of 6.81% - 7.03%, lipid content of 18.44% - 18.61%, and carbohydrate content of 70.01% - 70.36%. The best sensory characteristics were found in cookies formulated using breadfruit flour substitute ingredients from Latuhalat Village. The treatment had breadfruit aroma (3.515) preferred by panelists (3.045), a smooth texture (3.284) liked texture (3.518), a yellowish white color (3.58), liked color (3.36), breadfruit taste (3.25), and liked taste (3.38).

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