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The organoleptic, proximate, and crude fiber content of Durian (*Durio zibethinus*) skin flour cookies

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ABSTRAK

Latar Belakang: *Durian merupakan buah yang berasal dari Asia Tenggara salah satunya Indonesia yang kaya akan tanaman tropis. Umumnya durian hanya dimakan bagian buahnya saja sedangkan kulitnya akan menjadi limbah. Padahal bagian dalam kulit mengandung pektin bagian dari serat.*
Tujuan: *Mengetahui formulasi, uji organoleptik, Uji proksimat dan kandungan serat kasar dan pada cookies dengan subtitusi tepung kulit durian.*
Metode: *Penelitian kuantitatif dengan desain eksperimental dan uji organoleptik. Terdapat 4 sampel formulasi yaitu Formulasi 1 (F1) (10% tepung kulit durian : 90% tepung terigu), Formulasi 2 (F2) (20% tepung kulit durian : 80% tepung terigu), Formulasi 3 (F3) (30% tepung kulit durian : 70% tepung terigu), dan choco butter cookies control. Analisis data menggunakan uji Kruskal Wallis dan uji Mann Whitney untuk menentukan perbedaan organoleptik antar formulasi. Analisis Duncan digunakan untuk analisis perbedaan kandungan serta kasar antar formulasi.*
Hasil: *Hasil uji organoleptik dengan komponen warna, aroma, rasa dan tekstur pada choco butter cookies kulit durian menunjukkan adanya perbedaan nyata (P<0,05) pada semua formulasi F0, F1, F2 dan F3. Formulasi terpilih pada uji kesukaan yaitu F1 (10 gr tepung kulit durian bagian dalam dan 90 gr tepung terigu). Hasil uji proksimat menunjukkan rata – rata skor uji proksimat pada masing – masing kadar yang lebih tinggi dan lebih rendah nilainya yaitu 55,76 untuk kadar karbohidrat dan 1,185 kadar abu.Hasil uji kandungan serat kasar didapatkan hasil kandungan serat pada F0 sebesar 4,34%, F1 5,84%, F2 5,55% dan F3 5,09%. Hasil kandungan air pada F0 sebesar 10,22%, F1 14,25%, F2 13,12% dan F3 14,23%. Hasil kandungan abu pada F0 sebesar 1,15%, F1 1,31%, F2 1,48% dan F3 1,77%. Hasil uji kandungan lemak didapatkan hasil kandungan lemak pada F0 sebesar 20,97%, F1 21,85%, F2 17,74% dan F3 19,29%. Hasil uji kandungan lemak didapatkan hasil F0 sebesar 20,97%, F1 21,85%, F2 17,74% dan F3 19,29%. Hasil kandungan protein pada F0 sebesar 11,33%, F1 10,94%, F2 18,68% dan F3 8,89%. Hasil uji kandungan karbohidrat pada F0 sebesar 56,32%, F1 51,66%, F2 48,98% dan F3 55,83%.*
Kesimpulan: *Terdapat perbedaan nyata pada komponen warna, aroma, rasa dan tekstur dalam setiap formulasi F0, F1, F2, maupun F3 serta juga mempengaruhi hasil dari tes proksimat dan kandungan serat. F1 adalah formulasi yang paling disukai dan memiliki kandungan serat kasar tertinggi.*

KATA KUNCI*: cookies; serat kasar; tepung kulit durian*

ABSTRACT

Background: *Durian is a fruit originating from Indonesia in Southeast Asia, which is rich in tropical plants. The fruit is typically eaten for its flesh, while the skin, comprising a type of fiber called pectin, is discarded.*

Objectives: *This research aimed to determine the formulation, organoleptic, proximate, and crude fiber content in cookies produced with durian skin.*

Methods: *This is an experimental design with organoleptic testing on four formulations. These included F1 (10% durian skin flour: 90% wheat flour),F2 (20% durian skin flour: 80% wheat flour),F3 (30% durian skin flour: 70% wheat flour), and F0 (chocolate butter) as control.Kruskal-Wallis and Mann-Whitney tests were used to compare the organoleptic properties between formulations. Furthermore, Duncan's analysis determined the difference in crude fiber content between formulations.*

Results: *The organoleptic tests showed that the color, aroma, taste, and texture of durian skin chocolate butter cookies showed significant differences (P <0.05) in all formulations F0, F1, F2, and F3. F1 was the most preferred. The proximate test results showed the average score was 55.76 for carbohydrate content and 1.185 for ash content, signifying a higher and lower level, respectively. The fiber content in F0, F1, F2, and F3 was 4.34%, 5.84%, 5.55%, and 5.09%, respectively. The water content of F0, F1, F2, and F3 was 10.22%, 14.25%, 13.12%, and 14.23%, respectively.The ash content in F0, F1, F2, and F3 was 1.15%, 1.31%, 1.48%, and 1.77%, while the fat content was 20.97%, 21.85%, 17.74% and 19.29%, respectively.The protein content in F0, F1, F2, and F3 was 11.33%, 10.94%, 18.68%, and 8.89%, while the carbohydrate content was 56.32%, 51.66%, 48.98%, and 55.83%,respectively.*

Conclusions: *The organoleptic test showed significant differences in color,aroma, taste, and texture among all formulations. It also had an effect on the results of the proximate test and fiber content. F1 was the most preferred cookies and the highest crude fiber content.*

KEYWORD*: cookies; crude fiber; inner skin durian flour*

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INTRODUCTION

Indonesia is a nation with the highest biodiversity in the world, famous for its tropical forests with tropical plants, including the durian (1). According to the Central Statistics Agency (BPS) data, durian production in Indonesia reached 1.58 million tons in 2022 (2). This figure increased by 14.5% compared to the previous year of 1.35 million tons. In addition, South Sumatra recorded durian production of 40.6 thousand tons (3). Durian is a seasonal fruit, meaning it is not always available year-round (4). The fruit is only eaten for its flesh, while the skin is wasted. However, the white inside of the durian skin contains pectin, a type of fiber (5). Due to the rarity of the fruit, It is processed into flour to extend its shelf. This was an innovation in durian skin-based food products designed to minimize the accumulation of durian skin waste.

Butter Cookies are bakery products in the form of dry cookies composed of wheat flour, eggs, sugar, and margarine (6). Generally, butter cookies have a high fat and carbohydrate content but a low fiber content (7). Cookies can be made with different raw materials because gluten is not required as a raising agent (8). Butter cookies were considered suitable to be substituted with durian skin flour, which could increase the crude fiber content. According to Riskesdas data in 2018, 95% of Indonesians lack fiber intake. This research can increase income through community empowerment and reduce waste around the community. Therefore, this research was conducted to determine the formulation, organoleptic, proximate and crude fiber content of cookies substituted with durian skin flour.

MATERIALS AND METHODS

The research used a quantitative approach with an experimental research design. Organoleptic tests in the form of color, aroma,

texture, and taste, were conducted by giving 24 semi-trained panelists four samples of durian skin chocolate butter cookies formulation with ratios of F1 (10% inner skin durian flour:90% wheat flour), F2 (20% inner skin durian flour:80% wheat flour), F3 (30% inner skin durian flour:70% wheat flour), and choco butter cookies control (without durian skin flour). The method used was a Completely Randomized Design (CRD) (9). The number of repetitions in each treatment was based on the formula with r is number of repetitions and t is number of treatments. Based on the result of the calculation, the tests were conducted six times, obtaining 24 sample units (10):

$$(r - 1)(t - 1) \geq 15$$
$$(r - 1)(4 - 1) \geq 15$$
$$(r - 1)\,3 \geq 15$$
$$3r - 3 \geq 15$$
$$3r \geq 15 + 3$$
$$3r \geq 18$$
$$r \geq 18/3 = 6 \quad [1]$$

This research passed an ethical review under number 060/UN9.FKM/TU.KKE/2024, and was conducted after the Dean of the Faculty of Public Health at Sriwijaya University issued the research permit. It was carried out at various locations at each stage. Durian skin flour was manufactured at the production house of the Karang Anyar Village community, Palembang. The manufacture and processing of chocolate butter cookies were carried out at the home of the researcher on Taruna Ogan Road, Palembang City. The products were tested for organoleptic properties at the FKM Culinary Laboratory and crude fiber content at the Agricultural Product Technology Laboratory, Sriwijaya University.

The preparation of durian skin flour

Durian skin flour was prepared by separating the inside and outside of the durian skin. The inner skin was then washed, sliced thinly, and arranged in a tray. Subsequently, it was dried using an oven at 60°C for 10 hours before cooling at room temperature. The durian skin was then mashed with a blender and sieved using an 80-mesh sieve until it became flour (11). The production of chocolate butter durian skin cookies. The second step in making durian skin cookies was to mix the ingredients. The granulated sugar, palm sugar, butter, and margarine were added and stirred at high speed until well combined. Eggs were also added and stirred until slightly fluffy before adding flour, durian skin flour, and baking soda, then stirring until evenly distributed. Subsequently, chocolate chips were added and stirred until evenly distributed. Once the dough was cooked, 25 grams were weighed and arranged on a baking sheet lined with parchment paper and baked in the oven at 180°C for 10 minutes. The cookies were then removed and cooled at room temperature.

The organoleptic test

The organoleptic tests were conducted by 24 semi-trained panelists using the Hedonic test method. The organoleptic test scores used include (1) really dislike, (2) dislike, (3) somewhat like, (4) like, and (5) really like.

The proximate test and crude fiber content

The research was conducted with six repetitions for each level, bringing the total number of samples used to 24. Proximate analysis is carried out to predict the composition of nutrients in a material, which includes moisture, ash, fat, protein, and carbohydrate contents. The gravimetric method was used to analyze the water and ash content, while the difference method analyzed the carbohydrate content. Furthermore, the analysis of protein and fat contents was carried out with the Kjeldahl and Soxhlet method, respectively (AOAC, 2005). Testing of crude fiber content was carried out on four formulations, F0, F1, F2, and F3 using the method according to SNI 01-2891-1992.

RESULTS AND DISCUSSIONS

The Organoleptic Test Of Color Components

The results of the organoleptic test on the color components showed that the average preference score for the color of chocolate butter cookies ranged from 3.13 (quite like) to 4.04 (like). The results of the normality test showed a significance value (0.00) lower than the specified significance level (0.05). This implies that the data distribution did not meet normal requirements. The Kruskal-Wallis test was then carried out, with a significance level of α of (0.05). From the Kruskall-Wallis analysis, a significance value of (0.001) < (0.05) was found, suggesting a significant

difference in the color variable. Furthermore, the Mann-Whitney test was conducted, and the color advances test is shown in **Table 1**.

Based on the results of the Mann-Whitney test, the preference level for the color of chocolate butter cookies with durian skin flour did not show a significant difference (P>0.05) between F0 and F1 and F2 and F3. However, significant differences (P<0.05) were observed between F0 and F2, F0 and F3, F1 and F2, and F1 and F3. The percentage of durian skin flour added influenced the difference in color in each cookie treatment. This is due to the brownish cream color of the durian skin flour, caused by enzymatic browning of the initially white flour (12). Tissue damage occurs when slicing durian skin, resulting in contact with oxygen and a color change caused by the polyphenol oxidase enzyme (13). Other ingredients, such as granulated sugar and palm sugar, also affected the color of the cookies. The sugar content and the baking process caused the Maillard reaction (browning process). Heating of palm sap caused the brown color of the resulting brown palm sugar. Palm sap contains sucrose, reducing sugar, and protein, which undergo a Maillard reaction when heated, producing brown palm sugar (14). The smallest addition of 10 grams of durian skin flour affected the color component in the organoleptic test. The more durian skin flour was added, the lower the level of color preference, and the color of the resulting cookies became more concentrated.

The Organoleptic Test of Aroma Components

Organoleptic testing showed that the average preference score for the aroma of chocolate butter cookies ranged from 3.17 (quite like) to 4.50 (like). The normality test results showed that the data did not follow a normal distribution, with a significance value of (0.00) < (0.05). Data not following a normal distribution would be further analyzed using the Kruskal-Wallis test at a significance level of α (0.05). Based on the Kruskall-Wallis test results, a significance value of (0.000) < (0.05) was obtained, showing a significant difference in the aroma variable. Therefore, the Mann-Whitney test was conducted for further analysis, and the results are shown in **Table 1**.

Based on the results of the Mann-Whitney statistical test analysis, the level of preference for the aroma of chocolate butter cookies with durian skin flour did not show a significant difference (P> 0.05) between F1 and F2, F1 and F3, and F2 and F3. However, there was a significant difference (P <0.05) between F0 and F1, F0 and F2, and F0 and F3. The difference in aroma between cookie formulations was caused by the percentage of durian skin flour used. The higher the percentage, the more pungent the durian aroma was. The distinctive and pungent aroma of durian is due to the presence of the amino acid compound ethionine, which is released into the air when the durian is ripe (15). However, the aroma of durian skin can be disguised by adding butter, which gives out a sharper aroma compared to margarine. This is because butter has a higher milk fat content than margarine (16). The lowest addition (10 grams) of durian skin flour in the F1 formulation affected the aroma component of the organoleptic test. The more durian flour was added, the lower the preference for the aroma, and the resulting cookies had a stronger durian aroma.

The Organoleptic Test of Taste Components

The organoleptic test on the taste components showed that the average taste preference score for chocolate butter cookies ranged from 3.08 (quite like) to 4.17 (like). The results of the evaluation of the normality of the data showed a significance value of (0.00) < (0.05), implying that the distribution of the data did not meet the assumption of normality. Therefore, further testing was carried out using the Kruskal-Wallis test method with a significance level of α (0.05). Based on the results of the Kruskal-Wallis test analysis, a significance value of (0.000) < (0.05) was found, showing a significant difference in taste parameters. This was further analyzed with the Mann-Whitney test, and the results are shown in **Table 1**.

Based on the results of the Mann-Whitney test analysis, it was concluded that there was no significant difference (P>0.05) in the preference level for the taste of durian skin chocolate butter cookies between F2 and F3. However, significant differences (P<0.05) were observed between F0 and other formulations, and between F1 and F2 and F1 and F3. The difference in taste in chocolate butter cookies was caused by the amount of

durian skin flour added, which increased the distinctive taste of durian fruit. However, the taste of durian fruit can be disguised by adding other ingredients such as sugar, butter, and chocolate chips. Several factors affect the taste of a product, including chemical compounds, temperature, and interactions with other flavors (17,18). Temperature affects the taste of food because it affects the sense of taste. The hotter or colder a food was, the lower the sensitivity of the sense of taste (19). The lowest amount of durian skin flour (10 grams) in F1 affected the results of the organoleptic test of the taste components. The more durian skin flour was added, the lower the level of taste preference and the stronger the durian flavor in the cookies.

The Organoleptic Test of Texture Components

The organoleptic test on the texture components showed that the average preference score for the texture of chocolate butter cookies ranged from 3.08 (quite like) to 4.25 (like). The evaluation of the normality of the data showed a significant value (0.00) lower than the threshold value (0.05), showing that the data did not follow a normal distribution. Data that was not normally distributed were then analyzed using the Kruskall-Wallis test with a significance level of α (0.05). The results showed a significant value of 0.000, smaller than the threshold value (0.05), showing a significant difference in texture parameters. Therefore, further analysis was carried out using the Mann-Whitney test. and the results are shown in **Table 1.**

Based on the results of the Mann-Whitney test, it was concluded that the preference level for the texture of chocolate butter cookies with durian skin flour did not show a significant difference (P>0.05) between F2 and F3. However, there was a significant difference (P<0.05) between F0 and other formulations, and between F1 and F2, and F1 and F3. The cookie texture of the F0 formulation was crispier than F3 due to the addition of durian skin flour. The more durian skin flour added, the lower the protein content. In the protein structure, there were functional groups (NH2, NH, OH, CO) that allowed the protein to bind to water, resulting in a dry and crispy cookie surface. Another factor that affected the texture of cookies was the fat used (20).

Table 1. Preference level for the color, aroma, taste and texture of chocolate butter cookies with durian skin flour

Parameter	Mean Value of Sample Organoleptic Test			
	F0	F1	F2	F3
Color	4.04 ± 0.550[a]	3.75 ± 0.944[a]	3.25 ± 0.737[bc]	3.13 ± 1.116[bc]
Aroma	4.50 ± 0.659[a]	3.58 ± 0.974[b]	3.46 ± 0.779[b]	3.17 ± 0.963[b]
Taste	4.17 ± 0.816[a]	3.63 ± 0.824[b]	3.21 ± 0.779[b]	3.08 ± 0.928[b]
Texture	4.25 ± 0.737[a]	4.13 ± 0.741[b]	3.42 ± 0.881[c]	3.08 ± 0.881[c]

a, b = similar letter notation implies that there was no statistically significant difference, as determined by the Mann-Whitney test at a significance level of 5%

F0 (choco butter cookies control without durian skin flour), F1 (10% inner skin durian flour:90% wheat flour), F2 (20% inner skin durian flour:80% wheat flour), F3 (30% inner skin durian flour:70% wheat flour)

The fat in chocolate butter cookies was a mixture of butter and margarine. Butter cuts and stabilizes the gluten network so the resulting cookies are soft, while margarine has plasticine properties and remains solid at room temperature. This gives the resulting cookies a firm texture (21) The addition of durian skin flour had an effect on the results of the texture components of the organoleptic tests of cookies. F0 (100% wheat flour), F1, and F2 had a crunchy texture that suited the characteristics of cookies. Meanwhile, F3 had a chewier texture, making it better suited for soft cookies.

The Proximate Test and Crude Fiber Content

Table 2 shows that the lowest water content was found in F0, which amounted to 10.45%. Moisture content is the percentage of water content in a material that can be expressed as the amount of water content per unit weight of the material (22). Effective drying is required to remove moisture because high moisture content in food products can increase microbial growth. (23). Ash content affects the color and stability level of a food ingredient (24). It can also serve as a marker to assess the safety and quality of food products, with the lowest ash content found in F0,

at 1.18%. High levels of certain minerals, particularly heavy metals, may indicate potential contamination and pose a health risk (25). F2 had 17.77% fat, which was the lowest fat content found in this research. Fat is an important food component that provides texture and flavor (26). In food processing, it functions as a heat conductor and provides a more attractive and delicious flavor (27). The highest protein content was obtained from F2, which amounted to 14.05%. Previous research shows that flours with higher protein content can improve the structural integrity and quality of baked products (28). The highest carbohydrate content was found in F0, which amounted to 55.76%. Carbohydrates also play a role in giving sweetness to the food produced (29).

Table 2. Average proximate test results

Formulation	Water (%)	Ash (%)	Fat (%)	Protein (%)	Fiber (%)
F0	10.45	1.18	21.30	11.29	55.76
F1	13.80	1.33	21.46	10.51	52.89
F2	12.95	1.47	17,77	14.05	53.74
F3	14.29	1.79	19.84	9.91	54.16

The results of the content and crude tests showed that the fiber content ranged from 4.34% to 5.84%, which was above the quality standard (maximum of 0.5%) for crude fiber content for cookies according to SNI 01-2973-1992. The results of the fiber content data were tested using a one-way Analysis of Varance (ANOVA) test with α (0.05), followed by Duncan's test if there was a significant difference. Based on the one-way ANOVA test, a significance value of (0.006) < (0.05) was obtained, showing significant differences in the fiber content of each formulation. Furthermore, Duncan's test was carried out and the results showed that F0 significantly differed from F1, F2, and F3. F1 was significantly different from F3 and F0. There was a significant difference between F2 and F0, and F3 was significantly different from F0 and F1

Table 4. The Mann-Whitney test of crude fiber

Parameter	Unit	Result			
		F0	F1	F2	F3
Crude Fiber	%	4,34[a]	5,84[b]	5,55[b,c]	5,09[c]

Detail information: a, b = similar letter notation implies that there was no statistically significant difference, as determined by the Mann-Whitney test at a significance level of 5%.

. Based on the results of the crude fiber content test, crude fiber content increased from F0 to F1 but decreased from F1 to F2 and F3. This was caused by the sieving process with an 80-mesh sieve. The result was consistent with research conducted by Sakalaty et al. in 2021 which stated that the smaller the particles, the smaller the cellulose, hemicellulose, pectin, and lignin content which affected the fiber content (30). Therefore, the smaller the particles (mesh), the lower the fiber content.

CONCLUSIONS AND RECOMMENDATIONS

The organoleptic test results showed that the addition of durian skin flour to chocolate butter cookies affected the level of preference for color, aroma, taste, and texture in each formulation F0, F1, F2, and F3. It also had an effect on the results of the proximate test and fiber content. Cookies with the highest crude fiber content were in F1 (10% durian skin flour and 90% wheat flour). The recommendation for further research is that durian skin flour should not be sieved or a sieve with larger mesh holes should be used to avoid coarse fiber content from being wasted during its processing. Additionally, when durian skin has been washed and thinly sliced, the roasting process should be immediately carried out to avoid browning reactions.

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