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Preference Responses of Wheat Flour Substitution with Jackfruit Seed Flour on Oyster Mushroom Nuggets

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Abstract: The utilization of Jackfruit seeds is still limited as a snack even though it has no less nutritional substances than wheat flour, even the calories and carbohydrate content is lower so it has the potential to be processed into flour and is expected to substitute wheat flour. On the other, public concern about healthy foods with low-fat content has resulted in the need to develop sources of vegetable protein, one of which is oyster mushrooms which are processed into nuggets. This study aims to determine the preference response to oyster mushroom nugget products with jackfruit seed flour substitution The research treatment tested 4 treatment levels of substitution of wheat flour with Jackfruit seed flour, namely P0 (100% Wheat Flour), P1 (80% Wheat Flour + 20% Jackfruit Seed Flour), P2 (60% Wheat Flour + 40% Jackfruit Seed Flour), and P3 (Wheat Flour 40% + Jackfruit Seeds Flour 60%). The results show the substitution of jackfruit seed flour in mushroom nuggets oyster had an effect on the color, aroma, and taste of oyster mushroom nuggets and oyster mushroom nuggets had the best preference in t 20% substitution treatment.

Keywords: Jackfruit seed Flour; Nuggets; Oxidation; Oysters mushrooms

Introduction

Since 2014, the Government of the Republic of Indonesia through the Director General of Processing and Marketing of Agricultural Products (Dirjen Pengolahan dan Pemasaran Hasil Pertanian = PPHP) has made various efforts to substitute the use of wheat flour in food products with starch-producing plants that have been cultivated in Indonesia. One of the efforts is the development of flour-producing plant agricultural centers, including: rice, corn, sorghum, cassava, porang etc. (Fadila, 2014). This is due to an increase in the need for wheat flour every year, even in 2021 there will be an increase in the need for wheat flour by 4.6% compared to the previous year. The need for wheat flour is 66% for SMEs and 36% is for large industries (Utami, 2018; Setiawan, 2022).

Flour from rice, corn, sorghum and cassava is well known to the public but it is necessary (Ari Akin et al., 2022) to develop flour from fruit seeds which have nutritional components similar to wheat flour so that it is expected to be able to substitute them such as jackfruit, cempedak and durian. In 2011, jackfruit production in East Java Province amounted to 906,514 tons per year and increased by 10% compared to 2020 (Bayu, 2022) so that the use of jackfruit seeds as a food product needs to be developed. In Table 1, it can be seen that Jackfruit seed flour has a relatively high carbohydrate content compared to durian seed flour, but has a lower fat content than wheat flour, so it is expected to be able to substitute wheat flour in food products (Hsieh et al., 2017).

Table 1. Nutrition Composition Jackfruit Seeds Flour, Durian Seeds Flour and Flour Wheat in Procent.

Substance nutrition	Flour Jackfruit seeds[a]	Flour Seed durian[b]	Flour Wheat[a]
Calories	165.00	td	364
Proteins	4.20	14.17	20
Fat	0.10	8,49	1.92
Carbohydrate	36,70	12.96	74.48
Calcium	33.00	td	33
Iron	1.00	td	3.71
Phosphor	200.00	td	323
Water	56.70	6.60	14.42
Fiber	Td	18.59	Td

Description: a = Wadlihah (2010), b = Nuriana (2010), td = no is known.

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Table 2. Chemical Composition of White Oyster Mushrooms, Beef and Snakehead (per 100 grams).

Component	White Oyster Mushrooms[a]	Beef[b]	Snakehead[c]
Calories	365 Kcal	201 Kcal	td
Proteins	15 g	18.80 g	13.90 g
Carbohydrate	64.10 g	td	td
Fat	2.66 g	14 g	5.90 g
Fiber	39.80 g	td	td
Ash	7.08 g	td	td
Phosphor	Td	170 mg	124 mg
Sodium	133.70 mg	70.20 mg	34.60 mg
Potassium	33.12 mg	187.70 mg	219.50 mg
Magnesium	1.28 mg	21 mg	21.50 mg
Calcium	27.60 mg	11 mg	29.0 mg
Zinc	109.60 mg	4.80 mg	0.51 mg
Iron	68.60 mg	2.80 mg	0.64mg
Copper	12.90 mg	td	0.13 mg

Description: td = no known,[a] = Sumarsih (2015),[b] = Kementerian Kesehatan Republik Indonesia (2017),[c] = Marimutu et al. (2012).

Nuggets are processed meat products (beef, chicken, fish) that are well known and liked by the public, but these products have high levels of salt and fat. The high fat content in beef nuggets can be caused by the high fat content of beef as the basic ingredient. High fat levels accompanied by high salt levels can trigger various degenerative diseases. One effort to avoid this is to utilize vegetable protein sources as basic ingredients for nuggets, one of which is oyster mushrooms as a substitute for processed meat. Oyster mushrooms have various advantages compared to beef and fish (Wang & Zhao, 2023), which contain higher carbohydrates, lower fat content, high fiber content and some minerals are higher (Table 2). The description above is the main reason for researchers to conduct research that aims to determine the preference response to oyster mushroom nuggets with jackfruit seed flour substitution.

Method

The research was conducted at the Integrated Food Laboratory, Agro-industry Study Program, Vocational Faculty, Universitas 17 Agustus 1945, Surabaya. The study tested 4 (four) treatment levels of substitution of wheat flour with Jackfruit seed flour, namely P0 (100% Wheat Flour), P1 (80% Wheat Flour + 20% Jackfruit Seed Flour), P2 (60% Wheat Flour + 40% Jackfruit Seed Flour) %), and P3 (40% Wheat Flour + 60% Jackfruit Seed Flour). The composition of oyster mushroom nuggets is presented in Table 3. And the flow chart for making oyster mushroom nuggets is presented in Figure 1.

Table 3. Oyster Mushrooms Nugget Composition

Ingredients	P0	P1	P2	P3
Oyster Mushrooms (g)	250	250	250	250
Jackfruit seed flour (g)	0	15	30	45
Wheat flour (g)	75	60	45	30
Salt (g)	5.65	5.65	5.65	5.65
Pepper (g)	1	1	1	1
Garlic (g)	6.52	6.52	6.52	6.52
Skim milk (g)	2.17	2.17	2.17	2.17
Onion (g)	21.70	21.70	21.70	21.70
Egg (Items)	2	2	2	2

The materials used in the study were white oyster mushrooms (Pluerotus ostreatus), jackfruit seed flour produced by Kusuka Ubiku, all-purpose flour (Bogasari brand), fine salt, pepper, eggs, garlic, skim milk and onions. The equipment used in the manufacture of nuggets is a food processor (Philips Brand), cutting boards, knives, spoons, scales, baking sheets, frying pans and stoves. The panelist's preference response was measured through a hedonic test for color, aroma, taste, and texture. The hedonic test consists of 5 scales, namely: very much like = 5, like = 4, quite like = 3, dislike = 2, and really don't like = 1. The number of panelists is 30 people. In order to find out the difference in the panelists' preference, the Friedman test was carried out, followed by the Wilcoxon test at the 95% level of confidence.

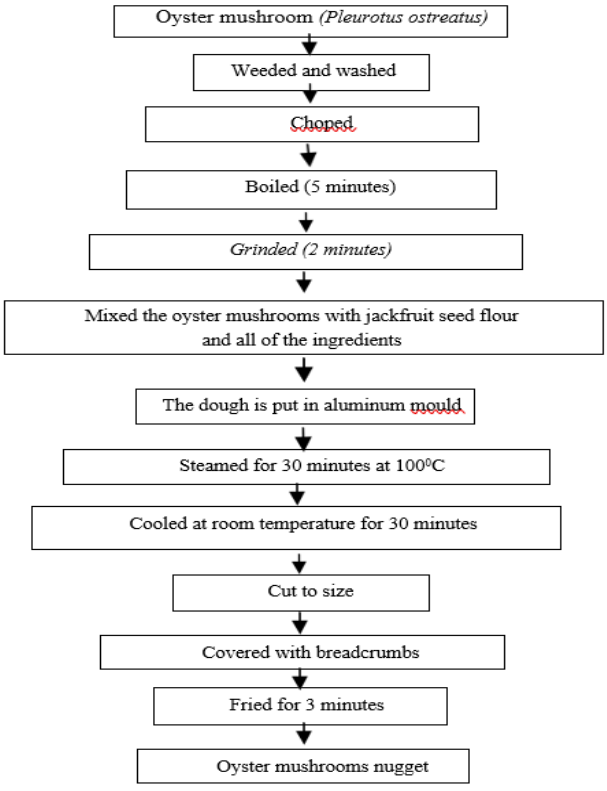

Figure 1. Flowchart of Making Oyster Mushroom Nuggets

Result and Discussion

Color

Color is the first factor to be considered in assessing the merits of a product (Mahfud, 2015). In Table 4, it appears that the higher the percentage of substituted jackfruit seed flour, the lower the panelists' preference for the color of oyster mushroom nuggets. This is due to the color of Jackfruit seed flour is brownish white. The brown color of Jackfruit seed flour is caused by the oxidation of phenolic compounds in Jackfruit seeds by the polyphenol oxidase enzyme which produces a brown pigment (melanin) (Hasnita et al., 2021).

Table 4. Percentage of Panelists Preference Responses to Oyster Mushroom Nugget Color.

	Frequency panelists (%)			
Panelists Preference	Po	P1	P2	P3
Very much Like	3.30	3.30	3.30	0.00
Like	60.00	36.70	33.30	20.0
Quite Like	36.70	60.00	53.30	13.30
Dislike	0.00	0.00	10.00	60.00
Really don't Like	0.00	0.00	0.00	6.70
Total	100	100	100	100

Based on the statistical test results, there was a difference in panelists' preference for the color of the jackfruit seed flour substitution nugget. In Table 5, it can be seen that the preference response of the panelists was significantly different between P0 (control treatment) and jackfruit seed flour substitution in all treatments (P1 to P3), 20% jackfruit seed flour substitution (P1) did not differ from the preferred response to the treatment. 40% substitution jackfruit seed flour (P2), but the preference response to the color of the nuggets in the P1 and P2 treatments was significantly different from the P3 treatment.

Table 5. Average Response of Panelists Preference for Color, Aroma, Texture and Taste of Oyster Mushroom Nugget

	Average Response of Panelists Preference			
Treatment	Color	Aroma	Texture	Flavor
P0	3.80 ± 0.55c	3.70 ± 0.50 c	3.50 ± 0.70	3.10 ± 0.37bc
P1	3.40 ± 0.57b	3.50 ± 0.70bc	4.00 ± 0.80	4.10 ± 0.69 c
P2	3.3 ±0.70 b	3.20 ± 0.51 b	3.50 ± 0.60	3.30 ± 0.99 b
P3	2.50 ± 0.50a	3.20 ± 0.48 a	3.6 ± 0.50	2.20± 1.10 a

Discription: different letters in the same column are not statistically significant

This means that the substitution of jackfruit flour as much as 60% of the weight of wheat flour is not liked by the panelists because it produces a brownish color of the nuggets. In the P1 and P2 treatments, although there was a ± 50% decrease in the panelist's preference response, the panelists were still able to tolerate changes in the color of the nuggets. The same thing was also shown in the results of Karyanina and Kurniawati's research (2016), there was a decrease in preference for the color of cookies with the substitution treatment of wheat flour with jackfruit seed flour because the color became browner. According to Kisnawaty and Kurnia (2017), the browning of the color of food products by substituting jackfruit seed flour is caused by an increase in the ash content which can encourage a darker color change in the resulting cookies.

Aroma

Aroma is the response of volatile compounds in food that enter the nose, then the olfactory system will respond. Aroma can determine the delicacy of the product (Winarno, 1997). The panelist's preference response to the jackfruit seed flour substitution nugget product decreased with increasing jackfruit seed flour substituted (Table 6.). In Table 6, the decrease in the panelists' preference response to the aroma of nuggets decreased by more than 30% compared to the control treatment (P0), however, the panelists' preference responses P0 and P1 (20% substitution) were not statistically significantly different at the 95% confidence level through the Wilcoxon test (Table 5.). Jackfruit seeds have a distinctive aroma (Spada et al., 2022), although not as sharp as the aroma of jackfruit fruit, so the higher the substitution of jackfruit seed flour, the sharper the distinctive aroma of jackfruit seeds will be. This aroma comes from the volatile components contained in jackfruit seeds including aromatics and esters (Kisnawaty and Kurnia, 2017). The same thing was also found by Qomari and Suhartiningsih (2013) in jackfruit seed flour crackers.

Table 6. Percentage of Panelists Preference Responses to Oyster Mushroom Nugget Aroma.

	Frequency Panelists (%)			
Panelists Preference	Po	P1	P2	P3
Very much like	3.30	10.00	3.30	6.70
Like	66.70	33.30	36.70	20.00
Quite Like	30.0	56.70	33.30	16.70
Dislike	0.00	0.00	26.70	43.30
Really don't Like	0.00	0.00	0.00	13.30
Total	100	100	100	100

Flavor

Taste is one of the important sensory characteristics of food products because taste influences one's food choices. The taste of white oyster mushroom nuggets with 20% substitution of jackfruit seed flour (P1) had the

highest preference response compared to other treatments (Table 7.). The results of the average difference test of 2 treatments using the Wilcoxon method (α = 95%) showed that the panelists' preference for treatment P1 was not significantly different from the control treatment (P0) and treatment P0 was not significantly different from treatment P2 (40% substitution) (data presented in Table 5.)

Table 7. Percentage of Panelists Preference Responses to Oyster Mushroom Nugget Flavor

	Frequency panelists (%)			
Panelists Preference	P0	P1	P2	P3
Very much Like	0.00	26.70	13.30	3.30
Like	10.00	53.30	26.70	13.30
Quite Like	86.70	20.00	36.70	0.00
Dislike	3.30	0.00	23.30	50.00
Really don't Like	0.00	0.00	0.00	33.30
Total	100	100	100	100

Factors that affect the preference response to the taste of a food product are influenced by the chemical compounds contained therein Suwaryo et al. (2022), temperature, concentration and interaction of food with other flavor components (Yuan et al., 2023). Jackfruit seeds have a soft, delicious and savory taste like potatoes. The results of the phytochemical screening of jackfruit seed extract carried out by a team of researchers from the Faculty of Pharmacy, University of Prof. Dr. Hamka (Dwitiyanti et al., 2019) showed that jackfruit seeds contain alkaloids, flavonoids, tannins, saponins, steroids and terpenoids (Sreeja Devi et al., 2021). In this study, if jackfruit seed powder was added in an amount of more than 20% to the oyster mushroom nuggets, it would cause a slightly bitter taste. This is due to the presence of saponins in jackfruit seeds. The same thing was also found in a study conducted by Theodora et al. (2019), where the more use of jackfruit seed flour will reduce the level of panelists' preference for the taste of wet rice noodles, because the higher the use of jackfruit seed flour produces a slightly bitter taste in wet rice noodles (Suzihaque et al., 2022).

Texture

Based on Table 8., the preference response for the texture of oyster mushroom nuggets was obtained in treatment P1 (20% jackfruit seed flour substitution), namely more than 50% of the panelists said they liked it very much, while in the control treatment only about 25% of the panelists liked it and nearly 50 The % says quite like. The higher the substitution of jackfruit seed flour, the panelist's preference response decreased (Spada et al., 2020). After testing with the Friedman method (α = 95%), it was concluded that substitution of jackfruit seed flour had no effect on the texture of oyster mushroom nuggets (Table 8 and Table 5).

Table 8. Percentage of Panelists Preference Responses to Oyster Mushroom Nugget Texture

	Frequency panelists (%)			
Panelists Preference	P0	P1	P2	P3
Very much Like	0.00	10.00	0.00	0.00
Like	26.70	53.30	26.70	22.70
Quite Like	43.30	30.00	40.0	41.0
Dislike	20.00	6.70	33.30	23.30
Really don't Like	10.00	0.00	0.00	13.00
Total	100	100	100	100

Pradipta and Putri (2015) stated that wheat flour consisted of 28% amylose and 72% amylopectin and Irwansyah (2010 in Saraswati et al., 2013) stated that jackfruit seed flour consisted of 16.23% amylose and 83.73% amylopectin. Amylose has the property of easily absorbing and releasing water Biduski et al. (2018), while amylopectin has the property of having difficulty absorbing water but water will be retained when it is absorbed (Akubor, 2003). The levels of amylose and amylopectin in food products will affect the hardness of the product (Zhang et al., 2020). Higher substitution of jackfruit seed flour will reduce the tenderness of the oyster mushroom nuggets, this is due to the highwater content of oyster mushrooms (Nowacka et al., 2023). This is in accordance with the results of Kisnawaty's research (2017), where the highest hardness value of jackfruit seed flour cookies was 8.81 N found in 30% jackfruit seed flour substitution, while the lowest hardness value was 3.30 N found in 0% jackfruit seed flour substitution (Hidayati et al., 2019).

Conclusion

Substitution of jackfruit seed flour on oyster mushroom nuggets had an effect on the color, aroma and taste of oyster mushroom nuggets and oyster mushroom nuggets which had the best preference response in the 20% substitution treatment.

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Author Contributions

Conceptualization, A, A. N, and T. W. S. P.; methodology, A.; validation, A. N and T. W. S. P.; formal analysis, A.; investigation, A. N. and T. W. S. P.; resources, A and T. W. S. P.; data curation, A. N.: writing—original draft preparation, A and A. N.; writing-review and editing, A. N.: visualization, T. W. S. P and A.; supervision, T. W. S. P.; project administration, A. N.; funding acquisition, A and A. N. All authors have read and agreed to the published version of the manuscript.

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Conflicts of Interest
The author declares no conflict of interest

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