

Wet Pasta “Fettuccine” Jackfruit Seed Flour Substitution: Physical and Organoleptic Quality

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Abstract

*This study aims to examine the effect of jackfruit seed flour (*Artocarpus heterophyllus*) substitution on the physical and organoleptic qualities of fresh fettuccine pasta as an alternative to partially replacing wheat flour. The research was conducted using an experimental method with three levels of jackfruit seed flour substitution: 5%, 10%, and 15%. Physical quality tests included water absorption capacity and elasticity, while organoleptic evaluations covered color, aroma, taste, and texture. The results of ANOVA analysis indicated that jackfruit seed flour substitution had no significant effect on water absorption or elasticity. Meanwhile, the Kruskal-Wallis test showed a significant effect on color and aroma, but no significant effect on taste and texture. Based on the Tukey post-hoc test, the 5% substitution level provided the best results in terms of color and aroma. This study suggests that substituting wheat flour with up to 5% jackfruit seed flour can produce fresh fettuccine with good physical and organoleptic quality, and has the potential to become a local food innovation that helps reduce dependency on wheat flour*

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1. INTRODUCTION

Jackfruit has the characteristic of growing seasonally; when the jackfruit season begins, the amount will be abundant. Jackfruit is a fruit that does not last long or is easily damaged and rots if not consumed immediately. Therefore, many processes of jackfruit into long-lasting processed products that have high sales value, such as jackfruit chips, jackfruit jam, jackfruit juice, jackfruit syrup, jackfruit dodol, and jackfruit vegetables found in typical West Sumatran cuisine, candied jackfruit, and others (Suryo et al., 2022). Jackfruit seeds have a fairly high nutritional content, the nutritional content includes 36.7 g of carbohydrates, 4.2 g of protein, 165 kJ of energy, and a mineral content of 200 mg of phosphorus, 33 mg of calcium, and 1.0 mg of iron, so that they have great potential in making flour. The composition of the starch in jackfruit seeds contains 25.95% amylose and 74.08% amylopectin. In addition, 100 g of jackfruit seeds contain 1.8 g of fiber (Masruroh et al., 2021).

Wheat flour is used as a raw material for various foods in Indonesia, including bread, various fried foods, biscuits, cakes, instant noodles, pasta, and so on. The increase in wheat flour consumption is caused by several factors, including the increasing population, the government's aggressive promotion of food diversification, and the relatively low price of wheat flour-based foods (Hastuti, 2019). One way to reduce wheat flour use is to substitute or replace wheat flour with one made from unused food processing waste, such as fruit seeds, for example, jackfruit seeds.

Pasta fettuccine, literally meaning "little ribbons," is a popular pasta shape in Roman and Tuscan cuisine in Italian culinary arts, which has a flat and long shape like a ribbon. Wet pasta

making fettuccini. This is done by mixing dry ingredients such as high-protein wheat flour with salt, then adding eggs. Mix until smooth and knead until it forms a dough and is shaped according to the criteria for a wet pasta shape fettuccine. Wet pasta fettuccine has a chewy texture and can be served with various sauces such as Bolognese, marinara, Alfredo, garlic and oil, carbonara, and others (Gisslen, 2009). This research needs to be conducted to find out how jackfruit seed flour substitution affects the physical and organoleptic quality of wet pasta fettuccine and to determine the ideal jackfruit seed flour substitution for making wet pasta fettuccine. It is also hoped that this will increase the quality of innovative products, increase the economic value of jackfruit seed flour, and increase local food production

2. MATERIALS AND METHODS

Physical quality is an evaluation of the physical characteristics of a material that provides a deep understanding of the product. In the manufacture of wet pasta fettuccine, jackfruit seed flour substitution can be influenced by the ingredients used; if the ingredients used are good, then the results will be good. The quality of wet pasta fettuccine. The substitution of jackfruit seed flour can be assessed through physical testing. Physical testing is an objective measurement, where the measurement uses physical instruments and objective responses such as a micrometer, pH meter, tender meter, refractometer, and thermometer. The physical quality of wet pasta *fettuccine* jackfruit seed flour substitution, there are at least 2 things that must be tested, namely the water absorption test and the elasticity test. The water absorption test on wet pasta fettuccine aims to find out how much water can be absorbed by wet pasta fettuccine. After cooking, water absorption was measured using a weighing method. Weigh 5 grams of raw wet pasta and cook it in 150 ml of boiling water for 5 minutes. Once cooked, drain the pasta until it is no longer dripping and weigh it again (Mulyadi et al. 2014).

Elasticity test on wet fettuccine is generally done to measure how elastic wet fettuccine is when pulled or pressed. Elasticity measurements are carried out using a ruler. The cooked sample is placed on the ruler and its length is measured as the initial length, then pulled until it breaks, and its length is measured as the final length (Ramlah, 1997).

In addition to physical testing, organoleptic testing was also conducted. Organoleptic testing or sensory testing is a method of assessment that utilizes the five human senses to observe the color, aroma, taste, texture, and shape of a food product (Ayustaningwarno, 2014). The ability of the senses in assessing a product includes the ability to detect, recognize, differentiate, compare, and the ability to assess likes or dislikes (Saleh, 2004). In this study, the panelists used were somewhat trained panelists consisting of 45 students of the Culinary Arts Education Study Program, Jakarta State University, because they already have basic knowledge of organoleptic assessment.

2.1 Method

This study uses an experimental method that aims to determine the effect of jackfruit seed flour substitution on the physical and organoleptic quality in making wet pasta. *This* research was conducted in the Laboratory Pastry and *Bakery* Culinary Arts Education Study Program, Faculty of Engineering, Jakarta State University. The study began in April 2024. Three treatments were used to substitute jackfruit seed flour in wet pasta *fettuccine* namely 5%, 10%, and 15%. Samples were taken randomly and then given a closed code. The organoleptic test assessment was carried out through a hedonic quality test on the aspects of color, taste, aroma, and texture, assessed by 5 expert panelists and 45 semi-trained panelists. Next, the physical quality test (water absorption test) of raw and boiled wet pasta was weighed using a scale, and the physical quality test (elasticity test) measured the level of elasticity of the pasta before and after being pulled using a ruler. This physical quality test was carried out 3 times for each treatment.

This research began with a trial of a control product without jackfruit seed flour, followed by substitution formulations until the best substitution formula was obtained. Data

from the organoleptic test were analyzed using Kruskal-Wallis then continued with the Tukey test. For the physical quality test data, it was analyzed using the ANOVA RAL test and continued with the *Duncan*. The hypothesis tested in this study was the physical and organoleptic quality of wet pasta products of *fettuccine with* jackfruit seed flour substitution.

3. RESULTS

3.1 Physical Quality Test of Wet Pasta *Fettuccine* Jackfruit Seed Flour Substitution

1. Water Absorption Test

ANOVA test results on the water absorption capacity of wet pasta *fettuccine* wheat flour substitution jackfruit as follows:

Table 1. ANOVA Test Results for Water Absorption Capacity

SK	Db	JK	KT	F _{count}	F _{table}
Treatment	2	27.991	13.995	2.308	5.143
Error	6	36.388	6.065		
Total	8	64.379	20.060		

The results of the ANOVA test on the water absorption capacity of wet pasta *fettuccine*. The substitution of jackfruit seed flour showed that the calculated F was 2.308 and the F-table was 5.143, which means that the calculated $F < F_{table}$. It can be concluded that there is no significant effect on the percentage of water absorption of wet pasta *fettuccine* jackfruit seed flour substitution 5%, 10%, and 15%.

2. Elasticity Test

Table 2. Results of the ANOVA Test of Elasticity Power

SK	Db	JK	KT	F _{count}	F _{table}
Treatment	2	7.542	3.771	2.100	5.143
Error	6	10.773	1.796		
Total	8	18.315	5.566		

The results of the ANOVA test on the elasticity aspect of wet pasta *fettuccine*. The substitution of jackfruit seed flour showed that the calculated F was 2.100 and the F-table was 5.143, which means that the calculated $F < F_{table}$. It can be concluded that there is no significant effect on the percentage of elasticity of wet pasta *fettuccine* jackfruit seed flour substitution 5%, 10%, and 15%.

3.2 Organoleptic Test of Wet Pasta *Fettuccine* Jackfruit Seed Flour Substitution

Table 3. Organoleptic Test Results for Color Aspect

Category	Wet Paste Color Aspect <i>Fettuccine</i>						
	Score	5%		10%		15%	
	n	%	n	%	n	%	
Cream mud	5	12	80,0	5	33,3	2	13,3
Cream	4	3	20,0	10	66,7	5	33,3
Krem tua	3	0	0	0	0	8	53,3
Light brown	2	0	0	0	0	0	0
Chocolate	1	0	0	0	0	0	0
Number (n)	15	100	15	100	15	100	
Shoes	72		65		54		
Mean	4,8		4,3		3,6		

The organoleptic test results for color aspect, with the highest average value at 4.8, were found at the 5% percentage, with a cream to light cream category. This was followed by the 10% percentage, with an average value of 4.3, in the cream category. Furthermore, the lowest average value was at the 15% percentage, with a dark cream category, with a 3.6.

Table 4. Results of Organoleptic Test of Taste Aspect

Category	Score	Taste Aspects of Wet Pasta <i>Fettuccine</i>					
		5%		10%		15%	
		n	%	n	%	n	%
No taste of jackfruit seeds	5	8	53,3	10	66,7	4	26,7
Just taste the jackfruit seeds	4	4	26,7	2	13,3	10	66,6
It tastes a bit like jackfruit seeds.	3	3	20	3	20	1	6,7
Tastes like jackfruit seeds	2	0	0	0	0	0	0
You can really taste the jackfruit seeds.	1	0	0	0	0	0	0
Number (n)		15	100	15	100	15	100
Total Score		65		67		63	
Mean		4,3		4,5		4,2	

The organoleptic test results for taste showed the highest average score at 4.5 at the 10% level, with a moderately noticeable jackfruit seed taste. This was followed by the 5% level, with a moderately noticeable jackfruit seed taste of 4.3. Furthermore, the lowest average score at 4.2 at the 15% level was found to be moderately noticeable jackfruit seed taste.

Table 5. Results of the Organoleptic Test of the Aroma Aspect

Category	Score	Aroma Aspects of Wet Pasta <i>Fettuccine</i>					
		5%		10%		15%	
		n	%	n	%	n	%
The aroma of jackfruit seeds is not strong	5	12	80	8	53,3	3	20
The aroma of jackfruit seeds is quite strong	4	3	20	6	40	9	60
The aroma of jackfruit seeds is quite strong.	3	0	0	1	6,7	3	20
Strong aroma of jackfruit seeds	2	0	0	0	0	0	0
The aroma of jackfruit seeds is very strong	1	0	0	0	0	0	0
Number (n)		15	100	15	100	15	100
Shoes		72		67		60	
Mean		4,8		4,5		4,0	

The organoleptic test results for the aroma aspect at 5% had the highest average value of 4.8, categorizing it as a fairly strong jackfruit seed aroma. This was followed by the 10% average value of 4.5, categorizing it as a fairly strong jackfruit seed aroma. The 15% average value had the lowest average value of 4, categorizing it as a fairly strong jackfruit seed aroma.

Table 6. Results of Organoleptic Test of Texture Aspect

Category	Score	Wet Pasta Texture Aspects <i>Fettuccine</i>					
		5%		10%		15%	
		n	%	n	%	n	%
Springy	5	6	40	9	45,9	5	33,3

Quite chewy	4	5	33,3	5	33,3	8	53,3
A bit chewy	3	2	13,33	0	0	2	13,3
Not chewy	2	2	13,33	1	21,6	0	0
Not very chewy	1	0	0	0	0	0	0
Number (n)	15	100	15	100	15	100	100
Total Score	60	67	63	63	63	63	63
Mean	4,0	4,5	4,2	4,5	4,2	4,2	4,2

The organoleptic test results for the texture aspect, with a percentage of 10% had the highest average value of 4.5, which is in the category of quite chewy. At a percentage of 15%, the average value was the second highest, at 4.2, which is in the category of quite chewy. At a percentage of 5%, the average value was the lowest, at 4, which is in the category of quite chewy.

Hypothesis Testing

A. Test Kruskal-Wallis

Table 7. Hypothesis Test Results *Kruskal-Wallis*

Testing Aspects	X _{count}	X _{table}	Conclusion
Color	18,932	5,991	X _{count} > X _{table} , eye H₀ rejected
Flavor	1,934	5,991	X _{count} < X _{table} , eye H₀ accepted
Aroma	11,475	5,991	X _{count} > X _{table} , eye H₀ rejected
Texture	2,404	5,991	X _{count} < X _{table} , for H₀ accepted

Based on the results of the hypothesis test, it shows that at percentages of 5%, 10%, and 15% there is no significant influence on the taste and texture aspects of wet pasta of *fettuccine* jackfruit seed flour substitution. Meanwhile, in terms of color and aroma, at 5%, 10%, and 15%, there was a significant effect, necessitating further Tukey testing.

B. Uji Tukey

Based on the results of the hypothesis, it shows that there is a significant influence on the color and aroma aspects, so that a further Tukey test is needed as follows:

Table 8. Tukey Test Results for Color Aspect

No.	Difference Between Each Treatment	Comparison of Results	Conclusion
1	A – B = 4,80 – 4,33 = 0,46	0,46 > 0,16	Real Difference
2	A – C = 4,80 – 3,66 = 1,2	1,2 > 0,16	Real Difference
3	B – C = 4,33 – 3,66 = 0,73	0,73 > 0,16	Real Difference

Based on the research results, the substitution of jackfruit seed flour affects the final quality of wet pasta *fettuccine*, especially in terms of color. The highest average value is at 5%, which is the best color for wet paste *fettuccine* jackfruit seed flour substitution preferred by panelists compared to percentages of 10% and 15%.

Table 9. Tukey Test Results for Aroma Aspect

No.	Difference Between Each Treatment Comparison of Results	Conclusion	
1	$ A - B = 4,80 - 4,46 = 0,34$	$0,34 > 0,16$	Real Difference
2	$ A - C = 4,80 - 4,00 = 0,80$	$0,80 > 0,16$	Real Difference
3	$ B - C = 4,66 - 4,00 = 0,66$	$0,66 > 0,16$	Real Difference

Based on the research results, the substitution of jackfruit seed flour has an effect on the final quality of wet pasta *fettuccine*, especially in terms of aroma. The highest average value was at 5%, which is the best aroma for wet pasta *fettuccine* jackfruit seed flour substitution preferred by panelists compared to percentages of 10% and 15%.

3.3 Discussion

Discussion of Physical Quality Testing

Based on the results of the physical test, water absorption measurements were carried out on each wet paste sample of *fettuccine* with an initial weight of 5 grams, boiled in 150 ml of boiling water for 3 minutes. During the boiling process, the pasta experienced varying water absorption depending on the percentage of jackfruit seed flour substitution used. The results of statistical analysis using ANOVA showed that jackfruit seed flour substitution of 5%, 10%, and 15% did not have a significant effect on the water absorption capacity of wet pasta *fettuccine* ($p > 0.05$), although the average values between treatments appeared different. The highest water absorption value was obtained in the 10% jackfruit seed flour substitution treatment, while the lowest value was found in the 15% treatment. This phenomenon indicates that increasing the amount of substitution is not always directly proportional to the water absorption capacity. The 10% percentage was the most optimal because the balance between the composition of wheat flour and jackfruit seed flour still allowed for the formation of a good dough structure.

According to Novita et al. (2023), the high starch content in jackfruit seed flour can increase the water absorption capacity of dry noodle products. However, in wet pasta products, the use of excessive amounts of jackfruit seed flour actually reduces water absorption capacity because the gluten content decreases and the dough structure become less strong. This condition causes water to escape more easily during the boiling process. In addition, the amylose (16.72%) and amylopectin (83.28%) content in jackfruit seed flour (Idhapola Sitohang et al., 2023) also affect the water absorption capacity. The high amylopectin composition allows for good gel formation in pasta, but excess amylose can result in a more brittle dough structure when the substitution percentage is increased.

Based on the results of the physical test, the measurement of elasticity was carried out by measuring the ratio of the initial length and final length of the pasta after being pulled using a ruler to determine the level of elasticity of the dough. Based on the results of the ANOVA test analysis, there was no significant effect on the elasticity of wet pasta *fettuccine* with jackfruit seed flour substitution ($p > 0.05$). However, descriptively, there is a tendency for the elasticity value to decrease as the substitution percentage increases. The 5% jackfruit seed flour substitution treatment showed the highest elasticity value of 4.47, while the 15% treatment showed the lowest value of 2.30.

This decrease occurs because the higher the percentage of jackfruit seed flour, the lower the gluten content, which plays a role in forming the elastic network in the dough. As a result, the gluten structure becomes weaker, and the dough's ability to return to its original shape after being stretched decreases.

These results are in line with research by Novita et al. (2023), which reported that increasing wheat flour will increase the elasticity of noodle products, while the addition of non-gluten flour such as jackfruit seed flour will reduce the elastic properties of the dough due to the absence of gluten protein, which forms an elastic network. Overall, both physical tests showed that the substitution of wheat flour Jackfruit seeds up to 15% did not have a significant effect on the physical characteristics of wet pasta *fettuccine*, but practically, a substitution level of 5–10% is still able to produce good water absorption and elasticity and is

sensorially acceptable.

Discussion of Organoleptic Tests

Organoleptic tests were conducted on 45 semi-trained panelists, with results indicating differences in average values between treatments for each parameter. Based on the Kruskal-Wallis's test, color and aroma significantly influenced the substitution of jackfruit seed flour, while taste and texture showed no significant differences between treatments. Tukey's test confirmed these results by showing significant differences between groups in color and aroma.

Color is the first impression that influences the perception of a product's quality. Based on test results, Kruskal-Wallis, the calculated X value is $18.93 > X_{table} 5.99$, which means H_0 is rejected, and H_1 is accepted. This means that there is a significant effect of jackfruit seed flour substitution on the color of wet pasta fettuccine. Tukey's test showed that the color at each substitution percentage (5%, 10%, and 15%) was significantly different. The 5% substitution produced a cream color, which was most preferred by panelists. This color change is caused by the natural phenolic content in jackfruit seed flour, which causes a browning reaction during drying. These results are in line with research by Ulyarti and Capriola (2022), who reported that increasing the percentage of jackfruit seed flour in making crackers reduces the product's brightness level. Therefore, the higher the percentage of jackfruit seed flour used, the darker the resulting paste due to the influence of the flour's phenolic compounds and natural pigments.

The results of the organoleptic test on the aroma aspect showed a calculated X value of $11.47 > X_{table} 5.99$, which means that H_0 was rejected and H_1 was accepted. This indicates a significant effect of jackfruit seed flour substitution on the aroma of wet pasta fettuccine. Tukey's test showed that products with 5%, 10%, and 15% substitution had significant differences in aroma assessment. Pasta with 5% substitution had a neutral aroma and was most preferred by panelists, while at 10% and 15%, a stronger and less preferred distinctive jackfruit seed aroma appeared. According to Izzah et al. (2025), the higher the percentage of jackfruit seed flour, the stronger the distinctive jackfruit seed aroma, which appears due to the presence of natural volatile compounds from phenolic and fat components in the seeds. This condition explains that the intensity of the jackfruit seed aroma increases as the level of jackfruit seed flour substitution in the dough increases.

Taste is the main parameter in determining consumer acceptance of food products. Based on the test results of Kruskal-Wallis, obtained X count of $1.93 < X_{table} 5.99$, which means H_0 is accepted, so there is no significant effect of jackfruit seed flour substitution on the taste aspect of wet pasta fettuccine. However, descriptively, it can be seen that the average taste score decreases with increasing substitution. The 15% treatment obtained the lowest score compared to 5% and 10%. This decrease is thought to be due to the emergence of the distinctive taste of jackfruit seeds, which is slightly bitter due to the increased content of phenolic compounds and tannins. This finding is in line with the results of research by Novita et al. (2023) on dry noodle products, which showed that substitution of jackfruit seed flour up to 15% did not cause a significant difference in taste, but at high levels, it could decrease the preference score due to the emergence of a distinctive taste. Thus, the use of jackfruit seed flour in low to medium amounts ($\leq 10\%$) are still sensorially acceptable, and provide additional nutritional value in the form of protein and fiber.

Texture is an important parameter that greatly influences consumer acceptance of pasta. Based on the test results, *Kruskal-Wallis*, the calculated X value is $2.40 < X_{table} 5.99$, which means H_0 is accepted, so there is no significant effect of jackfruit seed flour substitution on the texture of wet pasta fettuccine. Descriptively, a 10% substitution yielded the highest texture value, while at 15% the value decreased again. The addition of jackfruit seed flour in moderate amounts (around 10%) is thought to increase elasticity due to the balance between gluten protein and starch, while at higher percentages, the reduced gluten content causes the dough to become denser and less elastic. These results are similar to the research of Maskey et al. (2021) and Novita et al. (2023), which stated that substitution of non-gluten flour, such

as jackfruit seed flour, in low to medium levels is still sensory acceptable, but at high levels it tends to reduce texture quality due to weakening of the gluten network.

4. CONCLUSION

The results of the study showed that the substitution of jackfruit seed flour in making wet pasta *fettuccine* Jackfruit seed flour substitution at 5%, 10%, and 15% levels, had different effects on product characteristics. The analysis showed a significant effect on color and aroma ($p < 0.05$), but no significant effect on taste and texture. A 5% substitution resulted in the most preferred color and aroma by panelists. Increasing the substitution to 10–15% resulted in a darker product color and the appearance of a distinctive jackfruit seed aroma. Flavor scores decreased at 15% substitution due to increased phenolic and tannin compounds, which resulted in a slightly distinctive jackfruit seed flavor.

In physical tests, substitution of jackfruit seed flours up to 15% did not have a significant effect on water absorption or elasticity of wet pasta products of *fettuccine* ($p > 0.05$). The highest water absorption value was obtained at 10%, while the highest elasticity value was at 5%. The decrease in water absorption at 15% was caused by a reduction in gluten, which plays a role in forming the dough structure. The amylose and amylopectin content in jackfruit seed flour affected the water absorption and final texture of the pasta.

Substitution of 5% jackfruit seed flour is the most optimal formula that produces wet pasta *fettuccine* with the best physical and organoleptic qualities, namely in terms of color, aroma, taste, and texture, which were favored by panelists. The results of this study indicate that jackfruit seed flour has the potential to be used as an alternative local food ingredient to partially replace wheat flour. This not only increases the added value of jackfruit seed waste but also supports food diversification programs.

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