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Innovation in Adding Moringa Leaf Puree (Moringa Oleifera) in the Making of Roti Jala

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Abstract. Concerns over the adverse effects of using synthetic dyes in food products—such as the risk of allergies and long-term health issues—have prompted the need for safer and more nutritious natural dye alternatives. This research aims to explore the innovation in adding Moringa Leaf Puree *(Moringa Oleifera)* in the making of Roti Jala as an effort to present traditional foods that are healthier and more functional. The research employed an experimental approach with three treatments, namely the addition of *Moringa* leaf puree at levels of 25%, 50%, and 75% of the total wheat flour. The results showed that the 25% *Moringa* leaf treatment was the most preferred formulation among the panelists, achieving an overall preference rate of 81%, especially in terms of color, texture, and taste. The ANOVA test indicated significant differences in color, aroma, and taste, but not in texture. Macronutrient content analysis revealed an increase in energy, protein, and fat corresponding with the higher addition of *Moringa* leaf puree, where the 75% sample yielded 872.2 kcal of energy, 210.7 g of protein, and 179.2 g of fat per 200 grams serving. This study demonstrates that *Moringa* leaf puree can serve as a natural coloring agent while enhancing nutritional value without diminishing the typical characteristics of *Roti Jala*. These findings are expected to contribute to the development of traditional culinary innovations that are healthy, economically valuable, and supportive of sustainable food product advancement.

Keywords: Innovation; Puree; Moringa olaifera; Mesh bread; Organoleptic; Macronutrients

INTRODUCTION

Balanced food can improve a person's quality of life by implementing a healthy lifestyle that is currently trending (Ariyanti & Ningrum, 2022). To achieve sustainability, food consumption is one of the solutions because it is not only related to individual health but also related to public health (Handriana et al., 2022). The study emphasizes the importance of public health awareness as a key element influencing consumer buying interest in healthy food products (Nugraha et al., 2018). According to a Kantar study Insight Food 360 of 2022, which is outlined in SIAL Insights, Approximately 71% of consumers have changed their diet to improve health, while as many as 67% consume healthier foods, 37% of consumers pay more attention to the content in food and 72% prefer to buy products that do not contain artificial additives, such as dyes.

Concerns over the side effects of synthetic dyes—such as allergies and carcinogenic risks—are driving the need for safer sources of natural dyes (Novais et al., 2022; Villegas-Vazquez et al., 2025). The use of synthetic dyes is common in Indonesia, where the use of synthetic additives such as tarzin, CFC green, and CFC yellow can cause health problems if consumed continuously (Neto, 2024). This could trigger a change in consumption patterns in the last two decades showing an increase in interest in plant-based protein-based foods (Rizkyanto & Ulfah, 2025).

One of the various local plants that are used as natural dyes is moringa leaves (Moringa Oleifera) emerged as a prime candidate for natural dyes as well as a source of nutrients (Ibrahim et al., 2024). Dubbed the "magic tree," moringa leaves are rich in protein, vitamins A, C, and E, as well as essential minerals such as calcium and iron (Marhaeni, 2021). Its chlorophyll content results in a stable green pigment, while its nutritional profile includes calcium, potassium, magnesium, iron, as well as vitamins A, B, C, D, and E (Gopalakrishnan et al., 2016). Moringa plants can grow from lowlands up to 700 meters above sea level, are drought

resistant for up to 6 months and are easy to breed and do not require intensive maintenance (Marhaeni, 2021), so that it is easy to preserve in Indonesia. In fact, previous studies have shown that moringa leaves have a protein content of 28.25%, beta-carotene 11.93 mg, calcium 2241.19 mg, iron 36.91 mg, and magnesium 28.03 mg (Lutvianti et al., 2024). This makes it a potential solution in the development of various kinds of kunier products, including the famous red bread confectionery in Indonesia, especially in Batam. The natural dye from moringa leaves is healthier and economically valuable because it is seen as a functional food.

Other research results show that proper processing techniques, such as lyophilization, are able to maintain 89.9% β-carotene, 97.8% vitamin C, and 86.7% α-tocopherol, so moringa leaves are suitable as food fortification materials (Grosshagauer et al., 2021). Another study confirms that the process of adding (fortification) traditional foods with moringa leaves is able to increase nutritional value without reducing the taste (Aziz et al., 2024). In addition, moringa leaves also contain natural antioxidants, including ascorbic acid, flavonoids, phenolics, and carotenoids, which play an important role in maintaining a healthy body (Marhaeni, 2021). Quoted from Food Science and Human Wellness In fact, in 2016, moringa leaves were proven to have 7 times more vitamin C content than citrus fruits, contain 10 times more vitamin A than carrots, contain 17 times more calcium than milk, 9 times more protein than yogurt, 15 times more potassium than bananas and 25 times more iron than spinach.

With a high nutritional profile, the use of moringa leaves as an additive to traditional foods has become relevant. Traditional food is often a reflection of a culture's identity, and Roti Jala is one example that reflects Riau's rich Malay culinary heritage (Asyiqin et al., 2025). Its shape that resembles a fishing net reflects the coastal culture, while its unique manufacturing process using perforated strainers creates a distinctive texture (Yuliantoro et al., 2023). According to the book Preservation of Malay Traditional Food Heritage, roti jala is often served at major events, such as weddings, Ramadan or Hari Raya celebrations (Fauzi et al., 2022), due to its distinctive shape and is considered a symbol of good luck and prosperity (Paino et al., 2024).

In this context, the addition of moringa leaf puree to mesh bread not only gives it a natural green color, but also increases its nutritional and antioxidant content. This innovation makes breadcrumbs not just a traditional food, but a functional product that is in line with healthy food trends. However, the challenge is to maintain the balance of chewy texture, flavor, and appearance to keep the original characteristics of the mesh bread, while maintaining the nutrients through the proper processing process. This innovation has the potential to increase product attractiveness, strengthen local culinary competitiveness, and support the optimization of the use of Indonesia's natural resources.

Based on this background, the purpose of this study is to determine the influence of innovation in the use of moringa leaf puree, focusing on the evaluation of organoleptic qualities (color, aroma, taste, and texture) through hedonic quality tests and hedonic tests, in addition to conducting an analysis of macronutrient content (energy, carbohydrates, proteins, and fats). The results of the research are expected to make a scientific contribution to the development of healthy traditional foods, support the preservation of the culinary archipelago, and present innovative solutions to not only the use of moringa leaves as a natural coloring agent, which is certainly an alternative for the local food industry towards healthier and more sustainable products.

METHOD

The experimental research on adding moringa leaf puree (Moringa Olaifera) in the manufacture of mesh bread was carried out in March-August 2025 in Batam. The sample consisted of three treatments, namely the addition of 25% (40 grams), 50% (80 grams), and 75% (120 grams) of total wheat flour in the mesh bread recipe. In product processing, the Roti

Jala recipe is used based on a recipe from a Roti Jala seller at Kopi Ameng Balik Padang, so that the Roti Jala dough still follows the standard of traditional recipes, but is modified with the use of moringa leaf puree.

Table 1. Standard Mesh Bread Recipe

Material	Grammar
Flour	1000 grams
Melted butter	125 grams
Salt	1/2 tablespoon
Yellow dye	Enough
Water	To taste until the texture is liquid

(Source: Roti Jala Seller at Kopi Ameng Balik Padang in 2025)

Table 2. Standard Recipe for the Use of Moringa Leaf Puree in the Making of Mesh Bread

Material	Grammar		
	25%	50%	75%
Flour	160 grams	160 grams	160 grams
Moringa leaves	40 Grams	80 grams	120 grams
Water	245 Grams	257 grams	267 grams
Sugar	15 Grams	15 Grams	15 Grams
Salt	1 gram	1 gram	1 gram
Flavoring	1 gram	1 gram	1 gram
MSG	1 gram	1 gram	1 gram
Evaporated milk	10 Grams	10 Grams	10 Grams
Liquid margarine	25 Grams	25 Grams	25 Grams

(Source: Author 2025)

The process of making moringa leaf puree began by cleaning the moringa leaves in running water and continues with the separation of the moringa leaves with the stalks, then bleaching the moringa leaves until ripe and continued by blending the moringa leaves with water. Next, the ingredients and moringa leaf puree are mixed and then molded and become Moringa Leaf Puree Bread.

The quality assessment was carried out through organoleptic tests involving 6 trained panelists consisting of 3 culinary teaching staff at Batam Tourism Polytechnic, 2 chefs from the Marriott Habourbay Batam hotel and 1 mother who sells net bread in Balik Padang and 9 moderately trained panelists who are students from the culinary study program at Batam Tourism Polytechnic. This is done to assess the aroma, taste, color, and texture of the product. Data were collected using questionnaires and interviews, then analyzed descriptively and statistically (One-Way ANOVA and Ducan Multiple Range Test). The study also includes the analysis of macronutrient content based on the Indonesian Food Composition Table (TKPI) to determine the energy, protein, fat, and carbohydrate content of the final product, by means of the following calculations:

$$\text{Edible Portion (BDD)} = \frac{\text{BDD}}{100} \text{ x Qty}$$

$$\text{Calories} = \frac{\text{BDD Result x Nutrient Value from TKPI}}{\text{BDD}} = \text{result x 0}$$

$$\text{Protein} = \frac{\text{Calorie Result x Nutrient Value from TKPI}}{\text{BDD}} = \text{result x 4}$$

$$\text{Fat} = \frac{\text{Calorie Result x Nutrient Value from TKPI}}{\text{BDD}} = \text{result x 9}$$

$$\text{Carbohydrates} = \frac{\text{Calorie Result x Nutrient Value from TKPI}}{\text{BDD}} = \text{result x 4}$$

RESULTS AND DISCUSSION

The results of the experiment conducted are attached to table 3, the results of the One-Way ANOVA test using SPSS which shows the significance value (Sig.) of the three samples assessed by the joint panelists regarding hedonic quality. The results of the analysis showed that the Sig. value was > 0.05 on the texture which means that there was no significant difference between the samples. However, the Sig. value < 0.05 as in color, aroma and taste identified significant differences between samples. The next test carried out is the post hoc test ducan to see the significant difference can be seen in table 4:

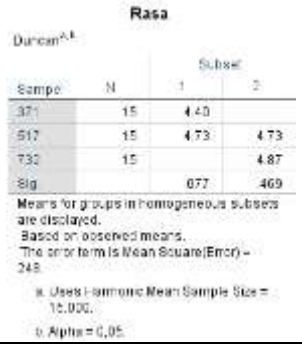
Table 3. Results of the Joint Panelists' Hedonic Quality ANOVA Test

Attribute	Color	Aroma	Texture	Taste
Anova Test	0,015	0,000	0,943	0,044

(Source: Results of SPSS data processing of 2025 researchers)

Table 4. Results of the Joint Panelists' Hedonic Quality Test

Attribute	Ducan Multiple Range Test Data	Research Results
Color	**Warna** Duncan[a,b] Subset Sampel N 1 2 517 15 2.80 371 15 3.20 3.20 732 15 3.73 Sig. .110 .163 Means for groups in homogeneous subsets are displayed. Based on observed means. The error term is Mean Square(Error) = .969. a. Uses Harmonic Mean Sample Size = 15.000. b. Alpha = 0,05	There was a significant difference between the samples (517) and (732) but between the samples (371) and (517) and (732) there was no significant difference. The sample (732) was the sample that was liked by the panelists.
Aroma	**Aroma** Duncan[a,b] Subset Sampel N 1 2 732 15 2.40 517 15 3.53 371 15 4.20 Sig. 1.000 .084 Means for groups in homogeneous subsets are displayed. Based on observed means. The error term is Mean Square(Error) = 1.041. a. Uses Harmonic Mean Sample Size = 15.000. b. Alpha = 0,05	There was a significant difference between the samples (732) and (517) and (371) but between the samples (517) and (371) there was no significant difference. The sample (371) was the sample that was liked by the panelists.
Texture	**Tekstur** Duncan[a,b] Subset Sampel N 1 732 15 4.20 371 15 4.20 517 15 4.27 Sig. .783 Means for groups in homogeneous subsets are displayed. Based on observed means. The error term is Mean Square (Error) = .379. a. Uses Harmonic Mean Sample Size = 15.000. b. Alpha = 0,05	There were no significant differences between the samples (732), (517), and (371). The sample (517) was the sample that was liked by the panelists.

Attribute	Ducan Multiple Range Test Data	Research Results
Taste		There was no significant difference between samples (517) and (371) and (732) but between samples (371) and (732) there was a significant difference. The sample (732) was the sample that was liked by the panelists.

Rasa

Duncan[a,b]

Sampe	N	Subset 1	2
371	15	4.40	
517	15	4.73	4.73
732	15		4.87
Sig		.077	.469

Means for groups in homogeneous subsets are displayed.
Based on observed means.
The error term is Mean Square(Error) = .248.

a. Uses Harmonic Mean Sample Size = 15.000.

b. Alpha = 0,05

(Source: Results of SPSS data processing of 2025 researchers)

The following table is the result of a hedonic test conducted with percentage descriptive analysis using Microsoft Excel to calculate the overall average value of the combined panelists as follows:

Table 5. Combined Panelist Color Hedonic Test

Value Type	Score	732		517		371	
		Number of Panelists	%	Number of Panelists	%	Number of Panelists	%
Very Like	5	5	33%	6	40%	6	40%
Like	4	6	40%	7	47%	4	27%
Somewhat Like	3	4	27%	1	7%	5	33%
Dislike	2	0	0%	1	7%	0	0%
Very Much Dislike	1	0	0%	0	0%	0	0%
Mean		4,1		4,2		4,1	
Panelist Preference Level		81%		84%		81%	

(Source: Microsoft Excel data processing results)

Based on table 5, it shows that samples 732 and 371 have the same level of panelist preference in terms of color, which is 81%, while sample 517 produces the highest level of panelist liking, which is 84%.

Table 6. Combined Panelist Aroma Hedonic Test

Value Type	Score	732		517		371	
		Number of Panelists	%	Number of Panelists	%	Number of Panelists	%
Very Like	5	2	13%	0	0%	1	7%
Like	4	8	53%	8	53%	6	40%
Somewhat Like	3	5	33%	4	27%	7	47%
Dislike	2	0	0%	3	20%	0	0%
Very Much Dislike	1	0	0%	0	0%	0	0%
Mean		3,8		3,3		3,4	
Panelist Preference Level		76%		67%		68%	

(Source: Microsoft Excel data processing results)

Based on table 6, it can be seen that sample 732 is the most preferred sample in terms of aroma with 76%, followed by sample 371 with a lower level of preference of the panelists at 68% and sample 517 with the lowest level of preference of the panelists at 67%.

Table 7. Hedonic Test of Combined Panelist Texture

Value Type	Score	732		517		371	
		Number of Panelists	%	Number of Panelists	%	Number of Panelists	%
Very Like	5	6	40%	6	40%	6	40%
Like	4	7	47%	6	40%	7	47%
Somewhat Like	3	2	13%	3	20%	1	7%
Dislike	2	0	0%	0	0%	1	7%
Very Much Dislike	1	0	0%	0	0%	0	0%
Mean		4,3		4,2		4,2	
Panelist Preference Level		85%		84%		84%	

(Source: Microsoft Excel data processing results)

Based on table 7, it can be seen that sample 732 is the most preferred sample in terms of texture with a score of 85%, followed by sample 371 and sample 517 which produces the same level of preference of panelists which is 84%.

Table 8 Combined Panelist Taste Hedonic Test

Value Type	Score	732		517		371	
		Number of Panelists	%	Number of Panelists	%	Number of Panelists	%
Very Like	5	6	40%	3	20%	3	20%
Like	4	4	27%	8	53%	6	40%
Somewhat Like	3	5	33%	4	27%	4	27%
Dislike	2	0	0%	0	0%	2	13%
Very Much Dislike	1	0	0%	0	0%	0	0%
Mean		4,1		3,9		3,7	
Panelist Preference Level		81%		79%		73%	

(Source: Microsoft Excel data processing results)

Based on table 8, it can be seen that sample 732 is the most preferred sample in terms of taste with a score of 81%, followed by sample 517 which gets a score of 79% and sample 371 which produces the lowest level of panelists' liking at 73%.

Table 9. Accumulated Levels of Preference of Combined Panelists

Rating Categories	Sample		
	732	517	371
Color	81%	84%	81%
Aroma	76%	67%	68%
Texture	85%	84%	84%
Taste	81%	79%	73%
Total	81%	78%	77%

(Source: Microsoft Excel data processing results)

The results of data processing of the Hedonic Test using Microsoft Excel were carried out to find out the level of preference of the combined panelists from various treatment samples, resulting in an accumulation as can be seen in table 9 that sample 732 (25% moringa leaves) became the most preferred sample by the combined panelists with the highest vote, namely with an average of 81% and followed by sample 517 obtained an average of 78% (50% moringa leaves) and sample 371 obtained an average of 77% (75% moringa leaves). So that the accumulation of the level of preference can be seen in table 10 of the comparison of each sample on the organoleptic indicator.

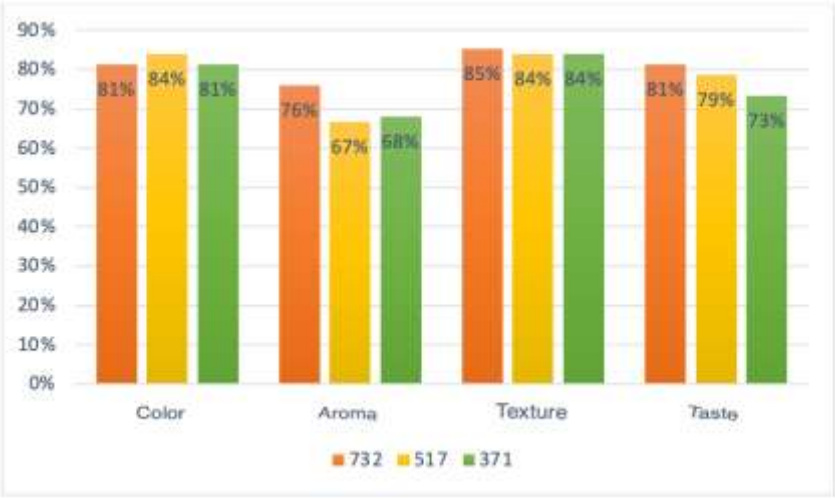


Figure 1. Accumulated Levels of Preference of Joint Panelists
(Source: Microsoft Excel data processing results)

Table 10. Macronutrient Content Analysis Results of 25% Moringa Leaves

Nutritional Value Information					
Moringa Leaf Puree Mesh Bread					
Estimated serving 200 grams / consumption 2-3 times					
No	**Material**	**Energy (Kcal)**	**Carbohydrates (g)**	**Protein (g)**	**Fat (g)**
1	Wheat Flour (160 grams)	533	1645,9	191,9	48,0
2	Moringa Leaves (40 grams)	24,4	9,8	6,0	2,0
3	Water (245 grams)	-	-	-	-
4	Sugar (15 grams)	59,1	222,2	-	-
5	Salt (1 gram)	-	-	-	-
6	Flavoring (1 gram)	-	-	-	-
7	Evaporated Milk (10 grams)	12,5	2,5	1	2,8
8	Liquid Margarine (25 grams)	194,4	-	-	122,5
	Total	823,4	1880,4	198,8	175,2

(Source: Researcher 2025)

Results of the calculation of BDD (Edible Weight) Roti Jala puree Moringa leaves 25% in table 10 produce a total energy of 823.3, total carbohydrates of 1880.4, total protein of 198.8 and total fat of 175.2 per estimated serving of 200 grams.

Table 11. Results of Macronutrient Content Analysis of 50% Moringa Leaves

Nutritional Value Information					
Moringa Leaf Puree Mesh Bread					
Estimated serving 200 grams / consumption 2-3 times					
No	**Material**	**Energy (Kcal)**	**Carbohydrates (g)**	**Protein (g)**	**Fat (g)**
1	Wheat Flour (160 grams)	533	1645,9	191,9	48,0
2	Moringa Leaf (80 grams)	48,8	19,5	11,9	4,0
3	Water (257 grams)	-	-	-	-
4	Sugar (15 grams)	59,1	222,2	-	-
5	Salt (1 gram)	-	-	-	-
6	Flavoring (1 gram)	-	-	-	-
7	Evaporated Milk (10 grams)	12,5	2,5	1	2,8
8	Liquid Margarine (25 grams)	194,4	-	-	122,5
	Total	847,8	1890,1	204,8	177,2

(Source: Researcher 2025)

The results of the calculation of BDD (Edible Weight) of 50% Moringa Leaf Pureed Mesh Bread in table 11 produced total energy of 847.8, total carbohydrates of 1890.1, total protein of 204.8 and total fat of 177.2 per estimated serving of 200 grams.

Table 12. Macronutrient Content Analysis Results of 75% Moringa Leaves

Nutritional Value Information					
Moringa Leaf Puree Mesh Bread					
Estimated serving 200 grams / consumption 2-3 times					
No	**Material**	**Energy (Kcal)**	**Carbohydrates (g)**	**Protein (g)**	**Fat (g)**
1	Wheat Flour (160 grams)	533	1645,9	191,9	48,0
2	Moringa Leaves (120 Grams)	73,2	29,3	17,9	5,9
3	Water (267 grams)	-	-	-	-
4	Sugar (15 grams)	59,1	222,2	-	-
5	Salt (1 gram)	-	-	-	-
6	Flavoring (1 gram)	-	-	-	-
7	Evaporated Milk (10 grams)	12,5	2,5	1	2,8
8	Liquid Margarine (25 grams)	194,4	-	-	122,5
	Total	872,2	1899,9	210,7	179,2

(Source: Researcher 2025)

The results of the calculation of BDD (Edible Weight) of 75% Moringa Leaf puree Mesh Bread in table 1 produced total energy of 872.2, total carbohydrates of 1899.9, total protein of 210.7 and total fat of 179.2 per estimated serving of 200 grams.

CONCLUSION

The study demonstrates that the Adding Moringa Leaf Puree in the making of Roti Jala significantly influences organoleptic characteristics—particularly color, taste, and aroma—based on both hedonic and hedonic quality tests, while texture remains unaffected. The addition of Moringa leaf puree is acceptable as a fortification ingredient, as it enhances the nutritional value of Roti Jala without altering its traditional qualities. This innovation utilizes easily accessible, locally cultivated ingredients like Moringa leaves, thereby supporting the development of healthier, more economically valuable traditional snacks and empowering MSMEs. Future research should focus on standardizing the Moringa leaf puree fortification process to improve product consistency and consumer acceptance on a broader scale.

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