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FERN VEGETABLE PROCESSING INNOVATION IN PASTA MAKING AND AS A SUBSTITUTE FOR BASIL LEAVES IN MAKING PESTO SAUCE

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Abstract

This research aims to develop a modified pesto sauce using ferns as a local ingredient, with the goal of creating an innovative culinary variation. Traditional pesto sauce is typically made with basil leaves; however, to introduce local elements and enrich the flavor, this research uses ferns, a plant that is easily found in Indonesia. The research involves the formulation and trial of a green pasta recipe and pesto sauce using ferns as a substitute for basil, with assessments of taste, texture, aroma, and appearance. The research method includes sensory testing of taste, aroma, texture, and appearance by panelists. After conducting Hedonic Quality Tests with 3 expert panelists and Hedonic Tests with 3 experts and 29 general panelists, the research findings indicate that the fern-based pasta and pesto sauce have met the quality standards for flavor, texture, aroma, and color, with scores exceeding the average of 3.5. Furthermore, the fern pasta and pesto sauce not only offer an intriguing flavor variation but are also well-received and preferred by the panelists. This research demonstrates the potential of ferns as a valuable local alternative in culinary product development, as well as opening new opportunities for the diversification of traditional Indonesian cuisine with an innovative touch.

Keywords: Pasta, pesto sauce, ferns, local ingredients, culinary variation

INTRODUCTION

Cuisine not only fulfills the need for food but also becomes an integral part of society, reflecting the richness of culture and ethnic diversity. Culinary traditions serve not just as a means to enjoy food but also as a cultural element that can be recognized as the identity of a community (Utami, 2018). Recently, there has been a growing awareness of the importance of sustainability in the Indonesian culinary sector (Suroto et al., 2023). With the increasing interest and awareness toward cuisine, there are more opportunities for innovation in culinary products, including the use of local ingredients that may be less known to the broader public in Indonesia.

Fiddlehead fern, a local food ingredient easily found in Indonesia, has a unique texture and flavor (Sompotan, 2024). This green plant with curled tips is a popular ingredient in Indonesia, especially as a side dish for rice (Buchr, 2020). Indonesians usually use fern leaves in various ways, such as eating them raw as a salad, boiling them into clear vegetable soup, cooking them into curry, or processing them into delicious cah fern (Pratoko, 2022). Known for its high nutritional content, including vitamins and minerals essential for the body, fern offers significant health benefits (Makarim, 2022). Traditionally, fern has mostly been used in local dishes, and its application in

modern food industries is still limited (Indrayeni et al., 2020). However, fern is rich in antioxidants, which play an important role in preventing various chronic diseases such as cancer, heart disease, diabetes, Alzheimer's, and stroke (Uzlatus et al., 2021).

Pasta is a food loved by people of all ages (Junizir, 2022). One of the popular processed ingredients in Indonesia is wheat flour, and one well-known product made from wheat flour is pasta (Lestari, 2022). Pasta has become a favored dish in Indonesia due to its flavor combination, ease of preparation, and flexibility in using various ingredients. Pasta is a processed food made from a mixture of wheat flour, eggs, water, and salt, which is then kneaded and shaped into various sizes and forms. Pasta can be combined with various sauces and local ingredients, such as fiddlehead fern. In Indonesia, one of the sauces commonly used for pasta is pesto (Lyliana, 2021b). However, basil leaves, the primary ingredient in pesto, are quite difficult to find (Lyliana, 2021a).

Therefore, this research focuses on the development of fiddlehead fern as a local alternative ingredient for more innovative culinary products, such as green pasta and pesto sauce. The use of local ingredients can reduce production costs and offer more environmentally friendly alternatives (Sinaga, 2024). The aim of this study is to explore the potential of processing fern into green pasta and as a substitute for basil leaves in pesto sauce. This research also aims to explore the aspects of taste, aroma, texture, and color of the resulting products, as well as to determine how much the products are liked by the panelists. Thus, this study aims not only to create new flavors that retain the characteristics of local cuisine but also to provide better nutritional benefits.

RESEARCH METHOD

This study used an experimental method with a case study design to develop and evaluate the quality of green pasta and fern pesto sauce. The data collection and research design consisted of several stages, namely:

1. Literature Review: The literature review is a process of reviewing relevant sources to generate new ideas for research (Salmaa, 2023). In this study, the literature review was conducted to understand the concepts and theories related to the development of culinary products from fern leaves.
2. Preliminary Survey: This survey was conducted to identify the preferences of respondents. Preliminary survey is a process in research with the aim of gaining a more fundamental and in-depth understanding of the phenomena or problems of a case object to be studied (Putra et al., 2021).
3. Observation: Observations were made by directly monitoring the processing, production, and consumption of fern pasta and pesto sauce products to understand real-world practices. Observations were carried out by viewing, counting, recording, noting, measuring events that occurred in the field (Abdi, 2023).
4. Product Trial: Product trials were conducted to ensure the quality of the products. The aim of the product trial was to collect data that would serve as a basis for determining the feasibility of the developed products.
5. Hedonic Quality Test: A hedonic quality test is a sensory analysis used as a variable to assess a product (Rizal Permadi et al., 2019). The hedonic quality test was used to assess the acceptance of fern pasta and pesto sauce by consumers.
6. Hedonic Test: A hedonic test is a sensory analysis used to determine the level of consumer preference for a product (Qamariah et al., 2022). In this study, the hedonic test was used to evaluate consumer preferences for fern pasta and fern pesto sauce.

The data obtained from the Hedonic Quality Test and the Hedonic Test were collected quantitatively and analyzed using descriptive statistical analysis techniques to describe the characteristics of the organoleptic test. The analysis step involved calculating the average score of the panelists for each criterion (taste, aroma, texture, and color) for both products. The data collection instrument used was Google Forms with a Likert scale of 1-6, ranging from strongly disagree to strongly agree, as well as from strongly dislike to strongly like.

RESULT AND DISCUSSION

The innovation of Fiddlehead fern processing in making pasta and pesto sauce begins with designing the design of both products. The first product, fern green pasta must have a soft and neutral aroma specification with a neutral and slightly savory taste, and a chewy, soft texture that is not easily broken. This pasta must have a fresh and attractive green appearance. The ingredients used and the steps in the first trial of making green pasta are listed in the following table:

Table 1. Fiddlehead Fern Green Pasta Recipe

Fiddlehead Fern Green Pasta		
Ingredient	**Quantity**	**Unit**
High-protein wheat flour	200	Grams
Olive oil	5	Ml
Water	120	Ml
Fiddlehead ferns	50	Grams
Salt	1	Tsp

Instructions:
1. Blend the fiddlehead ferns with water using a blender, then strain to obtain fiddlehead juice (without the pulp).
2. Mix the wheat flour, olive oil, and fiddlehead juice.
3. Knead the dough until smooth and elastic, then let it rest for 15 minutes to make it easier to shape. Cover the dough with a damp cloth to prevent it from drying out.
4. Roll the pasta dough to a thickness of 3 mm using a pasta rolling machine.
5. Cut the pasta dough into thin strips using a pasta cutting machine.
6. Boil water until it reaches a rolling boil, add 1 tsp of salt, and cook the pasta for 4 minutes.
7. Remove the cooked pasta, and it is ready to serve.

Note: Use high-protein wheat flour to ensure better water absorption, ease of kneading, and a result that is elastic and not easily broken.

Source: Data Proccesing (2024)

Figure 1. First Trial of Fiddlehead Fern Green Pasta
Source: Data Processing (2024)

Meanwhile, the fern pesto sauce should have a neutral aroma with a hint of cheese and garlic. In terms of taste, this pesto sauce should have a balanced flavor, combining the fresh taste of fern, the nuttiness of sunflower seeds, and the savory taste of Parmesan cheese, with a smooth and soft texture and a bright, fresh color that is not pale. The ingredients and steps for the first trial of making pesto sauce from ferns are listed in the table below:

Table 2. Fiddlehead Fern Pesto Sauce Recipe

Fiddlehead Fern Pesto Sauce		
Ingredient	**Quantity**	**Unit**
Fiddlehead ferns	100	Grams
Garlic	30	Grams
Parmesan cheese	15	Grams
Sunflower seeds	20	Grams
Olive oil	100	Ml
Salt	1	Tsp
White pepper	1/4	Tsp
Lemon juice	1/2	Tbsp
Instructions: 1. Soak the fiddlehead ferns with ½ tsp of salt for 5 minutes to remove the sap. 2. Rinse the soaked fiddlehead ferns thoroughly. 3. Blanch the fiddlehead ferns for 2 minutes to preserve the fresh green color of the ferns. 4. Blend the fiddlehead ferns with garlic, Parmesan cheese, sunflower seeds, olive oil, salt, white pepper, and lemon juice. 5. Cook the pesto sauce before serving.		
Note: The pesto sauce can be served with pasta or other dishes.		

Source: Data processing (2024)

Figure 2. First Trial of Fiddlehead Fern Pesto Sauce
Source: Data Processing (2024)

After the first trial, the design validation was conducted by 3 expert panelists who assessed the product quality through a Hedonic Quality Test. Expert panelists typically consist of 3-5 individuals who are well-versed in the factors influencing organoleptic evaluation and understand the impact of raw materials and processing methods on the final product (Khairunnisa & Arbi, 2021). The following table shows the results of the Hedonic Quality Test evaluation for the two products by 3 expert panelists:

Table 3. Hedonic Quality Test Results of Fiddlehead Fern Green Pasta

Aroma of Fiddlehead Fern Pasta				
		Frequency	Percent	Mean
Valid	Like	1	33.3	
	Loved it.	2	66.6	
	Total	3	100	5.66
Taste of Fiddlehead Fern Pasta				
		Frequency	Percent	Mean
Valid	Like	1	33.3	
	Loved it.	2	66.6	
	Total	3	100	5.66
Texture of Fiddlehead Fern Pasta				
		Frequency	Percent	Mean
Valid	Average	1	33.3	
	Loved it.	2	66.6	
	Total	3	100	5.66
Color of Fiddlehead Fern Pasta				
		Frequency	Percent	Mean

Valid	Like	1	33.3	
	Loved it.	2	66.6	
	Total	3	100	5.66

Source: Data Proccesing (2024)

Table 4. Hedonic Quality Test Results of Fiddlehead Fern Pesto Sauce

Aroma of Fiddlehead Fern Pesto Sauce				
		Frequency	Percent	Mean
Valid	Like	1	33.3	
	Loved it.	2	66.6	
	Total	3	100	5.66
Taste of Fiddlehead Fern Pesto Sauce				
		Frequency	Percent	Mean
Valid	Like	1	33.3	
	Loved it.	2	66.6	
	Total	3	100	5.66
Texture of Fiddlehead Fern Pesto Sauce				
		Frequency	Percent	Mean
Valid	Average	1	33.3	
	Loved it.	2	66.6	
	Total	3	100	5.66
Color of Fiddlehead Fern Pesto Sauce				
		Frequency	Percent	Mean
Valid	Like	1	33.3	
	Loved it.	2	66.6	
	Total	3	100	5.66

Source: Data Proccesing (2024)

It can be seen from both tables that the average evaluation scores for aroma, taste, texture, and color have exceeded 3.5. Revisions were made to refine the products: for the green pasta, improvements were made to address the pale color, while for the fern pesto sauce, revisions were focused on the texture, which was not smooth enough, and the flavor and aroma of Parmesan cheese, which were too dominant.

In the second trial of the green fern pasta, revisions were made to the processing of the fern pulp, which had not been used in the first trial. In the second trial, the fern pulp was mixed into the pasta dough. Meanwhile, in the second trial of the fern pesto sauce, revisions were made to the quantity of several ingredients: Parmesan cheese was reduced from 15g to 10g, sunflower seeds increased from 20g to 25g, olive oil from 85g to 100g, and lemon juice from 1/2 tbsp to 3/4 tbsp.

Figure 3. Second Trial of Fiddlehead Fern Green Pasta

Source: Data Processing (2024)

Figure 4. Second Trial of Fiddlehead Fern Pesto Sauce

Source: Data Processing (2024)

After these revisions, a Hedonic Quality Test was conducted again by 3 expert panelists on both products. The following table shows the results of the second-stage Hedonic Quality Test evaluation:

Table 5. Hedonic Quality Test Results II of Fiddlehead Fern Green Pasta

Aroma of Fiddlehead Fern Pasta				
		Frequency	Percent	Mean
Valid	Like	1	33.3	
	Loved it.	2	66.6	
	Total	3	100	5.66
Taste of Fiddlehead Fern Pasta				
		Frequency	Percent	Mean
Valid	Like	1	33.3	
	Loved it.	2	66.6	
	Total	3	100	5.66
Texture of Fiddlehead Fern Pasta				
		Frequency	Percent	Mean
Valid	Like	1	33.3	
	Loved it.	2	66.6	
	Total	3	100	5.66
Color of Fiddlehead Fern Pasta				
		Frequency	Percent	Mean
Valid	Like	1	33.3	
	Loved it.	2	66.6	
	Total	3	100	5.66

Source: Data Proccesing (2024)

Table 6. Hedonic Quality Test Results II of Fiddlehead Fern Pesto Sauce

Aroma of Fiddlehead Fern Pesto Sauce				
		Frequency	Percent	Mean
Valid	Like	1	33.3	
	Loved it.	2	66.6	
	Total	3	100	5.66
Taste of Fiddlehead Fern Pesto Sauce				
		Frequency	Percent	Mean
Valid	Like	1	33.3	
	Loved it.	2	66.6	
	Total	3	100	5.66
Texture of Fiddlehead Fern Pesto Sauce				
		Frequency	Percent	Mean
Valid	Like	1	33.3	
	Loved it.	2	66.6	
	Total	3	100	5.66
Color of Fiddlehead Fern Pesto Sauce				
		Frequency	Percent	*Mean*
Valid	Like	1	33.3	
	Loved it.	2	66.6	
	Total	3	100	5.66

Source: Data Proccesing (2024)

It can be seen from both tables that the average evaluation scores for aroma, taste, texture, and color in both products have exceeded 3.5. Both products also meet the specifications for aroma, taste, texture, and color. Next, a Hedonic Test was conducted with 3 expert panelists and 29 general panelists. The general panelists were only allowed to assess simpler organoleptic attributes, such as preference, and the panel consisted of more than 25 non-expert individuals (Khairunnisa & Arbi, 2021).

Figure 5. Hedonic Test of Fiddlehead Fern Green Pasta
Source: Data Proccesing (2024)

The following table shows the results of the Hedonic Test evaluation by 32 panelists in the second-stage testing:

Table 7. Hedonic Test Results of Fiddlehead Fern Green Pasta

Aroma of Fiddlehead Fern Pasta				
		Frequency	Percent	*Mean*
Valid	Dislike	1	3.1	
	Not really like	1	3.1	
	Quite liked	4	12.5	
	Like	8	25	
	Loved it.	18	56	
	Total	32	100	5.28
Taste of Fiddlehead Fern Pasta				
		Frequency	Percent	*Mean*
Valid	Not really like	1	3.1	
	Quite liked	7	21.9	
	Like	9	28.1	
	Loved it.	15	46.9	
	Total	32	100	5.18
Texture of Fiddlehead Fern Pasta				
		Frequency	Percent	*Mean*
Valid	Not really like	2	6.3	
	Quite liked	7	21.9	
	Like	6	18.8	
	Loved it.	17	53.1	

	Total	32	100	5.18
Color of Fiddlehead Fern Pasta				
		Frequency	Percent	*Mean*
Valid	Dislike	2	6.3	
	Quite liked	5	15.6	
	Like	8	25	
	Loved it.	17	53.1	
	Total	32	100	

Source: Data Proccesing (2024)

Figure 6. Hedonic Test of Fiddlehead Fern Pesto Sauce
Source: Data Proccesing (2024)

Table 8. Hedonic Test Results of Fiddlehead Fern Pesto Sauce

Aroma of Fiddlehead Fern Pesto Sauce				
		Frequency	Percent	*Mean*
Valid	Very much disliked	1	3.1	
	Not really like	1	3.1	
	Quite liked	7	21.9	
	Like	11	34.4	
	Loved it.	12	37.5	
	Total	32	100	4.96
Taste of Fiddlehead Fern Pesto Sauce				
		Frequency	Percent	*Mean*
Valid	Very much disliked	1	3.1	
	Not really like	1	3.1	
	Quite liked	5	15.6	
	Like	10	31.3	
	Loved it.	15	46.9	
	Total	32	100	4.96
Texture of Fiddlehead Fern Pesto Sauce				
		Frequency	Percent	*Mean*
	Dislike	1	3.1	
	Not really like	1	3.1	

Valid	Quite liked	4	12.5	
	Like	8	25	
	Loved it.	18	56.3	
	Total	32	100	5.28

Color of Fiddlehead Fern Pesto Sauce

		Frequency	Percent	*Mean*
Valid	Dislike	1	3.1	
	Not really like	2	6.3	
	Quite liked	2	6.3	
	Like	10	31.3	
	Loved it.	17	53	
	Total	32	100	5.25

Source: Data Proccesing (2024)

It can be seen from both tables that the average scores of the Hedonic Test for the green pasta and fern pesto sauce are above 3.5. This indicates that both products were favored by the panelists in terms of aroma, taste, texture, and color.

CONCLUSION AND IMPLICATION

After conducting two trials, it can be concluded that fiddlehead fern leaves can be used as a substitute for basil in pesto sauce production and can serve as an innovation in making green pasta. The hedonic quality test was performed with 3 expert panelists and 29 general panelists who were pasta and pesto sauce enthusiasts. The results showed that the texture, aroma, taste, and color appearance of both the fern pesto sauce and the green pasta were well-liked by the panelists. The fern pesto sauce and green pasta products also met the quality criteria in terms of taste, texture, aroma, and color.

The resulting green pasta has a soft, neutral aroma with a slightly savory taste, and a chewy, tender texture that does not easily break. Additionally, the pasta has a bright, fresh green color that enhances the visual appeal of the dish. Meanwhile, the fern pesto sauce has a neutral aroma with hints of cheese, garlic, and lemon, creating a fresh and appetizing scent. The taste of the pesto sauce is fresh, nutty, and savory, with a smooth and creamy texture, providing a satisfying eating experience. The fern pesto sauce also has a bright, natural green color that adds to the overall attractiveness of the dish.

Overall, the results of this trial show that using fern leaves as a base ingredient in making pesto sauce and green pasta not only provides a healthy and innovative alternative but also results in products with excellent taste and appearance that are highly favored by pasta and pesto enthusiasts. Therefore, fern leaves have great potential to be used as raw material in the development of new culinary products that are commercially viable and nutritious.

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