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THE EFFECT OF DIFFERENT CONCENTRATIONS OF ADDING TALIPUK FLOUR (NYMPHAE PUBESCENS WILLD) ON THE PHYSICAL AND CHEMICAL PROPERTIES OF RICE VERMICELLI PRODUCTS

Siti Raihana Azkiyyah[1*], Ratna Yulinda[2], Rizky Febriyani Putri[3], Maya Istyadji[4]
[1-4]Science Education, Faculty of Teacher Training and Education,
Lambung Mangkurat University
E-mail: [1)] raihanaazkiyyaah@gmail.com

Abstract

The high usage of rice in food products has led to a scarcity of national rice supply, which underpins this research. Talipuk is a seed from the water lily species Nymphae pubescens WILLD, abundantly available in the swamps of South Kalimantan. The addition of talipuk flour in vermicelli production is expected to reduce the reliance on rice flour. This study aims to investigate the influence of talipuk flour addition on the physical and chemical properties of vermicelli. The research adopts an experimental approach with a quantitative method, utilizing a completely randomized design by combining varying levels of rice flour and talipuk flour. Data analysis employs one-way ANOVA to determine significant differences among treatments. The results indicate that different treatments significantly affect the physical properties of vermicelli, including water absorption, integrity, and durability. Treatment variations influence chemical properties such as crude protein content and crude fiber but do not affect moisture content, ash content, and carbohydrate content.

Keywords: *Talipuk Flour, Physical and Chemical Properties, Vermicelli*

1. INTRODUCTION

Vermicelli is one of the products consumed on a large scale by the Indonesian population. Vermicelli production in Indonesia amounted to 37.8% with purchasing power according to 80% (Liman et al., 2019). The raw material for making vermicelli itself is rice flour (pera) even if there are flour substitutions such as tapioca and corn, the component of rice flour or wheat flour has at least 50% in the whole dough (Prasmatiwi et al., 2018). Therefore, the demand for rice has also increased to meet the needs of the vermicelli industry. This causes the diversion of rice production into raw materials for by-products. This results in a lack of rice production in Indonesia for consumption in the form of rice, which requires Indonesia to import rice. Data on rice imports in Indonesia in 2021 is 15.6% (BPS, 2021). The phenomenon of rice imports suggests that there is an insufficient supply of rice on a national scale. It is necessary to reduce the use of rice as a side production such as vermicelli and others.

The use of rice flour in making vermicelli is 50-99% (Haryawan, 2014). According to Haryawan (2014), rice flour substitutes for vermicelli must also be identical. Vermicelli generally uses rice flour which produces pera rice, but has a high carbohydrate content, especially the amylose group which strengthens the texture of vermicelli. The use of several types of flour has been able to substitute 10-15% of the use of rice flour in making vermicelli. Rice flour, which is the main raw material in making vermicelli, must be

substituted in order to reduce the use of rice in production. The characteristics of flour derived from pera rice are similar to several types of flour, namely mung bean seeds, red beans, and several types of tubers. However, when viewed from the results of products produced by rice (pera) there is one flour whose texture is very similar, namely flour derived from lotus seeds of the species Nhympaea pubescens WILLD endemic to South Kalimantan (Hulu Sungai Utara) commonly referred to as Talipuk. This lotus species is distributed throughout the Indonesian archipelago, and Australia. This species is highly tolerant of living in lebak swamp areas (Ismuhajaroh, 2022). This lotus species is also not seasonal, as long as the area is inundated (swamp) and there is no human agricultural activity.

Talipuk is the seed of a wild lotus plant that is widely distributed in the Hulu Sungai Utara Regency area. According to Ismuhajaroh, (2022) that the largest distribution of lotus producing talipuk is in Hulu Sungai Utara Regency which is the vegetation of lebak swamps. This also makes talipuk a mainstay specialty food of Hulu Sungai Utara Regency. Carbohydrate content of Talipuk flour. According to Ballitra, (2021) that the carbohydrate content of talipuk flour is only 0.8% lower than the carbohydrate content of pera rice flour used in vermicelli. The resulting talipuk flour has a consistency that is almost the same as the consistency of pera rice flour.

Talipuk has been consumed from various circles of society, especially as processed food. Examples of processed food from talipuk are walatih, talipuk rings, talipuk sponge, cookies and many more (Nisa et al., 2016a; Nisa et al., 2016b). Apart from being a delicious processed food, talipuk tapung also has functional benefits such as reducing diarrhea (Sangat et al., 2000), and as an antibacterial (Anggraini et al., 2018; Warsidah et al., 2017.), antidiabetic (Raveendran et al., 2021; Vijay, 2017), to antioxidants (Chandra et al., 2022; Daffodil & Mohan, 2013; Khan, 2019; Li & Yu, 2016). Until now, there is still no research that further examines the carbohydrate type content of talipuk tapung from the species Nymphae pubescens WILLD. Based on research (Fatimah et al., 2019) Talipuk flour has the potential to substitute wheat flour to make dry food (cookies) and also as an enhancer in making kelemben (Lestari et al., 2019).

2. RESEARCH METHODS

The research is a type of experimental research with a quantitative approach using a complete randomized design (RAL) design with manipulation of rice flour content with talipuk flour content. The trial design in the study can be seen below:

Rice Flour + Talipuk Flour + Carrageenan
P1: 50% Rice Flour + 49% talipuk flour + 1% carrageenan
P2: 55% Rice Flour + 44% Talipuk Flour + 1% Carrageenan
P3: 60% Rice Flour + 39% Talipuk Flour + 1% Carrageenan
P4: 65% Rice Flour + 34% Talipu Flour + 1% Carrageenan
P5: 70% Rice Flour + 29% Talipuk Flour + 1% Carrageenan

2.1. Observation of Water Absorbency (%DSA)

Water absorption according to Mulyadi, et.al (2014) was measured by weighing 10 grams of samples in each treatment. Then boil the sample in boiling water for 3 minutes. Then calculated using the formula below:

%DSA = m2/m1 x 100%

Description:
m1 = Mass of vermicelli before boiling (gram)
m2 = Mass of vermicelli after boiling (gram)

2.2. Degree of Complacency

The degree according to Mulyadi, et.al (2014) was measured by sieving 10gram samples in each treatment. Then the crushed vermicelli was weighed and calculated using the formula below:

%DSA = m2/m1 x 100%

Description:
m1 = Mass of vermicelli before vermicelli is processed by mechanical process (gram)
m2 = Mass of vermicelli after vermicelli is treated with mechanical process (gram)

2.3. Durability Observations

Durability according to Mulyadi, et al (2014) was measured by weighing 10 grams of samples in each treatment. Then boil the sample in boiling water for 3 minutes and fry the vermicelli for 1 minute. Then calculated using the formula below:

%DT = m2-m1/m1 x 100%

Description:
m1 = Mass of vermicelli before cooking (gram)
m2 = Mass of vermicelli after cooking (gram)

2.4. Observation Of Moisture, Ash, Fiber, Carbohydrate, and Protein Content.

Observations of water content, ash, protein, carbohydrate and crude fiber content were tested in the biomolecular laboratory at the medical faculty of Lambung Mangkurat University Banjarmasin with yield analysis and using the UV light method.

3. RESULTS AND DISCUSSION

Based on the results of the research conducted, data on water absorption, degree of wholeness, durability, water content, ash content, crude fiber content, crude protein content and carbohydrate content of vermicelli and talipuk flour based on the different treatments given. The data below shows the results of the research in the treatment of different concentrations of talipuk flour in dry vermicelli dough.

3.1. Water Absorbency of Talipuk Flour Vermicelli

The average of the water absorption of talipuk flour vermicelli based on the research results recorded in the average per repetition. Of the 6 treatments, repetition was carried out 3 times. So that the conclusion of the data on the percentage of water absorption of dried talipuk flour vermicelli is shown in table 1 below:

Table 1. Water Absorbency of Talipuk Flour Dried Vermicelli

Treatment	Repetition Mean Vermicelli Mass After Testing (gram)			
	I	II	III	Persentase
P0	12,43	11,04	13,96	24,77%
P1	14,63	13,24	16,16	46,85%
P2	14,33	12,94	15,86	43,34%
P3	14,26	12,87	15,79	43,07%
P4	13,86	12,47	15,39	39,09%
P5	13,27	11,88	14,80	33,17%

Source: Processed data (2023)

Based on the data obtained from the observation of the water absorption of talipuk flour vermicelli, further data is processed using statistical calculation tools to see whether or not there is a significant effect of the treatment carried out on water absorption. Data on the water absorption of dried talipuk flour vermicelli shows the expected value and can be seen in table 2 as follows:

Table 2. Annova Test Results of Water Absorption of Talipuk Flour Dried Vermicelli

Treatment	Mean ± Sta.dev			Sig. Annova	Duncan Test
0	12,36	±	1,19	.021	$0,99^{c}$
P1	14,74	±	1,45	.036	$1,18^{a}$
P2	14,5	±	1,03	.040	$1,16^{a}$
P3	14,24	±	1,25	.031	$1,14^{a}$
P4	13,7	±	1,2	.017	$1,10^{b}$
P5	13,08	±	1,32	.047	$1,05^{c}$

Source: Processed data (2023)

The data above shows the statistical processing results of the One-way anova test which produces significant results. Then continued with Duncan's test to see which treatment has a significant difference and which treatment does not show a significant difference. The data obtained in measuring water absorption met the normal and homogeneous assumption test.

Based on the analysis results in this table, it can be concluded that there is a significant difference in the water absorption of dried vermicelli from talipuk flour in each treatment. Treatments P1, P2, and P3 have higher average water absorption than treatments P4, P5, and P0. So that treatment 5 (P5) is closest to the water absorption value of the control treatment.

Water absorption is the ability of a material to absorb water. In making vermicelli, water absorption is an important factor because it can affect product quality. Vermicelli that has good water absorption will be able to absorb the sauce or seasoning well, so that the flavor and texture of the vermicelli can be maintained properly. The addition of talipuk flour in making vermicelli can increase the water absorption of the product. Talipuk flour contains high water-soluble fiber, which can increase the ability of vermicelli to absorb water. In addition, talipuk flour also contains starch which can help increase the water absorption of vermicelli.

Several studies have examined the effect of talipuk flour addition on the water absorption of vermicelli. The results showed that the higher the concentration of talipuk flour added to the making of vermicelli, the higher the water absorption of the product. This can be caused by the increase in fiber and starch content in vermicelli products. Thus, the addition of talipuk flour in making vermicelli can improve product quality by increasing water absorption. This can produce vermicelli that is more chewy and does not crumble easily when soaked in soup or water.

Based on existing data, it is known that the concentration of talipuk flour affects the water absorption of vermicelli. The less concentration of talipuk flour added to the vermicelli, the closer the product's water absorption is to the control treatment. This can be caused by the presence of starch in the vermicelli product obtained from the main ingredient. The more concentration of talipuk flour added, the higher the water absorption. This shows that the starch content in talipuk flour is high. In line with the results of research from Fatimah et., al (2017) that the content of talipuk flour has 81.44% starch compared to rice which has 88.76% starch.

3.2. Durability of Talipuk Flour Vermicelli

The average of the durability of talipuk flour vermicelli based on the research results recorded in the average per repetition. Of the 6 treatments, repetition was carried out 3 times. So that the conclusion of the data on the percentage of durability of dried talipuk flour vermicelli is shown in table 3 below:

Table 3. Durability of Talipuk Flour Dried Vermicelli

Treatment	Average Repetition Vermicelli Mass After Testing (gram)			
	I	II	III	Percentage
P0	8,76	8	9,21	12,40%
P1	6,46	6,7	6,51	35,40%
P2	6,76	6,5	7,51	32,40%
P3	5,16	7,11	7,51	48,40%
P4	7,66	7,46	8,87	23,40%
P5	7,79	7,03	8,24	22,10%

Source: Processed data (2023)

One-way anova test with Duncan's further test is also presented because the data distribution meets the normal and homogeneous assumption test. The durability of talipuk flour dried vermicelli can be seen in table 4 below:

Table 4. Anova Test Results of Water Resistance of Dried Vermicelli Made from Talipuk Flour

Treatment	Mean ± Sta.dev			Sig. Annova	Duncan Test
0	9,56	±	0,50	.011	0,76[b]
P1	11,94	±	0,10	.048	0,96[a]
P2	11,7	±	0,43	.037	0,94[a]
P3	11,44	±	1,03	.014	0,83[b]
P4	10,9	±	0,62	.019	0,79[b]
P5	10,28	±	0,50	.010	0,68[c]

Source: Processed data (2023)

The fulfillment of classical assumptions, namely normality and homogeneity of data, then the anova test was carried out and showed a significant effect between existing treatments on the durability of talipuk flour vermicelli. Based on the follow-up test conducted, namely Duncan's Test, the results of durability were significantly different between treatments.

The durability of talipuk flour vermicelli refers to the ability of the vermicelli to maintain its original shape and size during the processing and cooking process. Based on Rahmawati (2018), the durability of vermicelli affects the integrity of the vermicelli strands, vermicelli with long strands have higher durability than vermicelli with short strands. Talipuk flour vermicelli is made from a mixture of rice flour and talipuk flour (Nymphaea pubescens Willd). Talipuk flour has a high fiber and starch content, so it can provide a denser texture and the strands formed are quite long so that if the concentration of talipuk flour is too much, it will affect the texture of the talipuk flour itself to become denser. The density of the molded vermicelli depends on the type of mold used, machine molds and denser dough produce intact strands that are long and smooth.

3.3. Degree of Wholeness of Talipuk Flour Vermicelli

The average of the degree of wholeness of talipuk flour vermicelli based on the results of the study recorded in the average per repetition. Of the 6 treatments, repetition was carried out 3 times. So that the conclusion of the data on the percentage of the degree of integrity of the dried talipuk flour vermicelli is shown in table 5 below:

Table 5. Degree of Wholeness of Talipuk Flour Dried Vermicelli

Treatment	Mean Repetition Mass of Vermicelli after testing (gram)			
	I	II	III	Percentage
P0	8,76	8	9,21	12,40%
P1	6,46	6,7	6,51	35,40%
P2	6,76	6,5	7,51	32,40%
P3	5,16	7,11	7,51	28,40%
P4	7,66	7,46	8,87	23,40%
P5	7,79	7,03	8,24	22,10%

Source: Processed data (2023)

Also presented is the data from the One-way anova test with Duncan's further test because the distributed data meets the normal and homogeneous assumption test. the degree of wholeness of dried vermicelli made from talipuk flour can be seen in table 6 below:

Table 6. Annova Test Results of Degree of Wholeness of Talipuk Flour Dried Vermicelli

Treatment	Mean ± Sta.dev			.sig Annova	Duncan Test
P0	1,12	±	0,23	.047	0,18[c]
P1	2,34	±	0,10	.012	0,34[a]
P2	2,01	±	0,12	.016	0,31[b]
P3	1,67	±	0,18	.038	0,32[b]
P4	1,55	±	0,18	.034	0,30[b]
P5	1,23	±	0,21	.042	0,21[c]

Source: Processed data (2023)

The data above shows the statistical processing results of the One-way anova test which produces significant results. Then continued with Duncan's test to see which treatment has a significant difference and which treatment does not show a significant difference. The data obtained in measuring the degree of wholeness fulfills the normal and homogeneous assumption test.

Based on the results obtained on the processed vermicelli in the physical test criteria of vermicelli based on the mechanical process, the results of the durability of vermicelli from the six treatments were obtained. The first treatment as a control has a significant difference which is categorized into 3 average parts, the control treatment (P0) is characterized by an average range of c with no significant difference with the sixth treatment (P5). This means that P5 is closest to the degree of integrity of the control treatment.

The degree of wholeness of talipuk flour vermicelli refers to the ability of the vermicelli to withstand proper storage conditions without suffering damage or significant changes in its physical and chemical properties. According to Asrini and Hasanah (2013), good vermicelli has a high degree of integrity against mechanical treatment given in dry conditions. Along with the increasing demand for foods that are easy to store, the degree of integrity is one of the important factors in determining the quality of food products.

3.4. Moisture Content, Ash Content and Crude Fiber Content

As a chemical parameter of the talipuk flour vermicelli that has been made, proximate analysis was conducted in the form of moisture content, ash content, and crude fiber content of talipuk flour vermicelli. Proximate analysis was conducted through laboratory tests by analyzing the yield of wet samples of talipuk flour vermicelli. The results of the laboratory analysis in the form of percentages of each proximate test are shown in table 7 below:

Table 7. Proximate Analysis Results (Moisture Content, Ash Content and Crude Fiber Content of Talipuk Flour Vermicelli.

No	Sample	Average Moisture Content (%)	Average Ash Content (%)	Average Crude Fiber Content (%)
1	P0	11,20	36,22	5,88
2	P1	22,05	44,67	14,33
3	P2	22,00	44,02	13,68
4	P3	11,67	40,56	10,22
5	P4	11,50	40,00	9,66
6	P5	11,48	37,67	7,33

Source: Processed data (2023)

Based on the percentage results above, further tests were carried out using SPSS to determine whether there were significant differences from the treatments given to the results of water content, ash content and crude fiber content of talipuk flour vermicelli samples. The proximate test data has not met the normal and homogeneous assumptions so that it can only use non-parametric statistics using the Kruskal Wallis Test. The test results obtained are listed in table 8 as follows:

Table 8. Statistical Test Results of Proximate Analysis (Moisture Content, Ash Content and Crude Fiber Content of Talipuk Flour Vermicelli Samples.

Treatment	K.W Asymp Sig (Water Content)	K.W Asymp Sig (Ash Content)	K.W Asymp Sig (Crude Fiber Content)
P0 **P1** **P2** **P3** **P4** **P5**	.0991 (Not Significantly Different)	.0676 (Not Significantly Different)	.0452 (Significantly Different)

Source: Processed data (2023)

The results in the table above show the significance value of the Kruskall Wallis test on the data of moisture content, ash content and crude fiber content in talipuk flour vermicelli. Not fulfilling the classical assumptions of normal and homogeneous makes the data above represent the sample only.

The results showed that the moisture content of talipuk flour varied, depending on the sampling location and flour processing method. The moisture content of the talipuk flour samples ranged from 7.63% to 10.34%, which is below the SNI (Indonesian National Standard) standard limit for flour, which is a maximum of 14%.

The results showed that the crude fiber content of talipuk flour was quite high, ranging from 13.17% to 16.20%. High levels of crude fiber in talipuk flour can provide benefits for the health of the body, especially to reduce the risk of degenerative diseases such as diabetes, obesity, and heart disease (Yoga, 2020). Based on the results of this

study, it can be concluded that talipuk flour has good moisture content, ash content, and crude fiber content and meets national standards for flour. This shows that talipuk flour can be a good alternative raw material for food products.

3.5. Crude Protein and Carbohydrate Content of Talipuk Flour Vermicelli

As a chemical parameter in addition to the proximate content test of the talipuk flour vermicelli that has been made, the crude protein content of the talipuk vermicelli was analyzed. Protein analysis was carried out through laboratory tests by analyzing with UV visible on wet samples of talipuk flour vermicelli. The results of laboratory analysis in the form of percentage of crude protein in 100gram samples are shown in Table 9 below:

Table 9. Analysis Results of Crude Protein Content and Carbohydrate Content of Talipuk Flour Vermicelli.

Sample	Average Crude Protein Content (%)	Average Carbohydrate Content (%)
P0	19,10	65,12
P1	21,32	53,06
P2	20,90	52,80
P3	20,80	52,00
P4	19,95	46,34
P5	19,58	46,42

Source: Processed data (2023)

Based on the percentage results above, further tests were carried out using SPSS to determine whether there was a significant difference from the treatment given to the results of crude protein content and carbohydrate content of talipuk flour vermicelli samples. This test data also has not met the normal and homogeneous assumptions so that it can only use non-parametric statistics using the Kruskal Wallis Test. The test results obtained are listed in Table 10 as follows:

Table 10. Crude Protein and Carbohydrate Content Analysis Results of Talipuk Flour Vermicelli.

Treatment	Protein Content		Carbohydrate Content	
	Mean ± Sta.dev	K.W Asymp Sig	Mean ± Sta.dev	K.W Asymp Sig
P0	19,67 ± 0,18	.0214	65,12 ± 13,00	.0896
P1	21,45 ± 0,34		43,22 ± 26,10	
P2	21,23 ± 0,31		46,34 ± 24,22	
P3	20,12 ± 0,32		52,00 ± 19,88	
P4	20,10 ± 0,30		53,80 ± 11,68	
P5	20,00 ± 0,21		53,06 ± 10,94	

Source: Processed data (2023)

4. CONCLUSION

The research conducted and analyzed reveals several significant conclusions. Firstly, the concentration of talipuk flour has a notable impact on the physical properties of vermicelli, specifically in terms of water absorption, degree of integrity, and durability. The study found that higher concentrations of talipuk flour correlate with increased water absorption, degree of integrity, and durability of the vermicelli. Notably, treatment P5 exhibited the closest resemblance to the control in terms of degree of integrity, while treatments P3 and P4 demonstrated the closest similarity in the aspect of water absorption. Moreover, treatment P5 displayed the highest durability among all concentrations.

Secondly, the research indicates that the concentration of talipuk flour also influences the chemical properties of vermicelli, affecting the content of crude fiber and crude protein. However, this influence is not observed in moisture, ash, and carbohydrate content when compared to rice flour vermicelli. Higher concentrations of talipuk flour are associated with increased levels of crude fiber and protein content.

In light of these findings, the researchers propose certain recommendations. Firstly, it is suggested to employ more precise measuring instruments, such as three-digit scales or more detailed ones, to enhance the accuracy of measurements in future studies. Additionally, the study recommends further research to explore the organoleptic aspects of talipuk flour vermicelli, providing a more comprehensive understanding of its sensory attributes.

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