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The Effect Of The Comparison Of Binders In The Manufacture Of Carp Rolade *(Cyprinus Carpio)* On The Physical Properties And Consumer Acceptability

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Abstract
This research aims to analyze the effect of binder ratio in the making of carp fish roulade on the physical properties and consumer acceptance. The research was conducted at the Food Processing Laboratory, Department of Culinary Education, Universitas Negeri Jakarta. The research period began in August 2023 and ended in June 2024. The method used in this research was experimental. The research sample used grass carp roulade with a binder ratio between tapioca flour and wheat flour at 1:1, 2:1, and 1:2. The samples were then tested on 30 moderately trained panelists who evaluated overall aspects. Based on the results of statistical hypothesis testing using the Friedman test, it was found that there was no influence of binder ratio on the acceptance of carp fish roulade at ratios of 1:1, 2:1, and 1:2 in terms of skin color before and after frying, filling color before and after frying, fish aroma, spice aroma, taste, and structural compactness. However, one aspect that had an influence was the level of tenderness. Based on the results of statistical hypothesis testing, physical testing using the Kruskal-Wallis test showed that the binder ratio had no significant influence on the physical quality of grass carp roulade in terms of hardness level. The conclusion of this study is that the acceptance of carp fish roulade is recommended at a binder ratio of 1:1 between tapioca flour and wheat flour.

Keywords: Binder, Consumer Acceptance, Carp Fish, Roulade, Physical Properties

Introduction

In accordance with (Downer et al., 2020), everyone's nutritional needs are determined by many factors, namely age, gender, Weight, and height. At Daily Value (RDA), it is listed that Protein Requirements for Men aged 19-64 years are as much as 65 grams, while for adult women 19-64 years, 60 grams of protein, and for children aged 4-9 years range from 25-40 grams. On the other hand, some people, especially older people over 50 years, begin to limit their meat intake or reduce meat consumption due to abstinence from diseases such as *gout, arthritis,* and coronary heart (Aminati, 2022). People affected by the disease need other sources of protein besides meat that can be obtained, one of which comes from fish (Alam & Mukarrom, 2022; Dickin & Gabrielsson, 2023). Fish contains relatively high animal protein and essential unsaturated fatty acids necessary for the human body (Sebök & Hanelt, 2023). Fish is also a very famous source of vitamin A in addition to other vitamins, and it contains various minerals. Fish are rich

in benefits and can increase the growth and development of children's maximum intelligence (Hendrawati and Zidni, 2017). The nutritional content of fish is good for the development of brain intelligence and visual acuity. Fish also contains protein equivalent to meat and contains the most complete amino acids, especially *lysine* and *threonine* (Tasripin, 2013).

Goldfish is a food that contains a lot of water, so it is easy to decay *(perishable food)* (Seviyanto et al., 2022). Various ways are done to overcome this, ranging from initial handling, preservation, and processing to storage and distribution (Huang et al., 2024). Processing carp into various types of products is an effort to diversify fishery products. This is an effort to fulfill fish protein for the community and can increase the income of fish farmers, fishermen, and fish processors (Norhayani et al., 2017). Directorate of Processed Fish Directorate General of P2HP in 2007 said carp could be consumed by all parts of the body 80%, while 20% of other body parts, such as the head, bones/spines, can not be consumed directly but can be used to be processed into broth. The nutritional content of carp per 100 grams BDD (Edible Part) is 86 Kcal energy, 16 grams protein, and 2 grams fat.

Although it has high nutrition and is good for health, some people, especially children, do not like to eat fish whole (Downer et al., 2020). Based on this, it is necessary to innovate in carp processing so that one's protein needs and other nutrients can be met while overcoming saturation in consuming fish, especially for children who have difficulty consuming fish and some people who have taboos on consuming red meat. An innovation that can be done is to make roulade with the main ingredient of carp as an alternative food for the fulfillment of protein sources.

Rolade is a processed product made from a mixture of meat that has been mashed with the addition of flour or starch, eggs, spices, and other additives that are stirred evenly, wrapped in omelet sheets, and rolled using Aluminium *f*oil or banana leaves, then ripened by the steaming method. Rolade is made from beef or chicken (Rasyid, 2018). Rolade includes food that can be stored for a long time. Several studies related to fish rolade have been conducted. The research conducted by (Norhayani et al., 2017) Aims to determine the processing of catfish rolade by substituting tapioca flour with wheat flour and the level of consumer acceptance, and to determine the chemical content contained in catfish rolade with four treatments, namely the use of 50% tapioca flour without the addition of wheat flour, 10% wheat flour and 40% tapioca, 30% wheat flour and 20% tapioca, and 50% flour without tapioca flour. Based on the results of chemical tests, all treatments differ very markedly, while based on organoleptic test results, all treatments do not differ markedly. The treatment of 10% flour and 40% tapioca is the best treatment.

Research by (Al Husna et al., 2020) aims to determine the effect of adding sago flour on tilapia rolade and consumer acceptance and obtain the best concentration of sago flour in tilapia rolade based on organoleptic and proximate tests. The treatment carried out is by adding sago as much as 0 grams, 50 grams, 75 grams, and 100 grams. The results showed that making tilapia rolade with the addition of sago flour had a significant effect

on organoleptic tests. The results of the best rolade research with treatment in the form of adding 50 grams of sago flour.

The use of binders in food preparation must be appropriate. If the binder used is not right, the resulting dough will contain too much water or can also become too hard or too chewy (Lin, Liang, Yan, Zhao, & Li, 2024). In general, the types of binders commonly used in making food are tapioca flour, rice flour, sago, cornstarch, and wheat flour (Abu-Alruz, 2023; Lin, Liang, Yan, Zhao, Niu et al., 2024). Protein in the form of flour is believed to bind the dough so that it becomes firm and increases the volume of the dough. This study aims to analyze the effect of the ratio of binders between tapioca flour and wheat flour on the manufacture of carp rolade on physical properties and consumer acceptability and obtain the best composition of carp rolade based on organoleptic tests and physical tests.

Based on the background description, several research problems can be identified. First, carp is used as an ingredient in the manufacture of rolade. Secondly, the right binder must be selected to ensure the quality of the goldfish rolade. Third, the determination of the optimal amount of binder ratio. Fourth, the influence of physical properties and quality of goldfish role is a different ratio of binders. Fifth, the influence of consumer acceptability on variations in the ratio of binders. In addressing this issue, research is limited to the comparative effect of binders on the physical properties and consumer acceptability of goldfish role, focusing on aspects of color, aroma, taste, and texture.

The resulting formulation of the problem is whether there is an effect of the comparison of binders on the physical properties and consumer acceptability in making carp rolade. The purpose of this study was to analyze the comparative impact of binders on the physical properties and consumer acceptability of goldfish rolade. The results of the research are expected to be useful for students in improving analytical, critical, and innovative skills, as well as for the community in producing new innovations from carp into nutritious processed products. In addition, this research is expected to make a positive contribution to the Culinary Education Study Program as a reference and contribution to the development of food processing courses as well as educational benefits for future research and other parties who need related information.

Research Methods

The research method used in this study is an experimental method that aims to determine the possibility of a cause-and-effect relationship between the ratio of tapioca flour binders and wheat flour in goldfish rolade to physical properties and consumer acceptability. The object of this study was a carp rolade with a ratio of binders in the form of tapioca flour and wheat flour as much as 1:1, 2:1, and 1:2, which were tested on panelists randomly. Data sources of this study include physical and organoleptic tests. Physical tests include testing the texture of goldfish rolade products using a texture analyzer, while organoleptic tests include the assessment of a product measured using the five human senses. Panelists are somewhat trained to perform hedonic tests or favorability tests to obtain data on consumer acceptability.

The population in this study was carp rolade, and the sample was carp rolade with a ratio of binders tested to panelists randomly. This sample consists of three different treatments, namely the ratio of binders 1:1, 2:1, and 1:2. The techniques and research tools used include a texture analyzer tool to measure the texture of goldfish rolade products. This tool works by measuring the durability of the product due to the application of compressive force from the tool through the probe to the sample or the ability of the sample to return to its initial condition after applying pressure to the sample technically serves to measure the level of hardness of a product that you want to observe with units of gf (gram force).

The analytical technique used in this study was a one-way Anova (Analysis of Variance) Test on carp rolade before and after frying for H0 and Ha acceptance. The test results will be calculated using a rating scale of 1 to 5, with a score rating scale of 1 very dislike, score two dislike, score three somewhat like, score four like, and score five very like. The assessment includes several aspects, namely color, aroma, taste, texture (level of softness), and compactness of the rolade structure.

Results and Discussion

Validation Test Results

The validation test was carried out by five expert Panelists who are lecturers of the Culinary Education Study Program, State University of Jakarta, on research products in the form of carp rolade with a ratio of tapioca flour and wheat flour binders of 1:1, 2:1, and 1: 2. The aspects assessed in this research validation test include aspects of skin color and content color before and after frying, fish aroma, spice aroma, taste, softness, and compactness of rolade structure. The results of the validation test can be seen in the following summary.

Skin Color Aspect (before frying)

The results of the validation test assessment by expert Panelists on aspects of skin color before frying in carp rolade products with a ratio of binders of 1:1, 2:1, and 1:2 are as follows:

Table 1. Rolade Skin Color Aspect Validation Test Results (before frying)

Category	Score	Goldfish Rolade with Binder Comparison					
		1:1		2:1		1:2	
		n	%	N	%	n	%
Golden yellow	5	2	40,0	2	40,0	3	60,0
Brownish-yellow	4	3	60,0	3	60,0	0	0,0
Pale yellow	2	0	0,0	0	0,0	1	20,0
Light yellow	3	0	0,0	0	0,0	1	20,0
Beige	1	0	0,0	0	0,0	0	0,0
Jumlah		**5**	**100**	**5**	**100**	**5**	**100**
Mean		**4,4**		**4,4**		**4**	

Based on the results of validation tests from 5 expert lecturers on the treatment of 1:1 and 2:1 binder, 2 Panelists, with a percentage of 40%, chose rolade skin before frying golden yellow, and 3 Panelists with a percentage of 60%, chose a brownish yellow color.

While the 1:2 treatment stated that 3 Panelists with a percentage of 60% chose golden yellow and 1 panelist each with a percentage of 20% chose pale yellow and light yellow. The results of the validation test of 5 expert Panelists on the skin color aspect of carp rolade before frying showed that the 1:1 treatment obtained an average value of 4.4, the 2:1 treatment obtained an average value of 4.4, and the 1:2 treatment with an average value of 4. It can be concluded that carp rolade with a ratio of binders of 1: 1, 2: 1, and 1: 2 is in the brownish-yellow category.

Fill the Color Aspect (before frying)

The results of the validation test assessment by expert Panelists on the color aspect of the contents before frying in carp rolade products with a ratio of binders of 1: 1, 2: 1, and 1: 2 are as follows:

Table 2. Rolade Fill Color Aspect Validation Test Results (before frying)

Category	Score	Goldfish Rolade with Binder Comparison					
		1:1		2:1		1:2	
		n	%	n	%	n	%
Brownish-gray	2	0	0,0	0	0,0	0	0,0
Pale Grey	4	1	20,0	0	0,0	1	20,0
Light Grey	5	4	80,0	5	100,0	4	80,0
Grey	3	0	0,0	0	0,0	0	0,0
Dark Grey	1	0	0,0	0	0,0	0	0,0
Total		**5**	**100**	**5**	**100**	**5**	**100**
Mean		**4,8**		**5**		**4,8**	

In accordance with Table 2, the 1:1 treatment shows one panelist with a percentage of 20% stating pale gray color and 4 Panelists with a percentage of 80% stating light gray color. In the 2:1 treatment, 100% of Panelists stated a light gray color, and in the 1:2 treatment, 20% of Panelists stated a pale gray color, and 80% stated light gray. Based on the data above, in the aspect of the color of the contents of the carp rolade before frying, expert Panelists stated that the 1:1 and 1:2 treatments obtained an average value of 4.8, and the 2:1 treatment had an average value of 5. So, carp rolade with a ratio of binders of 1:1, 2:1, and 1:2 is in the light gray category.

Skin Color Aspect (after frying)

The results of the validation test assessment by expert Panelists on skin color aspects after frying in carp rolade products with a ratio of binders of 1: 1, 2: 1, and 1: 2 are as follows:

Table 3. Rolade Skin Color Aspect Validation Test Results (after frying)

Category	Score	Goldfish Rolade with Binder Comparison					
		1:1		2:1		1:2	
		n	%	n	%	n	%
Golden brown	2	1	20,0	1	20,0	0	0,0
Pale Brown	1	0	0,0	0	0,0	1	20,0
Yellowish brown	3	1	20,0	1	20,0	1	20,0
Brown	5	3	60,0	3	60,0	3	60,0
Dark Brown	4	0	0,0	0	0,0	0	0,0
Total		**5**	**100**	**5**	**100**	**5**	**100**
Mean		**4**		**4**		**3,8**	

Referring to the table of validation results from 5 expert lecturers, the 1:1 and 2:1 treatments showed that 20% of panelists stated golden brown, another 20% stated fawn, and 60% of panelists stated brown. The 1:2 treatment showed 60% of Panelists stated brown, and 20% of other Panelists stated pale brown and yellowish brown. The results of the validation above can be concluded that in the aspect of the skin color of carp rolade after frying, expert Panelists stated that the 1:1 and 2:1 treatments obtained an average value of 4, then the 1:2 treatment had an average value of 3.8. So, goldfish rolade with a ratio of binders of 1: 1, 2: 1, and 1: 2 is in the brown color category.

Color Aspect of Fill (after frying)

The results of the validation test assessment by expert Panelists on the color aspect of the contents after frying in carp rolade products with a ratio of binders of 1: 1, 2: 1, and 1: 2 are as follows:

Table 1. Rolade Content Color Aspect Validation Test Results (after frying)

Category	Sc	Goldfish Rolade with Binder Comparison					
		1:1		2:1		1:2	
		n	%	n	%	n	%
Golden brown	2	0	0,0	1	20,0	0	0,0
Pale Brown	3	1	20,0	0	0,0	2	40,0
Yellowish brown	5	1	20,0	2	40,0	1	20,0
Greyish Brown	4	3	60,0	2	40,0	2	40,0
Dark Brown	1	0	0,0	0	0,0	0	0,0
Jumlah		**5**	**100**	**5**	**100**	**5**	**100**
Mean		**4**		**4**		**3,8**	

Based on the results of the validation test of 5 expert lecturers on the treatment of 1:1 binders, 20% of Panelists chose pale brown, 20% chose fawn, and 60% of other Panelists chose grayish brown. While in the 2:1 treatment, 20% of Panelists stated that they chose golden brown, 40% chose fawn, and 40% were grayish brown. In the 1:2 treatment, expert Panelists stated that 40% chose pale brown, 20% chose fawn, and 40% chose grayish brown. The results of the validation test of 5 expert Panelists on the color aspect of the contents of carp rolade after frying showed that 1: 1 and 2: 1 treatment obtained an average value of 4 and 1: 2 treatment obtained an average value of 3.8. It can be concluded that carp rolade with a ratio of binders of 1: 1, 2: 1, and 1: 2 is in the grayish-brown category.

Aroma Aspects of Fish

The results of the validation test assessment by expert Panelists on the aspects of fish aroma in goldfish rolade products with a ratio of binders of 1: 1, 2: 1, and 1: 2 are as follows:

Table 2. Fish Aroma Aspect Validation Test Results

Category	Score	Goldfish Rolade with Binder Comparison					
		1:1		2:1		1:2	
		n	%	n	%	n	%
Very Strong	3	0	0,0	0	0,0	0	0,0
Strong	4	3	60,0	2	40,0	3	60,0
Rather Strong	5	1	20,0	2	40,0	1	20,0
Weak	2	1	20,0	1	20,0	1	20,0

Very Weak	1	0	0,0	0	0,0	0	0,0
Total		**5**	**100**	**5**	**100**	**5**	**100**
Mean		**3,8**		**4**		**3,8**	

In accordance with the table above, the 1:1 and 1:2 treatment showed that 60% of Panelists stated that it smelled of strong fish, 20% of Panelists stated that it smelled rather strong, and 20% stated that it smelled of weakfish. In the 2:1 treatment, 40% of panelists stated that it smelled like a strong fish, 40% said it smelled rather strong, and 20% said it smelled like a weakfish. Based on the data above, in the aspect of carp aroma in the rolade, expert Panelists stated that the 1:1 and 1:2 treatments obtained an average value of 3.8 and the 2:1 treatment had an average value of 4. So, a carp rolade with a ratio of binders of 1:1, 2:1, and 1:2 in terms of fish aroma is in the category of strong fish aroma.

Aroma Aspect of Spices

The results of the validation test assessment by expert Panelists on the aroma aspects of carp rolade spices with a ratio of binders of 1: 1, 2: 1, and 1: 2 are as follows:

Table 3. Validation Test Results of Spice Aroma Aspects

Category	Score	Goldfish Rolade with Binder Comparison					
		1:1		2:1		1:2	
		n	%	n	%	n	%
Very Strong	4	0	0,0	0	0,0	0	0,0
Strong	5	2	40,0	3	60,0	3	60,0
Rather Strong	3	2	40,0	1	20,0	1	20,0
Weak	2	1	20,0	1	20,0	1	20,0
Very Weak	1	0	0,0	0	0,0	0	0,0
Jumlah		**5**	**100**	**5**	**100**	**5**	**100**
Mean		**3,6**		**4**		**4**	

Referring to the validation results above, the 1:1 treatment showed 2 Panelists with a percentage of 40% stating a strong spice aroma, 40% of other Panelists stating a slightly strong spice aroma, and 20% stating a weak spice aroma. While in the 2:1 and 1:2 treatments, 60% of Panelists stated a strong aroma, 20% had a slightly strong aroma, and another 20% stated a weak spice aroma. It can be concluded that in the aspect of the aroma of goldfish rolade spices, expert panelists stated that the 1:1 treatment obtained an average value of 3, and then the 2:1 and 1:2 treatments had an average value of 4. So, carp rolade with a ratio of binders of 1:1, 2:1, and 1:2 is in the category of very strong spice aroma.

Taste Aspect

The results of the validation test assessment by expert Panelists on the taste aspects of carp rolade with a ratio of binders of 1:1, 2:1, and 1:2 are as follows:

Tabel 4. Hasil Uji Validasi Aspek Rasa

Category	Score	Goldfish Rolade with Binder Comparison					
		1:1		2:1		1:2	
		n	%	n	%	n	%
Very savory	4	2	40,0	0	0,0	0	0,0
Savory	5	2	40,0	4	80,0	3	60,0
A bit savory	3	1	20,0	1	20,0	2	40,0
Not savory	2	0	0,0	0	0,0	0	0,0
Very not savory	1	0	0,0	0	0,0	0	0,0

Total	**5**	**100**	**5**	**100**	**5**	**100**
Mean	**4,2**		**4,6**		**4,2**	

Referring to the table, the 1:1 treatment shows 2 Panelists with a percentage of 40% stating a very savory taste, 40% of other Panelists stating savory, and 20% stating slightly savory. In the 2:1 treatment, 80% of Panelists stated savory, and 20% stated slightly savory. While in the 1:2 treatment, 60% of panelists chose savory taste, and 40% chose slightly savory. It can be concluded that in the aspect of the taste of goldfish rolade, expert panelists stated that the 1:1 and 1:2 treatments obtained an average value of 4.2, and the 2:1 treatment had an average value of 4.6. So, carp rolade with a ratio of binders of 1:1, 2:1, and 1:2 is in the savory category.

Softness Level Aspect

The results of the validation test assessment by expert Panelists on aspects of softness (when chewed) in carp rolade products with a ratio of binders of 1: 1, 2: 1, and 1: 2 are as follows:

Table 5. Softness Aspect Validation Test Results

Category	Score	Goldfish Rolade with Binder Comparison					
		1:1		2:1		1:2	
		n	%	n	%	n	%
Very Soft	4	0	0,0	0	0,0	1	20,0
Soft	5	4	80,0	4	80,0	3	60,0
A bit soft	3	1	20,0	1	20,0	1	20,0
Not soft	2	0	0,0	0	0,0	0	0,0
Very not soft	1	0	0,0	0	0,0	0	0,0
Total		**5**	**100**	**5**	**100**	**5**	**100**
Mean		**4,6**		**4,6**		**4,4**	

According to the table, the 1:1 and 2:1 treatments showed that 80% of Panelists stated that goldfish rolade was soft in texture, respectively, and 20% of other Panelists stated that it was slightly soft. In the 1:2 treatment, 20% of panelists chose a very soft texture, 60% stated soft, and 20% stated slightly soft. Based on the data above, in the aspect of the softness of goldfish rolade, expert Panelists stated that the 1: 1 and 2: 1 treatment obtained an average value of 4.6 and the 1: 2 treatment had an average value of 4.4. So, carp rolade with a ratio of binders of 1: 1, 2: 1, and 1: 2 in terms of the level of softness when chewed is in the soft textured category.

Aspect of Compactness of Structure

The results of the validation test assessment by expert Panelists on the compactness aspect of the carp rolade structure with a ratio of binders of 1: 1, 2: 1, and 1: 2 are as follows:

Table 6. Validation Test Results of Structural Compactness Aspects

Category	Score	Goldfish Rolade with Binder Comparison					
		1:1		2:1		1:2	
		n	%	n	%	n	%
Very compact	4	1	20,0	0	0,0	1	20,0
Compact	5	2	40,0	4	80,0	3	60,0
Rather compact	3	2	40,0	1	20,0	1	20,0
Not compact	2	0	0,0	0	0,0	0	0,0

Very not compact	1	0	0,0	0	0,0	0	0,0
Total		**5**	**100**	**5**	**100**	**5**	**100**
Mean		**4**		**4,6**		**4,4**	

Based on the results of validation tests from 5 expert lecturers on the treatment of 1:1 binders showed that one panelist, with a percentage of 20%, chose very compact, 40% of Panelists chose compact, and 40% of other Panelists chose rather compact. In the 2:1 treatment, 4 Panelists, with a percentage of 80%, chose compact, and one panelist, with a percentage of 20%, chose rather compact. While the 1:2 treatment stated that 20% of Panelists chose very compact, 60% of other Panelists chose compact, and 20% of Panelists chose rather compact. The results of the validation test of 5 expert Panelists on the aspect of compactness of the structure of goldfish rolade showed that the 1:1 treatment obtained an average value of 4, the 2:1 treatment obtained an average value of 4.6, and the 1:2 treatment obtained an average value of 4.4. So it is concluded that the structure of carp rolade with a ratio of binder of 1:1, 2:1, and 1:2 is in the compact category.

Skin Color Aspect Assessment (before frying)

Assessment of Hypothetical Results of Skin Color Aspects (before frying)

The calculation results for 30 moderately trained Panelists obtained x2 count = -9.891 at a significant level of α = 0.05 while x2 table at the degree of confidence db = 3-1 = 2, which is 5.99 Table of analysis calculation results based on aspects of skin color of carp rolade before frying can be seen in the following table:

Table 7. Results of Skin Color Aspect Hypothesis Testing (before frying)

Test Criteria	x^2 count	x^2 table	Conclusion
Skin Color (before frying)	-9,891	5,99	x^2 count < x^2 table, thus H_0 accepted dan H_1 rejected

Based on the table above shows the value of x2 count < x2 table H0 accepted and H1 rejected. The table above shows that there is no effect of the ratio of binders of 1: 1, 2: 1, and 1: 2 on the aspect of skin color of carp rolade before frying on consumer acceptance.

Assessment of Fill Color Aspects (before frying)

Assessment of Hypothetical Results of Aspects of Fill Color (before frying)

The calculation results for 30 moderately trained Panelists obtained x2 count = 5.816 at a significant level of α = 0.05 while x2 table at the degree of confidence db = 3-1 = 2, which is 5.99. The table of analysis calculation results based on the color aspect of the contents of carp rolade before frying can be seen in the following table:

Table 12. Results of Hypothesis Testing of Fill Color Aspects (before frying)

Test Criteria	x^2 count	x^2 table	Conclusion
Skin Color (before frying)	5,816	5,99	x^2 count < x^2 table, thus H_0 accepted dan H_1 rejected

Based on the table above shows the value of x2 count < x2 table H0 accepted and H1 rejected. The table above can be concluded that there is no effect of the ratio of binders

of 1: 1, 2: 1, and 1: 2 on the color aspect of the contents of carp rolade before frying on consumer acceptance.

Skin Color Aspect Assessment (after frying)

Assessment of the Hypothetical Results of Skin Color Aspects (after frying)

The calculation results for 30 moderately trained Panelists obtained x2 count = -10.35 at a significant level of α = 0.05 while x2 table at the degree of confidence db = 3-1 = 2, which is 5.99. The table of analysis calculation results based on aspects of carp rolade skin color after frying can be seen in the following table:

Table 13. Results of Skin Color Aspect Hypothesis Testing (after frying)

Test Criteria	x^2 count	x^2 table	Conclusion
Skin Color (before frying)	10,35	5,99	x^2 count < x^2 table, thus H_0 accepted dan H_1 rejected

Based on the table above shows the value of x2 count < x2 table H0 accepted and H1 rejected. The table above shows that there is no effect of the ratio of binders of 1: 1, 2: 1, and 1: 2 on the aspect of skin color of carp rolade after frying on consumer acceptance.

Assessment of Fill Color Aspects (after frying)

Assessment of Hypothetical Results of Color Aspects of Contents (after frying)

The calculation results for 30 moderately trained Panelists obtained x2 count = 1.31 at a significant level of α = 0.05 while x2 table at the degree of confidence db = 3-1 = 2, which is 5.99. The table of analysis calculation results based on the color aspect of the contents of carp rolade after frying can be seen in the following table:

Table 14. Results of Hypothesis Testing of Fill Color Aspects (after frying)

Test Criteria	x^2 count	x^2 table	Conclusion
Fill Color (after frying)	1,31	5,99	x^2 count < x^2 table, thus H_0 accepted dan H_1 rejected

Based on the table above shows the value of x2 count < x2 table H0 accepted and H1 rejected. The table above can be concluded that there is no effect of the ratio of binders of 1: 1, 2: 1, and 1: 2 on the color aspect of the contents of carp rolade after frying on consumer acceptance.

Assessment of Fish Aroma Aspects

Assessment of the Results of the Hypothesis of Fish Aroma Aspects

The calculation results for 30 moderately trained Panelists obtained x2 count = 1.81 at a significant level α = 0.05 while x2 table at the degree of confidence db = 3-1 = 2, which is 5.99. The table of analysis calculation results based on aspects of carp rolade fish aroma can be seen in the following table:

Table 15. Results of Hypothesis Testing of Ika Aroma Aspects

Test Criteria	x^2 count	x^2 table	Conclusion

Fish Aroma	1,81	5,99	x^2 count < x^2 table, thus H_0 accepted dan H_1 rejected

Based on the table above shows the value of x2 count < x2 table H0 accepted and H1 rejected. The table above shows that there is no effect of the ratio of binders of 1: 1, 2: 1, and 1: 2 on the aroma aspect of carp rolade fish on consumer acceptance.

Assessment of Aroma Aspects of Spices

Assessment of Hypothetical Results of Spice Aroma Aspects

The calculation results for 30 moderately trained Panelists obtained x2 count = 1.25 at a significant level of α = 0.05 while x2 table at the degree of confidence db = 3-1 = 2, which is 5.99. The table of analysis calculations based on aspects of the aroma of goldfish rolade spices can be seen in the following table:

Table 16. Results of Hypothesis Testing of Spice Aroma Aspects

Test Criteria	x^2 count	x^2 table	Conclusion
Spice aroma	1,25	5,99	x^2 count < x^2 table, thus H_0 accepted dan H_1 rejected

Based on the table above shows the value of x2 count < x2 table H0 accepted and H1 rejected. The table above shows that there is no effect of the ratio of binders of 1: 1, 2: 1, and 1: 2 on the aroma aspect of carp rolade spices on consumer acceptance.

Assessment of Taste Aspects

Assessment of the Results of the Taste Aspect Hypothesis

The calculation results for 30 moderately trained Panelists obtained x2 count = -0.816 at a significant level of α = 0.05 while x2 table at the degree of confidence db = 3-1 = 2, which is 5.99. The table of analysis calculation results based on the taste aspects of goldfish rolade can be seen in the following table:

Table 17. Results of Testing the Taste Aspect Hypothesis

Test Criteria	x^2 count	x^2 table	Conclusion
Taste	-0,816	5,99	x^2 count < x^2 table, thus H_0 accepted dan H_1 rejected

Based on the table above shows the value of x2 count < x2 table H0 accepted and H1 rejected. The table above can be concluded that there is no effect of the ratio of binders of 1: 1, 2: 1, and 1: 2 on the aspect of the taste of carp rolade on consumer acceptance.

Aspect Assessment of Softness Level

Assessment of Hypothetical Results of Aspects of Softness Level

The calculation results for 30 moderately trained Panelists obtained x2 count = 9.00 at a significant level α = 0.05 while x2 table at the degree of confidence db = 3-1 = 2, which is 5.99. The table of analysis calculation results based on aspects of the softness level of goldfish rolade can be seen in the following table:

Table 18. Results of Hypothesis Testing of Aspects of Softness

Test Criteria	x^2 count	x^2 table	Conclusion
Softness Level	1,40	5,99	x^2 count < x^2 table, thus H_0 accepted dan H_1 rejected

Based on the table above shows the value of x2 count > x2 table H0 accepted and H1 rejected. The table above shows that there is no effect of the ratio of binders of 1: 1, 2: 1, and 1: 2 on the aspect of the softness of goldfish rolade on consumer acceptance.

Assessment of Structural Compactness Aspects

Assessment of Hypothesis Results of Aspects of Structural Compactness

The calculation results for 30 moderately trained Panelists obtained x2 count = 0.616 at a significant level α = 0.05 while x2 table at the degree of confidence db = 3-1 = 2, which is 5.99. The table of analysis calculation results based on the aspect of compactness of the structure of goldfish rolade can be seen in the following table:

Table 19. Results of Hypothesis Testing of Aspects of Structural Compactness

Test Criteria	x^2 count	x^2 table	Conclusion
Compactness of the structure	0,616	5,99	x^2 count < x^2 table, thus H_0 accepted dan H_1 rejected

Based on the table above shows the value of x2 count < x2 table H0 accepted and H1 rejected. The table above can be concluded that there is no effect of the ratio of binders of 1: 1, 2: 1, and 1: 2 on the aspect of compactness of the structure of goldfish rolade on consumer acceptability.

Discussion of Research Results

Acceptability Test Results

Based on the results of data obtained in organoleptic testing on consumer acceptability tests conducted on 30 rather trained Panelists, namely students of Culinary Education, Faculty of Engineering, Jakarta State University. The data obtained were assessed based on research aspects on making carp rolade with a ratio of binders of 1: 1, 2: 1, and 1: 2, which included a scale of very like, like, somewhat like, dislike, and very dislike. Based on the results of organoleptic testing on the aspect of rolade skin color before frying, it shows that the highest average score at 4.3 is in the like category, which shows that the skin color of carp rolade before frying is liked and accepted by consumers. In the hypothesis test, there was no effect of skin color before frying in carp rolade with a ratio of binders of 1: 1, 2: 1, and 1: 2. So it can be concluded that the ratio of binders with different amounts does not affect the color aspect of a product and also does not affect the level of consumer preference.

The results of organoleptic tests on the color aspect of the contents of carp rolade before frying show that the product is liked and accepted by consumers. In testing, the hypothesis stated that there was no influence on the color of the contents of the carp rolade before frying with a ratio of binders of 1:1, 2:1, and 1:2. The color aspect in the physical quality test is an influential aspect in research, it can occur due to changes in temperature factors and the addition of materials (Sriyani, 2021). Based on the results of organoleptic

tests on the aspect of skin color, carp rolade after frying was accepted and liked by consumers with an average value of 4.27. From the results of the hypothesis test analysis, there is no effect of the ratio of binders on the aspect of skin color of carp rolade after frying with a ratio of binders of 1: 1, 2: 1, and 1: 2. The results of organoleptic tests conducted based on the color aspect of the contents of carp rolade after frying show that the product is liked and accepted by consumers. Referring to the results of the hypothesis test analysis, there is no effect of the ratio of binders of 1: 1, 2: 1, and 1: 2 on the color aspect of the contents of carp rolade after frying on consumer acceptance.

In the aspect of fish aroma, the highest average value was obtained in the treatment of binders of 1:2 with a total of 4.23, which showed that the aroma of carp received positive acceptance and was liked by consumers. The results of the hypothesis test did not have an effect on the ratio of binders to fish aroma in goldfish rolade with a ratio of 1:1, 2:1, and 1:2. One of the factors causing the aroma of goldfish to get positive acceptance from consumers is because the use of fresh carp directly purchased from traders live which are handled on that day hygienically so as to reduce the fishy aroma caused by goldfish and the quality is maintained. The use of fish, if not handled properly, will experience damage and affect the taste (Razin, 2024). So, it can be concluded that the aroma of fish is not influenced by the ratio of binders but is influenced by the quality of the fish used and does not affect the level of consumer preferences.

Based on the results of organoleptic tests on the aspect of spice aroma in goldfish rolade with a ratio of binders of 1: 1, 2: 1, and 1: 2 received and liked by consumers with the highest average score of 4.10 in the 2: 1 treatment with the category of likes. The results of the hypothesis analysis test showed that there was no influence of the aroma of spices from carp rolade with the ratio of binders. The spice referred to in this case is the use of garlic, onion, ground nutmeg, and ground pepper to strengthen the aroma and disguise the fishy aroma of goldfish. So, it can be concluded that the aroma of spices is not influenced by the ratio of binders but is influenced by spices and spices used and does not affect the level of consumer preferences.

The results of organoleptic tests on the taste aspect of carp rolade with a comparison of binders show that the product is accepted and liked by consumers. In the hypothesis analysis test, it was stated that there was no influence on the taste of goldfish rolade in the ratio of binders 1:1, 2:1, and 1:2. The taste of carp rolade is obtained from the addition of salt and flavoring using mushroom broth, and from the carp meat itself. One factor that affects the salty taste aspect is the use of salt (Rahayu & Ridawati, 2015). In addition, the use of fish can also provide a salty taste naturally (Muchtadi et al., 2010). The umami taste is naturally obtained from broth, chicken, meat, fish, etc., while artificially obtained through the addition of flavoring seasonings, such as monosodium glutamate (Ketaren, 2019). It can be concluded that the taste of goldfish rolade is Not influenced by the ratio of binders but influenced by the addition of spices and flavorings because carp meat is less savory and does not affect the level of consumer preferences.

On the aspect of softness level, From goldfish rolade with a ratio of binders, the results of organoleptic testing show that the product is acceptable and preferred by

consumers. In the hypothesis analysis test, there was no effect on the softness level of goldfish rolade in the ratio of binders 1:1, 2:1, and 1:2. The level of softness in carp rolade comes from the ratio of the amount of tapioca flour and wheat flour used in making rolade dough, the ratio of the amount of tapioca flour is less than the amount of wheat flour. One of the ingredients used in making rolade is tapioca flour, which serves to improve texture, increase softness, and help the development process (Aminullah et al., 2020). Every material that has gone through the grinding process will produce a smooth and soft texture, and this affects the texture of rolade (Muchtadi, Sugiyono and Fitriyono Ayustaningwarno, 2010)

In accordance with the results of organoleptic tests that have been carried out, the compactness of the structure of goldfish rolade with the ratio of binders can be accepted and liked by consumers. Based on the acquisition of the average value on the aspect of compactness of the structure of the goldfish rolade, the ratio of 1:1 treatment binders has the highest average value of 4.17, which is in the range of the like category. Referring to the hypothesis analysis test it states that there is no influence on the compactness of the structure of the goldfish rolade with a ratio of binding materials of 1:1, 2:1, and 1:2.

Physical Test Results

In this study, the physical quality of carp rolade was tested with a comparison of binders, which includes aspects of hardness. In the physical hardness test, the average level of hardness of carp rolade with the ratio of binders before frying, which was carried out three times, obtained results between 13.3-28.3 gf, showing that there was an influence on the level of hardness of carp rolade in each treatment was significantly different. In the physical test of goldfish rolade hardness with a ratio of binders after frying with three repetitions, the average result was between 24-30 gf.

The physical quality testing of carp rolade before and after frying showed an effect on the hardness level of carp rolade, and each treatment had no significant effect. The highest level of goldfish rolade hardness before frying is found in the 1:2 treatment, which is (23.8) gf, and the lowest level of hardness is in the 1:1 treatment of (13.3) gf. While the hardness level of carp rolade after frying with the highest rank is found in the 1:2 treatment, which is (30) gf, then the lowest level of hardness is in the 2:1 treatment of (24) gf.

Conclusion

Based on the research on making carp rolade, it can be concluded that the best formula involves using a binder ratio of tapioca flour to wheat flour of 1:1, 2:1, or 1:2. Descriptive data from consumer acceptability tests, which included aspects such as skin color before and after frying, color of contents before and after frying, aroma of fish, aroma of spices, taste, level of softness, and compactness of structure, were collected from 30 moderately trained panelists. The highest scores for various aspects were observed across different ratios, with the 1:2 ratio often receiving the highest ratings in categories such as skin color before frying, color of contents before and after frying, and fish aroma. However, the statistical analysis using the Kruskal-Wallis test indicated no significant effect of the

binder ratio on the physical quality of the rolade's hardness. Therefore, despite the varying preferences in specific aspects, the overall data suggest that the 1:1 binder ratio is the most recommended for further development, as it is generally preferred by consumers. This conclusion answers the research question by identifying the optimal binder ratio for consumer preference in carp rolade production.

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