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Acceptability and Nutritional Content of Sago Cauldron (Sinole) with Cork Fish Meat Substitution *(Channa Straita L.)*

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Abstract. Papua Province has abundant natural potential, one of which is the potential of sago forest covering an area of 1.2 million hectares. The use of sago as a staple food is usually processed by burning without the addition of other food ingredients so local food modification is needed to increase the nutritional value of the food consumed by the community. Local/traditional food that can be modified is Sago Cauldron/Sinole with the addition of snakehead fish meat. The purpose of this study was to determine the acceptability, nutritional content, and economic value of sago cauldron/sinole with the addition of snakehead fish meat. This type of research is a Quasi Experiment with 3 (three) formulas for making Sago Cauldron/Sinole. The panelists on the organoleptic/preference test were moderately trained and the panelists accepted the acceptance test by the general public in Mappi District. The nutritional value of sago cauldron /sinole food was converted to the Food Ingredients Composition List (DKBM), and the results of the organoleptic/preference test of the 3 formulas took the highest average value of all favorite characteristics. Then the formula with the highest value was tested for acceptability using the Comstock method. The economic value of nutrition is calculated by calculating the price per gram of protein from sago cauldron/sinole food with the addition of snakehead fish. The results showed that the highest caloric value in formula 151 was 154.6 kcal, and protein in formula 373 was 7.9 g. In general, the organoleptic/preferred test from the characteristics of color, taste, and texture of the most preferred formula was formula 373, while the preferred formula for aroma is formula 262. Sago cauldron/Sinole acceptance panelists mostly (73,3%) finished the sample served. In conclusion, formula 373 has the highest average rating on organoleptic properties and protein content tests so it has the highest nutritional economic value.

Keywords: Sago Cauldron/Sinole, Snakehead Fish Meat, Organoleptic, Acceptability, Economical Nutrition

1 Introduction

The province of Papua has a very abundant natural potential. The seas and rivers in Papua are so rich in sources of animal side dishes such as fish, while the land potential in Papua and West Papua provinces is in the form of sago forests of 1.2 million hectares (Sidiq et al., 2021). In Papua, sago has a fairly important social, economic, and cultural role, because it is a staple food for people, especially those who live in coastal areas. 40% of sago plants in Papua are sago stands (covering an area of 300,000 ha) which are productive plants ready for harvest but have only been used for about 0.34% or about 7,140 tons/year (Limbongan, 2007). Sago (sago flour) in utilization, generally still in the form of traditional food, for example, consumed as a staple food ingredient in the form of sago porridge (papeda), sago cauldron, and sago balls, namely sago shaped like a ball then burned on the fire, eaten by the outer shell that has been cooked, the rest is burned again, so continuously until it runs out (Ismail et al., 2022).

The potential of snakehead fish is quite abundant and this type of fish is found in many rivers/times in Mappi Regency, in the market the price is relatively cheap. People consume this fish as a side dish for animal protein sources. In general, the processing is by frying, smoking, and cooking yellow gravy. This study used the addition of snakehead fish meat to the cauldron sago food product, which is expected to be able to increase protein content and public acceptance of sago Kuali/Sinole products.

2 Research Methods

2.1 Tools and Materials

The tools used in this study were pots, large and small basins, pans (cauldrons), 60 mesh sieves, tears, and stoves. Plastic wrapping, organoleptic assessment form, Comstock form, and stationery. The ingredients used in this study were fresh sago flour purchased at traditional markets, fresh snakehead fish with an average weight per head of 500 – 1000 grams and taken meat after steaming the fish. Brown sugar, grated half-old coconut, and salt are obtained from the market.

2.2 Stages of Research: The Making Process of Sago Kuali/Sinole

The research began by compiling a formula that will be used in the research, the formula used is Formula I (60 fish: 40 sago), Formula II (50 fish: 50 sago), and Formula III (40 fish: 60 sago), with this formula for one recipe, ingredients are needed as in Table 1.

Table 1. Formulation of ingredients for making Sago Kuali/Sinole with cork fish meat substitution (1 recipe)

Material Type	Formula I (gr)	Formula II (gr)	Formula III (gr)
Sago Flour	30	25	20
Snakehead fish	20	25	30
Brown sugar	7	7	7
Half-old coconut (grated)	5	5	5
Salt	0.5	0.5	0.5

The stages of making products in this study are described as follows:

- Clean the snakehead fish, then steam it, after it is cooked remove and separate the meat from the skin and bones, then the meat is mashed.
- Prepare other ingredients, sago flour, brown sugar (which has been crushed/mashed) grated coconut, and salt. Combine the four ingredients until well mixed.
- Combine snakehead fish meat into a mixture of sago flour, stirring until well mixed so that it becomes a cauldron sago dough.
- Heat the pan on the stove, after the pan is warm, put the cauldron sago dough into the pan and flatten the dough with a thickness of about 0.5 cm.
- Cook/heat the dough until cooked with marks, the dough is light brown and dry and smells good.
- Lift, sago cauldron ready for consumption.

2.3 Trial Design

The type of research used was Quasi-experimental with a one-shot case study design. The research was carried out at the Health Polytechnic Jayapura food laboratory for organoleptic tests and the Mappi Regency Health Office for the acceptance test, to find out the value of organoleptic (Sensory) parameters using a favorability test on a scale of 1-5 with 25 panelists and for acceptability using the Comstock method with 30 panelists (Setyaningsih, 2010). The content of nutrients is calculated using the conversion of food ingredients using the Food Ingredients Composition List (Yaacob et al., 2021). The formulation codes used in this study are Formula I code 151, Formula II code 262, and Formula III code 373.

2.4 Analysis methods

The sensory test data obtained are processed descriptively to determine the formula that has the highest average value. The formula with the highest average value will be further tested to find out the acceptability.

3 Results and Discussion

3.1 Organoleptic Properties

The Organoleptic test used is the hedonic (favorability test), this test was carried out by 25 panelists on the cauldron /sinole sago product. Panelists were asked for their responses about their liking or dislike of the product. The degree of favorability is stretched into 5 levels, namely very dislike, dislike, neutral, like, and very like. The test parameters carried out in this study include the characteristics of color, aroma, texture, and taste (Tarwendah, 2017). The results of the organoleptic test research by the panelists on Sago Kuali/Sinole, are described in Table 2 below

Table 2. The average value of the organoleptic test results of sago cauldron/Sinole which is substitution with snakehead fish meat

Formula	Average value				Sum
	Color	Aroma	Taste	Texture	
I (151)	3	3.6	3.53	3.48	13.61
II (262)	3.76	4	3.8	3.48	15.04
III (373)	3.84	3.8	4.4	3.72	15.76

Table 2 above, shows that the color of the Sago Kuali/Sinole product panelists prefers Formula III, with an average value of 3.84 or a neutral assessment up to the very like. The results of the panelist's assessment of the color characteristics of the Sago Kuali/Sinole food with different ingredient formulations gave different values. The color in Formula III tends to be dark brown and the color is the color preferred by panelists, while in Formula I it is light brown, one of the reasons is that the sago starch used is brownish. The quality of food ingredients, in general, is very dependent on several factors including taste, color, texture, and nutritional value, visually the color factor appears first and sometimes greatly determines consumer acceptance of a food product (Zakariah et al., 2020).

Color is one of the parameters other than taste, texture, and nutritional value that determine consumers' perception of a food ingredient (Lei et al., 2018). Consumer acceptance is often determined based on the external appearance of a food product. Good food color provides more appeal to consumers. Color in food products has several functions including as an indicator of the perfection of the food processing process, for example in the frying process, the onset of brown color is often used as an indicator of the final maturity of food products (Blankenship et al., 2018).

The brown color of sago starch is caused by an enzymatic browning reaction during the processing process from sago stalks to sago starch caused by oxidase activities such as phenolics or polyphenols and catecholase which will catalyze the oxidation reaction of phenol compounds into ketones. The brown color of the sago cauldron/synole is not only due to the enzymatic browning reaction in sago starch but is also caused by the nonenzymatic browning reaction, namely the Maillard reaction during heating. Maillard reactions are reactions – reactions between carbohydrates, in particular reducing sugars with primary amine groups (Winarno et al., 2020).

The aroma of food largely determines the deliciousness of the food products made. In general, the smell received from the nose and brain is more of a mixture of four main odors, namely: fragrant, sour, rancid, and charred. The sense of disobedience serves to assess the odors of a product, both food and non-food (Winarno et al., 2020). Olfactory or smell is also called remote tasting because humans can recognize the deliciousness of food that has not been seen just by smelling it from a distance. In many ways the taste of food is determined by smell, the food industry considers it very important to test odors because it can quickly give the results of an assessment of its products liked or disliked. The aroma characteristics of sago Kuali/Sinole panelists prefer Formula II, with an average value of 4 or a neutral rating of up to very favorable. However, the aroma in Sago Kuali/Sinole did not have much effect on the level of acceptance by the panelists.

The aroma in all treatments is the same, which is the typical fragrant of sago flour but there is a fishy aroma from the formulation of snakehead fish meal, due to the volatile compound of reducing sugar. The panelists preferred the smell of formula II, one of the reasons was the softer smell of snakehead fish so that the fishy aroma of snakehead fish meat was not smelled. In formula I, there is more smell of grilled sago. In fish processing, the fishy aroma can be reduced by soaking in lime juice, this is because lime juice contains Limonene essential oil which can eliminate the fishy smell in the fish, reduced by soaking the fish in a lime solution for ± 6 hours.

Aroma is the smell of a food product, the smell itself is a response when volatile compounds from a food enter the nasal cavity and are felt by the olfactory system. Volatile compounds enter the nose when humans breathe or inhale them, but can also enter from the back of the throat during a person's meal (Kusuma et al., 2017). The aroma of sago flour is also due to volatile compounds that have a distinctive odor (Laili et al., 2019). The aroma in all treatments is the same, which is the typical fragrant of sago flour but there is a fishy aroma from the formulation of snakehead fish meal, due to volatile compounds in both sago flour and snakehead fish meat. Aroma compounds are volatile, so they easily reach the olfactory system in the upper part of the nose, and need sufficient concentration to be able to interact with one or more olfactory receptors. Aroma compounds can be found in foods, fruits, herbs, fragrant oils, and essential oils, these compounds play an important role in the production of flavorings, which are used in the food service industry, to improve taste and generally increase the attractiveness of such food products (Adawiya & Waysima, 2010). Aroma is also a sensory property that can determine consumer choices about a product, this sensory property in a processed food product will show the main aroma on the basic ingredients used in making a food product (Ameliya & Handito, 2018).

Taste is one of the important aspects of a food product. Taste can also determine whether the food product is acceptable or not by consumers. The taste of food can be recognized by the papillae found on the tongue. The taste in food consists of salty, sweet, bitter, sour taste. Taste in food is influenced by several factors, namely chemical compounds, temperature, concentration and interaction with other taste components (Winarno et al., 2020). Many foods that can be consumed daily contain glutamate acid so that it has a savory taste depending on the type. Naturally occurring glutamate can be found in meats and vegetables, while inosinate is mainly derived from meat and guanylate from vegetables. Thus, the umami taste (savory and delicious) is common for foods that contain high levels of L-glutamate, especially in fish, shellfish, meats, smoked meats, as well as vegetables (such as mushrooms, tomatoes, chicory, spinach, celery, and others or fermented products such as cheese, pets, soy sauce, and others.

Based on the reasons of the panelists in the reasoning column that has been provided that many like the formula of sago Kuali/sinole with the addition of snakehead fish, because the savory taste in the sago cauldron that is substituted for snakehead fish meat is compared to the taste of the sago Kuali/sinole food which has not been given the addition of snakehead fish. The savory taste comes from snakehead fish meat and grated coconut which are the main ingredients in making the sinole.

The texture and consistency of an ingredient will affect the taste caused by the material, changes in the texture or viscosity of the material can change the taste and smell that arises because it can affect the speed of stimulation to olfactory receptor cells and salivary glands (Winarno et al., 2020). The texture is an important aspect of food quality sometimes more important than aroma and color. Texture affects the taste, texture also affects a person's level of liking for food. Many groups of people, including children, do not like the food because of the texture that is not liked even though the taste of the food is delicious, in general people like textures that are tender, chewy, and crispy (Chen & Rosenthal, 2015).

The results of the assessment of the characteristics of sago Kuali/sinole food, in general, include all characteristics of both color, aroma, taste, and texture. This shows that the number of average values given by the panelists to the 4 organoleptic characteristics in order is: Formula 373 has the highest number of assessments among other formulas, namely 15.76, then Formula 262 which is 15.04, and formula 151 which is 13.61. This assessment illustrates that the panelists like the addition of snakehead fish meat to the cauldron/sinole sago product because the addition of the meat will add a savory taste to the food products made.

3.2 Acceptability Test Results

The highest average result of the level of favorability with the panelists is rather trained, obtained by Formula III, thus making the Product with Formula III to be tested for public acceptance of this product. The acceptability test, with 30 general public panelists as shown in the Table 3.

Table 3. Distribution of the results of the Sago Kuali/Sinole Food Acceptance Test substituted for snakehead fish meat

Amount (%) of food spent	N	%
0-25 %	4	13.3
26-50 %	2	6.7
51-75 %	2	6.7
76-100 %	22	73.3
sum	**30**	**100**

Table 3 showed that the panelists who spent a sample of sago cauldron/sinole as much as 76-100 % for a total of 22 people (73.3 %), 51-75 % for a total of 2 people (6.7 %), 26-50 % several 2 people (6.7 %) and 0-25 % several 4 people (13.3 %). This shows that most of the panelists like Sago cauldron/Sinole which is substituted with snakehead fish meat. The preference for this product is related to people's habits in consuming sago which is processed into papeda and Sinole/Sago cauldron and the habit of people in consuming snakehead fish in the daily menu which is processed by boiling, frying, or burning, this causes the taste and aroma of the food product (sago cauldron/sinole) are familiar and can be accepted by the sense of taste and the sense of dismembering. Different things were shown by 4 people or 13.3% who did not like this food product, it was related to personal experience in consuming both types of foodstuffs used in the manufacture of this product (sago and snakehead fish). Poor experience in relation to the consumption of certain foodstuffs, will cause unfavorable psychological effects on the preferences of these foodstuffs.

3.3 Nutritional Value of Energy and Protein of Sago Kulai/Sinole Food

Nutritional content of energy from sago/sinole food in this study was calculated based on conversion in the Food Ingredients Composition List (DKBM). The nutritional value of Energy and Protein in the cauldron/sinole sago food is presented in Table 4.

Table 4. Nutritional Value of Energy and Protein in Sago Kuali/Sinole Foods substituted for snakehead fish meat in 1 recipe

Formula	Energy (Kal)	Protein (gr)
I (151)	154,6	5,5
II (262)	140,7	6,7
III (373)	126,7	7,9

Based on the results of nutrient calculations using the conversion of nutrient content in the Food Ingredients Composition List, it shows that the energy content in formula I (151) is 154.6 Kcal/recipe or per piece higher than Formula II (262) of 140.7 KCal/recipe, as well as formula III (373) of 126 Kcal/recipe, this is due to the increasing addition of snakehead fish meat, there is a decrease in the amount of sago flour which is the source of energy from carbohydrates. The same thing happens with the protein content, the product that Formula III (373) is 7.9 grams/recipe, higher than Formula II (262) by 6.7 grams/recipe and formula I (151) by 5.5 grams/recipe, this shows that the more substitutions of snakehead fish meat, the protein content in sago Kuali/Sinole products increases, this is due to that snakehead fish meat is a fairly high and good source of protein.

4 Conclusion

The results of this study conclude that Formula III (snakehead fish meat 30 gr: sago flour 20 gr) has the best organoleptic acceptance compared to Formula I (snakehead fish meat 20 gr: sago flour 30 gr) and Formula II (snakehead fish meat 25 gr: sago flour 25 gr), The public acceptance test for sago Kuali/Sinole formula III products showed that 73.3% of panelists liked this product, Calculation of nutrient conversion using the List of Composition of Foodstuffs, it can be seen that formula 151 has the highest energy value of 154.56 kcal per fruit or recipe, and the highest protein value is in formula 373, which is 7.9 gr per fruit or recipe.

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