

Development of Chicken Porridge Based on Orange Sweet Potato (*Ipomoea batatas* L.) and White Rice

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ABSTRACT

Objective: This study aims to evaluate the level of preference (organoleptic characteristics), nutritional value, and antioxidant content of porridge formulated with orange sweet potatoes and white rice as local ingredients to enhance nutritional quality. **Method:** An experimental approach using a Completely Randomized Design (CRD) was conducted with four porridge formulations. Sensory evaluation was performed using a 9-point hedonic scale, while nutritional analyses – including carbohydrates, protein, fat, moisture, ash, fiber, and antioxidant levels – were determined following the Association of Official Agricultural Chemists (AOAC) and Diphenylpicrylhydrazil (DPPH) methods. **Results:** The optimal formulation (F2), composed of 150 g orange sweet potato, 100 g white rice, and 500 ml chicken broth, demonstrated favorable sensory acceptance and provided per 100 g: 65.18% moisture, 0.52% ash, 1.09% fat, 9.66% protein, 23.54% carbohydrates, 142.67 total calories, and 9.79% antioxidants. **Novelty:** This research introduces the utilization of orange sweet potatoes as a functional ingredient in porridge formulation, highlighting its potential to enhance antioxidant capacity and nutritional value, thereby promoting the development of locally based, health-oriented functional foods.

INTRODUCTION

Porridge is a practical and readily available food. Furthermore, it can be consumed by all ages, from toddlers to the elderly and those with swallowing difficulties. Porridge is generally made from rice without any additional ingredients [1]. This leads to unmet nutritional needs, such as antioxidants and fiber. Therefore, it is necessary to add local food ingredients to help maintain regional food security, while also providing more affordable prices and widespread availability. One local food ingredient that can be developed is sweet potato [2].

Sweet potato is a food with a high nutritional content. The nutritional content of sweet potatoes depends on the type and color; this study used orange sweet potatoes. Orange sweet potatoes contain several nutrients, including 11.90 g of carbohydrates, 4.42 g of protein, 1.30 g of fat, and 1.23 g of fiber in 100 g of cooked orange sweet potatoes. In addition to macronutrients, orange sweet potatoes also contain antioxidants, β -carotene, α -carotene, and iron, which are higher than other vegetables [3]. A study conducted by Kourouma v et al showed that the total antioxidant activity content in orange sweet potatoes steamed for 15 minutes was 14.42%. In addition to using sweet potatoes, this porridge also uses chicken broth [4], [5]. This addition is done to add flavor to the resulting porridge product and prevent food from spoiling. This is because the broth uses spices such as bay leaves, garlic, shallots, spring onions, celery, salt, and ground pepper. Considering that making porridge using sweet potatoes and broth requires a long time and process [6], [7], [8].

The porridge product made from orange sweet potato (*Ipomoea batatas* L.) and white rice produced in this study was in semi-liquid form. Therefore, organoleptic testing was necessary to determine the best formula and analyze its nutritional content.

RESEARCH METHOD

1. Research Design

This research was an experimental study using a completely randomized design (CRD). The independent variables were orange sweet potato (*Ipomoea batatas* L.), white rice, and chicken broth. The dependent variables were preference levels and the nutritional content of the porridge. This study began with the porridge formulation, followed by a preference test, and concluded with a nutrient content test of the selected formula. This study was conducted from August to October 2023.

2. Research Location

The process of making porridge from orange sweet potato (*Ipomoea batatas* L.) and white rice was conducted in the Food Technology Laboratory (ITP) of the Department of Nutrition, Faculty of Medicine, Diponegoro University. The preference level test was conducted in the Prof. Dr. Satoto Hall, 5th floor of the Nutrition Building, Faculty of Medicine, Diponegoro University. Analysis of the nutrient content and shelf life of the porridge was conducted in the Nutrition Analysis Laboratory, Faculty of Nursing and Health, Universitas Muhammadiyah Semarang.

3. Research Sample

The sample in this study consisted of 80 consumer panelists, both male and female students at Diponegoro University, who agreed to serve as panelists and assess the level of preference for porridge made from orange sweet potato (*Ipomoea batatas* L.) and white rice (*Oryza sativa* L.).

4. Research Stages

This study was divided into three stages:

- a. Formulating porridge made from orange sweet potato (*Ipomoea batatas* L.) and white rice using a laboratory experimental design.
- b. Conducting a preference test on consumer panelists to determine the selected formula for porridge made from orange sweet potato (*Ipomoea batatas* L.) and white rice (*Oryza sativa* L.).
- c. Conducting proximate nutrient analysis (carbohydrate, protein, fat, water content, ash content), antioxidant and fiber content, and testing the shelf life of porridge products made from orange sweet potato (*Ipomoea batatas* L.) and white rice (*Oryza sativa* L.).

5. Data Collection Procedure

a. Porridge Formula Preparation

The main ingredients used in this study were orange sweet potato and rice. Supporting ingredients such as chicken stock (chicken bones), bay leaves, garlic, shallots, spring onions, celery, salt, and ground pepper were also used. The main and supporting ingredients were obtained from traditional markets.

b. Porridge Making Equipment

The tools used to make this porridge included a basin, stockpot, knife, cutting board, saucepan, blender, aluminum foil, meter tube, pH meter, oven, and spectrophotometer (Shimadzu, Japan).

c. Porridge Making Materials

The ingredients used to make this porridge are shown in Table 1 below.

Table 1. Porridge Formula Ingredients

Formula Ingredients	F1	F2	F3	F4
Orange Sweet Potato (g)	100	150	200	250
White Rice (g)	150	100	50	0
Chicken Stock (ml)	500	1500	500	500
Pepper	1/4 sdt	1/4 sdt	1/4 sdt	1/4 sdt
Garlic	2 cloves	2 cloves	2 cloves	2 cloves
Celery	1stalk	1stalk	1stalk	1stalk
Scallions	½ stalk	½ stalk	½ stalk	½ stalk
Lime Leaves	1 leaf	1 leaf	1 leaf	1 leaf
Bay Leaves	1 leaf	1 leaf	1 leaf	1 leaf
Salt	¼ sdt	¼ sdt	¼ sdt	¼ sdt

This formula is repeated based on Federer's formula as follows:

$$(t-1)(n-1) > 15$$

t = number of formulas

n = number of formula repetitions

$$(t-1)(n-1) > 15$$

$$(4-1)(n-1) > 15$$

$$3n-3 > 15$$

$$3n = 15 + 3$$

$$n = 18/3$$

$$n = 6$$

In this study, the formula was repeated six times.

d. Porridge Making Procedure

- 1) Thoroughly wash the chicken, bay leaves, garlic, and spring onions.
- 2) Place the chicken, crushed bay leaves, crushed garlic, and split spring onions in a saucepan.
- 3) Boil in 750 ml of water over low heat at 90°C to prevent vitamin depletion and maintain the nutritional value of the chicken stock until the chicken is cooked.
- 4) While waiting for the chicken stock to cool, peel, grate, and wash the orange sweet potatoes.
- 5) Prepare the white rice and strain the finished stock.
- 6) Combine the chicken stock, white rice, and purple sweet potatoes in a 30cm diameter saucepan.
- 7) Cook until porridge forms.
- 8) Once cooled, pack the porridge in an aluminum foil pouch.

The research data were processed using Microsoft Excel, then analyzed statistically using SPSS 16.0 for Windows. All data except the acceptance test were analyzed statistically using Kruskawalis to determine the selected formula. The data from the nutritional content analysis were further processed to calculate the contribution of nutrients based on the Recommended Nutritional Intake (RDA).

RESULTS AND DISCUSSION

Result

1. Porridge Formulation

The porridge made in this study was made from orange sweet potato (*Ipomoea batatas* L.), white rice, and chicken broth, designed to meet consumer needs during disasters. The raw material selection in this study was also based on the use of a commonly found local food source, namely orange sweet potato. The determination of the quantity of ingredients used in this porridge formula was also obtained after several trials, ultimately resulting in the formula shown in Table 2 below.

Table 2. Porridge Formula

Formula	Sweet Potato Formula (g)	White Rice (g)	Chicken Broth (mL)
F1	100	150	500
F2	150	100	500
F3	200	50	500
F4	250	0	500

2. Preference Level Test

The preference level test is an organoleptic test to determine consumer acceptance of porridge based on local orange sweet potato (*Ipomoea batatas* L.) and white rice. This test assesses color, aroma, texture, and taste to determine the best and most preferred formula using a 9-point hedonic scale: (1) dislike extremely, (2) dislike extremely, (3)

dislike extremely, (4) dislike somewhat, (5) neutral, (6) like somewhat, (7) like extremely, (8) like extremely, (9) like extremely.

Table 3. Level of Preference

Attributes	Color	Texture	Aroma	Taste	Overall
F1	5,79±2,01	5,89±1,84	5,78±1,60	5,19±2,08	5,65±1,41
F2	6,11±1,42	6,01±1,60	5,81±1,51	5,58±1,68	5,87±1,09
F3	5,53±1,70	5,95±1,63	5,70±1,69	5,29±1,81	5,52±1,27
F4	5,20±1,75	4,08±1,73	4,86±1,70	4,09±1,62	4,55±1,15

Table 3 explains that the overall level of liking for color, texture, aroma and taste, the selected formula was formula 2 porridge (150 grams of orange sweet potato and 100 grams of rice and 500 ml of stock) with a mean of 5.87 and a standard deviation of 1.09. According to Meilgaard et al, texture is an assessment that influences a product. Color is an important sensory attribute in determining consumer impressions regarding rejection or acceptance of a food product. Color can also be used as an indicator in determining the quality of food ingredients. Texture is also an important attribute in the acceptance and evaluation of a product. Ingredients that are not smooth and not mixed evenly will cause a rough texture. Texture consists of several categories, including viscosity, consistency, and texture.

Aroma is a sensory attribute assessed using the sense of smell and is an important organoleptic property of food products because it can influence panelists' perceptions when evaluating a product. Therefore, the food industry considers aroma testing crucial because it can quickly provide results regarding consumer preference for a product.

Taste is the most important attribute in assessing and determining whether a food product will be accepted or rejected. Taste is the most important attribute and influences consumers' consumption of food products compared to other attributes. Determining taste involves the sense of taste, namely the tongue. The overall score in the organoleptic test is based on the panelists' general acceptance of all sensory attributes of the product, including color, aroma, texture, taste, and other characteristics.

3. Nutrient Content Analysis

Nutrient content analysis was conducted in the Nutrient Analysis Lab, Faculty of Nursing and Health, Muhammadiyah University of Semarang. The results of the porridge analysis can be seen in Table 4:

Table 4. Nutritional content of Formula 2 porridge

Nutritional Content	Ingredients (Serving)	
	100 gram	300 gram
Water %	65,18 ± 1,94	195,54 ± 5,82
Ash %	0,52 ± 0,11	1,56 ± 0,33
Carbohydrate %	23,54 ± 2,32	70,62 ± 6,96

Nutritional Content	Ingredients (Serving)	
	100 gram	300 gram
Protein %	9,66 ± 0,49	28,98± 1,47
Fat %	1,09 ± 0,13	3,27 ± 0,39
Fiber %	8,70 ±0,12	26,1 ±0,36
Antioxidants %	9,79 ± 0,75	29,37 ± 2,25
Energy Kcal	142,67 ±7,38	428,01 ± 22,13

Data presented as mean and standard deviation.

Table 4 explains that 100 grams of Formula 2 porridge contains 65.18% water, 0.52% ash, 1.09% fat, 9.66% protein, 23.54% carbohydrates, 142.67% total energy, and 9.79% antioxidants. Consuming 300 grams of Formula 2 porridge contains 195.54% water, 1.56% ash, 428.01 kcal of energy, 28.98% protein, 3.27% fat, and 70.62% carbohydrates.

Discussion

Water content is an important component in determining the percentage of nutrients in a food as a whole. Water content in food also affects shelf life during storage and can be used as an indicator of food safety [9], [10].

Ash is the inorganic residue of a food that remains after combustion or complete oxidation of organic matter in the food. The ash content of a product is influenced by the mineral content of the food. In addition, a factor influencing ash content is the presence of water-soluble mineral salts lost during processing [11], [12].

Protein is a complex organic compound with a high molecular weight composed of amino acid monomers linked together by peptide bonds. In the body, protein is a primary macronutrient that functions as a building block, regulator, and energy source. The decrease in protein content in porridge is caused by the breaking of bonds between amino acids [13], [14].

Fat is a macronutrient component with functional properties that are useful for food processing and can determine the quality of a food product. The source of fat in porridge formulas comes from chicken broth. According to Boateng et al, palm oil contains 50% saturated fatty acids, 40% monounsaturated fatty acids, and 10% polyunsaturated fatty acids. Fat content is influenced by the heating process. The higher the temperature, the greater the damage to the fat. When heated with an alkaline solution, essential fatty acids will be isomerized [1], [15]. Fat is also sensitive to light, temperature, and oxygen. The resulting fat oxidation process can inactivate its biological functions.

Carbohydrates are a macronutrient component that serves as the primary source of energy. The presence of carbohydrates also determines the organoleptic characteristics of food ingredients, such as taste, texture, and color. The carbohydrate content of porridge is calculated using the by-difference method, so its content is influenced by the presence of other nutrients such as water, ash, fat, and protein. The lower the content of non-carbohydrate components, the higher the carbohydrate content.

Fiber or dietary fiber is an important role for intake, dietary fiber as a contributor to overall metabolic health, In addition, there is a clear relationship between dietary fiber intake and several pathologies that include cardiovascular disease, gut health, gut motility and the risk of colon tumor prevention. This product has a fiber content of 8.70% where based on BPOM No. 13 of 2016 concerning high-fiber foods, it is categorized as high if in liquid form food 100 kcal is 3 grams.

Natural antioxidants in fruits and vegetables scavenge harmful free radicals, thus having a protective effect against oxidation, increasing nutritional value and preventing food spoilage. Furthermore, consumption of antioxidants prevents intracellular oxidation, which has been linked to health promotion and the prevention of most degenerative diseases. The intake of antioxidant-rich foods (a daily intake of at least 400 g of fruits and vegetables) has been recommended to the general public by the World Health Organization as a way to protect against chronic diseases [11], [16]. However, there are no formal recommendations for the type, amount or quantity of antioxidants that should be consumed daily. It is unknown whether individual antioxidants or the synergy of several different antioxidants (some of which may not yet be discovered) in fruits and vegetables contribute to disease prevention. The observed beneficial effects on health may also originate from other phytochemicals present in foods, such as dietary fiber, folate, vitamins, polyphenols, and potassium. Antioxidants from herbs and spices form complexes with metal ions (Fenton reaction) and or quench free radicals formed during the initiation phase of autoxidation. Flavor and aroma due to oxidation of dietary lipids trigger oxidative degradation, which leads to a decrease in food quality and causes undesirable tastes and odors in foods as well as changes in color and texture. By inhibiting or delaying the onset of lipid oxidation and its progression in processed foods that undergo various processes during production, natural antioxidants from spices and herbs provide efficient antioxidant protection to minimize oxidative damage to foods. Because many studies have revealed a decrease in the availability of health-promoting compounds such as phytochemicals and antioxidants during improper processing, handling, and long-term storage.

CONCLUSION

Fundamental Finding : The study concludes that Formula 2 (F2), composed of orange sweet potato (*Ipomoea batatas* L.) and white rice, was the most preferred porridge formulation in terms of color, aroma, taste, and texture. Nutritional analysis of 100 grams of F2 revealed 65.18% moisture, 0.52% ash, 1.09% fat, 9.66% protein, 23.54% carbohydrates, 142.67 total calories, and 9.79% antioxidant content, indicating its potential as a functional food rich in nutrients and antioxidants. **Implication :** These findings suggest that F2 porridge can serve as a nutritious and acceptable dietary option that supports community-based nutrition improvement, particularly among vulnerable groups such as the elderly. **Limitation :** The study was limited to laboratory and sensory testing without assessing the physiological effects of consumption in specific populations. **Future Research :** Further studies should include intervention-based trials

involving elderly participants and comparative analyses of all porridge formulations to evaluate their long-term nutritional benefits and antioxidant effects on health outcomes.

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