



## B-PORIS : Black Potato (*Plectranthus rotundifolius*) Instan Porridge As An Nutraceutical Product

**Cindy Natasya<sup>1</sup>, Maureta E. R. Safrina<sup>2</sup>, Salsabila E. S. Ningrum<sup>3</sup>, Fitriyani<sup>4</sup>, Lisa A. Zahra<sup>5</sup>, Burhan Ma'arif<sup>6</sup>**

<sup>1,2,3,4,5,6</sup> Faculty of Medical and Health Sciences, Maulana Malik Ibrahim State Islamic University, Malang, Indonesia

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### ABSTRACT

Black potato (*Plectranthus rotundifolius*) is one of the horticultural plants that has potential as nutraceutical food and also contain bioactive compounds such as being rich in flavonoids, especially anthocyanins. The potential benefits of black potatoes are not widely known by public, so it is necessary to cultivate one of them by processing it into food such as instant porridge, which is then labeled as B-PORIS product. The reason for choosing instant porridge was because it is a practical food product. This research aimed to prove that instant porridge from black potato contains bioactive compounds flavonoids, especially anthocyanins. These instant porridges are made with the appropriate ratio in 3 formulations with different parameters of black potato flour concentration, formulation 1 10%, formulation 2 9%, and formulation 3 11%. This research was conducted with organoleptic tests, moisture content tests, flavonoids, anthocyanins, and hedonic tests. The results of the organoleptic test obtained soft texture, characteristic chocolate smell, brown color, and slightly sweet and sweeter taste. The results of moisture content test were qualified with water content of not more than 7%. The results of flavonoid and anthocyanin test obtained positive results in all of formulations. The hedonic test result 80-90% of panelists indicate choose an option like, and really like in questionnaires, results demonstrated that formulation 3 was most likely. So it can be concluded that black potato tubers has the potential to become a nutraceutical product as an instant porridge with antioxidant effect that received and liked by various groups of age.

## 1. INTRODUCTION

Indonesia, as an agricultural country, has abundant agricultural commodities. One of the agricultural products is tubers, including black potatoes. Black potato (*Plectranthus rotundifolius*), as a horticultural commodity with rich carbohydrates, is widely used as an alternative food. However, people are generally more familiar with ordinary potatoes or yellow potatoes. So, the use and management of black potatoes must be cultivated [18].

Black potato has a lot of content. These tubers are rich in high carbohydrates of 33,7 grams/100 grams, higher than potatoes and sweet potatoes, which only have carbohydrates of 13,5 grams/100 grams and 20,6 grams/100 grams [2]. Besides, black potatoes are also a fairly high source of vitamin C and minerals, including calcium, phosphorus, and iron. Black potatoes per 100 grams contain 76% water, 21 carbohydrates, 1,4% protein, 0,7% fiber, 0,2% fat, and 0,1% ash, and as a source of vitamins [18]. This content is the reason for using black potatoes as food.

The use of black potatoes as food can provide benefits in the field of treatment, such as cancer [2]. Besides, black potatoes are also efficacious for curing ulcer disease, have potential as natural antioxidants, and antiproliferation (anti-multiplication of cancer cells) of the *triterpenic acid* group [18]. The content of flavonoids and vitamin C in black potatoes can increase the activity of antioxidants in the body, so food products made from black potatoes act as functional foods [4]. Flavonoids is a secondary metabolites in plants as antioxidants [10]. The application of using black potatoes as food is made into black potato flour which is then processed into instant porridge. The nutritional components in it and their comparison with ordinary potatoes or yellow potatoes are as follows [10]:

**Table 1.** Nutritional Components of Black Potatoes Per 100 grams

Component	Unit	Black Potato	Black Potato Flour	Yellow Potato
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Energy	Kal	142	-	62
Water	%	64.0	12	83
Protein	grams (g)	0.9	1.87	2.1
Fat	grams (g)	0.4	0.83	0.2
Carbohydrate	grams (g)	33.7	70.09	13.5
Calcium	Milligrams (mg)	34.0	70.72	63
Phosphor	Milligrams (mg)	75.0	156	5.8
Iron	Milligrams (mg)	0.2	0.56	0.7
Thiamine	Milligrams (mg)	0.02	0.04	0
Vitamin C	Milligrams (mg)	38	79.04	21
Fiber	grams (g)	34	-	-

Processing black potatoes as instant porridge are one of the cultivation efforts that later black potatoes can be better known and processed in the community. Instant porridge is a cereal-based food that can be consumed by both toddlers and the elderly [27]. Instant porridge of good quality must, of course, have high nutritional value, be beneficial for health, and be sensory acceptable. Black potatoes are effective for processing into instant porridge because they contain abundant nutrients. The nutrients contained in instant porridge are generally macronutrients which include carbohydrates, protein, fiber, and other supporting nutrients, as well as intake of micronutrients such as antioxidants that play an important role in the health of the human body [25]. Antioxidants have a role in preventing free radicals from disease, one of which is cancer. The content of antioxidants and other nutrients contained in black potatoes, as already mentioned.

Instant porridge as a fast food processed product is used as a substitute for rice and is quite popular with the public as a nutraceutical product. During the process of making instant porridge, it has undergone a further processing process so that in its presence there is no need for a cooking process but only adding hot water or milk according to taste [15]. Besides, instant porridge is more flexible to be consumed according to the desired time and place. This also makes instant porridge more durable because it is in a dry dosage form.

The majority of instant porridge formulations are made from rice flour and tubers, making it easy to consume because it has a soft texture and is easy to digest

after serving. The principle of making instant porridge, in general, is a thick porridge that is dried and then mashed [25]. Therefore, this study uses variations in the ratio of black potato flour and other ingredients by adjusting the drying temperature to obtain the appropriate consistency and taste. This instant porridge product was then given the name “B-PORIS (Black Potato Instant Porridge)”.

## 2. METHODS

### Materials

The materials used in the manufacture of this research include black potato flour (Lawang Market in Malang Regency), water, rice flour, skim powder, refined sugar, vegetable oil, chocolate flavor, Mg powder, 2% HCl, and NaOH. All ingredients are purchased from convenience stores and chemical stores.

### Methods

The black potatoes are washed and then peeled and sliced with a thickness of 1-2 mm. Then do the immersion using water. Then the black potatoes were drained and dried using an oven (MEMMERT Universal Oven Original UN30) at 40°C for 24 hours. Dried black potatoes were mashed using a blender, and then black potato flour was sifted through a sieve.

### Sample Preparation

Making instant porridge is ready by weighing all the ingredients and then mixing all the ingredients little by little according to the formulation until homogeneous. The mixture of ingredients is cooked for 2 minutes at a temperature of ± 70°C until the mixture thickens. The porridge that has been cooked and thickened is cooled and then spread thinly on a baking sheet that has been lined with parchment paper, and then the porridge is dried in the oven at 50°C for 1 hour. After drying, the pulp is mashed using a blender and then sieved using a sieve. In the last step, the instant porridge is weighed as much as 30 grams and put into the package.

**Table 2.** Instant porridge formulation from black potato (*Plectranthus rotundifolius*)

Ingredient	F1 (%)	F2 (%)	F3 (%)	Utility
Black Potato Flour	10%	9%	11%	Active Ingredients
Rice Flour	7%	7%	7%	Fastener
Skimmed Milk powder	8%	8%	10%	Taste
Fine granulated sugar	2%	2%	3%	Flavour
Vegetable Oil	2%	3%	2%	Fastener

Chocolate Flavour	3%	3%	3%	Flavour
Water	75%	75%	71%	Solvent

### Making Instan Porridge

The way to serve this instant porridge is to add one sachet of instant porridge into the container. After that, pour enough hot water and stir until smooth and a soft porridge texture is obtained. Instant black potato porridge is ready to be served.

### Organoleptic Test

An organoleptic test or sensory test is a test method using the human senses as the main tool to determine the characteristics of a sample which includes color, aroma, texture, and taste [8]. The senses used in this test include the senses of sight, touch, smell, and taste. Then explained about the organoleptic black potato instant porridge (color, texture, aroma, and taste).

### Moisture Content Test

Moisture content is a test carried out to find out how much water is contained in the sample expressed in percent [9]. The water content test was carried out using a water content device (Metller Toledo). The first step is for 0.5 grams of instant porridge powder to be weighed, put in a porcelain exchange, and flattened. After that, the tool is closed and waited until it gets a constant weight. Record the results on the water content screen [15].

### Flavonoid Test

The flavonoid test was carried out to determine the presence or absence of flavonoid compounds in the sample [13]. The flavonoid test was carried out by taking a sample of 2 grams, then adding Mg powder into a test tube (pyrex) to taste and four drops of 2% HCl, and observing the color of the sample. If the color of the sample shows a color change to orange-red, this indicates a positive flavonoid [14].

### Anthocyanin Test

The anthocyanin test is a test used to determine the anthocyanin content in the preparation [5]. First, the sample was heated with 2M HCl over Bunsen for 2 minutes using a temperature of 100°C, and the color of the sample was observed. If the red color in the sample does not change (constant), this indicates a positive anthocyanin. In the second stage, the sample is mixed by adding 2M NaOH into the test tube (pyrex) little by little. When the red color changes to blue-green and fades slowly, this indicates a positive anthocyanin [13].

### Hedonic test

The hedonic test is a type of test in which panelists or

volunteers are asked to express their personal responses to a questionnaire about their likes or dislikes of a product in stages [22]. The hedonic test was carried out on 30 panelists using a questionnaire. Tests were carried out voluntarily on black potato instant porridge products by asking panelists for responses from the taste, color, smell, texture, total acceptance, and the comparison between formulations 1, 2, and 3 of the instant porridge products that had been served. The assessment of likes and dislikes is expressed in the form of a hedonic scale [7]. The hedonic test scores of the panelists started from 1 (dislike very much), 2 (disliked), 3 (liked quite a bit), 4 (liked), and 5 (liked very much).

### 3. RESULTS AND DISCUSSION

#### Organoleptic Test

An organoleptic test is used to examine the physical appearance of the raw material for formulation 1, formulation 2, and formulation 3 of Black potato instant Porridge including texture, smell, color, and taste. The organoleptic results can be seen in the table below:

**Table 3.** Result of Organoleptic Test

Parameter	Formulation 1	Formulation 2	Formulation 3
Texture	Smooth	Smooth	Smooth
Smell	Chocolate	Chocolate	Chocolate
Color	Brown	Brown	Brown
Flavor	Slightly Sweet	Slightly Sweet	Sweet

Instant black potato porridge from these three formulas has the same texture, which is smooth because it goes through a sifting process. Then the distinctive smell of chocolate and brown color due to the use of chocolate flavoring, black potatoes themselves do not have a distinctive odor with a dark brownish yellow color. Black potato instant porridge is also made with a taste that is not too sweet. This is with the aim of making it safe for consumption by all groups, especially adults, and considering people who do not like sweet tastes. However, formulation three was made slightly sweeter than formulations 1 and 2 to consider people's preference for sweetness. People can also add their own sugar when the instant porridge is served according to taste.

#### Moisture Content Test

Based on the results of the water content test of “B-

PORIS” black potato instant porridge using a moisture analyzer, it can be seen that the highest moisture content is found in instant porridge formulation 1 with a moisture content value of 6,73%, then formulation 2 with a moisture content value of 5,56%, and finally formulation 3 with a water content value of 4,19%. Based on SNI 01 4321-1996 regarding instant porridge cream soup, the water content requirement for instant porridge cream soup is 2-7% [19]. This proves that the water content in each formula of “B-PORIS” black potato instant porridge meets the specified requirements. Measurement of water content in food products needs to be carried out because the water content in foodstuffs affects the occurrence of organoleptic changes and determines the microbial content in food products which also has an impact on product safety for consumption [3]. Water content that is too high can increase the growth and activity of microorganisms in foodstuffs so that chemical reactions occur, which will shorten the storage time of food products [6].

In addition, the high water content can cause lipolytic and proteolytic activity to increase, resulting in loss of nutrients (protein and fat) and increased production of free fatty acids, which causes the organoleptic quality of the product to decrease. The lower the water content in foodstuffs, the more positive impact on the nutritional content of food products. This is because low water content can increase the content of compounds, such as protein, carbohydrates, fats, and minerals, but in general, vitamins and dyes are reduced [26].

**Table 4.** Result of Moisture Content Test

Formulation	Moisture Content
F1	6,73%
F2	5,56%
F3	4.19%
<b>Average</b>	<b>5,49%</b>

The results of the flavonoid test using samples of instant black potato porridge from formulation 1, formulation 2, and formulation 3 of 2 grams each obtained positive results. The test method used is the Wilstatter test, where the test is carried out by adding a sample with 2-4 drops of concentrated HCl and Mg in a test tube which is then shaken to obtain a positive orange-red result [20]. Positive results from the three samples were mainly found in sample formulation three, which was reddish-orange in color, formulation 1 was orange, formulation 2 was slightly faded orange, and formulation 3 was orange. The color

difference is due to the percentage of black potato flour used. The more black

#### 4. CONCLUSIONS

Our finding in this research is that we were able to extract collagen from the skin of Tilapia which types I collagen which is indicated by the presence of a triple-helical structure 3. The ointment collagen has a better wound closure diameter than the negative control containing only based. The formulation with 15% collagen extract showed effective results with wound closure diameter on the last day of 0.11±0.02 cm, significantly different from the negative control of 0.22±0.01 cm. This is indicated by the rate of wound healing in mice observations. Furthermore the ointment has met the standards of homogeneity, spreadability, and pH. potatoes you use, the more intense the orang-red color will be. This proves that black potato flour contains flavonoid compounds.

**Table 5.** Flavonoid test of Formulation 1; formulation 2; formulation 3

Formulation	F1	F2	F3
Flavonoid Test	Positive	Positive	Positive
Color	Orange	Slightly faded orange	Orange
Result	The samples are positive flavonoids if it is orange		

#### Anthocyanin Test

An anthocyanin test was carried out to determine the content of secondary anthocyanin metabolites in black potatoes. This anthocyanin test was carried out using a phytochemical screening method, and the sample tested in this study was the instant black potato porridge product "B-PORIS" with variations in formulation 1, formulation 2, and formulation 3. The anthocyanin test results can be seen in the figure below:

**Table 6.** Anthocyanin test of formulation 1; formulation 2; formulation 3

Formulation	Anthocyanin Test		Color	
	2M HCl	2M NaOH	2M HCl	2M NaOH
F1	Positive	Positive	Red	Green
F2	Positive	Positive	Red	Green
F3	Positive	Positive	Red	Green

Based on the results of the anthocyanin test using the phytochemical screening method on the instant black potato porridge product "B-PORIS" with variations in formulation 1, formulation 2, and formulation 3, it showed positive results containing anthocyanins. This positive

result was indicated by a color change from brown to red of the samples (a, b, and c) during the heating reaction and addition of the 2M HCl reagent. Addition of 2M NaOH (d, e, and f), indicated a positive results by changing the color of the sample from brown to green [12].

Anthocyanins are natural dyes that belong to the flavonoid group and have three carbon atoms bonded by an oxygen atom to link the two aromatic benzene rings (C6H6) of the main structure. As bioactive compound, anthocyanins function as natural antioxidants in humans due to the arrangement of conjugated double bonds in the anthocyanin structure [1]. Anthocyanins can utilize free radicals from various types of reactive oxygen-derived free radicals, including hydroxyl (OH\*), peroxy (ROO\*), and monooxygenase (O2\*) [24].

Based on research conducted by Pamolango (2016), black potatoes contain anthocyanins which are derivatives of flavonoids ranging from 15 to mg-40 mg per 100 grams. Black potatoes have a higher anthocyanin content than ordinary potatoes. In black potatoes, anthocyanins function as natural dyes containing blackish purple pigments as a source of antioxidants [23]. The function of these natural antioxidants is to neutralize free radicals so that the body is protected from various degenerative diseases and cancer. Another function is to suppress the aging process or antiaging [23].

Besides, anthocyanins are reported to have high antiviral, antifungal, and anti-bacterial activities [21]. Anthocyanins as immunostimulants work by stimulating lymphocytes to produce interleukin (IL)-2 and interferon (INF)-γ. Anthocyanins which are flavonoids can also modulate various immune functions, including increasing PBMC responsiveness, IL-4 cytokine secretion, and NK cell lytic activity [11]. Therefore, the anthocyanin compounds in black potatoes are needed because they have many health benefits, and the number of compounds is higher than in ordinary potatoes.

#### Hedonic Test

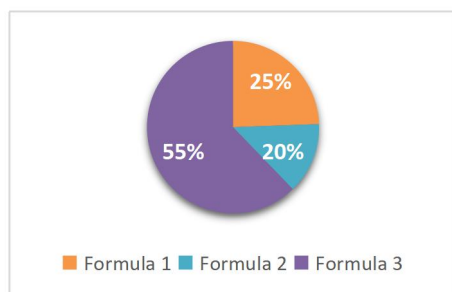
The hedonic test is used to check the panelists' preference for instant porridge products. This hedonic test consists of a total 30 participants male and females, ranging from a 16 years old teenager to 55 years adults. The percentage of male panelists is 15%, and the percentage of female panelists is 85%.

The parameters tested in the hedonic test, including texture, color, smell, taste, and overall assessment of instant porridge parameters, were assessed using a score of 1-5 with a total panel of 30 people of various ages

through google form media. The results of the hedonic test can be seen in the table below:

**Table 7.** Hedonic Test Result

Question	1	2	3	4	5
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Do you like the texture of the instant porridge "B-PORIS" product?	0 (0%)	0 (0%)	0 (0%)	21 (70%)	9 (30%)
Do you like the color of the instant porridge "B-PORIS" product?	0 (0%)	0 (0%)	1 (3%)	15 (50%)	14 (47%)
Do you like the smell of instant porridge "B-PORIS" product?	0 (0%)	0 (0%)	1 (3%)	13 (44%)	16 (53%)
Do you like the taste of instant porridge "B-PORIS" product?	0 (0%)	0 (0%)	0 (0%)	12 (40%)	18 (60%)
How do you rate the instant porridge "B-PORIS" product?	0 (0%)	0 (0%)	1 (3%)	20 (67%)	9 (30%)
What is your assessment of the "B-PORIS" instant porridge product as a whole?	0 (0%)	0 (0%)	1 (3%)	21 (70%)	8 (27%)

Based on the test results for filling out question number 1 in the questionnaire, there were 21 panelists who chose option 4, which means they like it, and nine panelists chose option 5, which means they really like the texture of the instant porridge product "B-PORIS". The result of test 2 in the questionnaire, one panelist chose option 3, which was neutral, 15 panelists chose option 4, which means they liked it, and 14 panelists chose option 5, which means they really like the color of the instant porridge product "B-PORIS". The results of test 3 in the questionnaire, one panelist chose option 3, which was neutral, 13 panelists chose option 4, which means they like it, and 16 panelists chose option 5, which means they really like the smell of the instant porridge product "B-PORIS". The result of test 4 in the questionnaire, 12 panelists chose option 4, which means they like it, and 18

panelists chose option five, which means they really like the taste of the instant porridge product "B-PORIS".

The processed product from black potato meat, "B-PORIS", has good organoleptic properties in terms of texture, color, smell, and taste so that it can be enjoyed by various age groups. Based on the results of questionnaire number 5, there is one panelist choosing option number 3, which is neutral, 20 panelists choosing option number 4, which means like, and nine panelists choosing option 5, which means really like the instant porridge product "B-PORIS". Based on the results of questionnaire number 6, 1 panelist chose option number 3, which was neutral, 21 panelists chose option number 4, which means like, and eight panelists chose option five, which means they really like the whole instant porridge product "B-PORIS". This proves that the instant porridge product "B-PORIS" can be received with a positive response by society and has the potential to be developed as an innovative antioxidant-rich food that is beneficial to health. From all the formulations, the most preferred taste by the panelists was instant porridge formulation 3, with a percentage value of 55%.

**Figure 3:** The respondent level of acceptance to the three formulation

## 5. CONCLUSION

Research has proven that "B-PORIS" has the potential to become a nutraceutical product as an instant porridge with an antioxidant effect. Proved by the laboratory test results showed that the "B-PORIS" product positive flavonoids and anthocyanins in phytochemical screening. Moreover, B-PORIS products have a soft texture, a characteristic chocolate smell, a brown color, and a slightly sweet. B-PORIS product have water content of not more than 7%. Furthermore, the results of hedonic tests conducted on 30 panelists also showed that formulation 3 instant porridge was the most preferred, with a percentage of 55%. Based on the results of the questionnaire 80-90% of panelists' answers indicate choosing an option like and really like. This proves that the processed product from black potato to instant porridge received and liked by various groups of age.

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