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Formulation and Antioxidant Activity Test of Rice Bran Extract Cream from Two Varieties of White Rice

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ABSTRACT

Rice bran extract contains high antioxidant compounds. Formulation and antioxidant activity testing of cream preparations containing rice bran extract has been carried out. This study aims to formulate and evaluate cream preparations containing bran extract from two varieties of white rice and their antioxidant activity. The white rice varieties used were the Kalpatali variety (FI) and the Rice 64 (FII) variety. There were three cream formulas, namely the basic formula (F0) and the formula containing rice bran extract with a concentration of 3.1% each (FI and FII). Evaluation of cream preparations included organoleptic test, homogeneity, pH, washability, stability, irritation test, and antioxidant activity test. This study showed that FI has an antioxidant activity of 87.23% and FII has an antioxidant activity of 64.08%. Different varieties of rice show differences in antioxidant activity in cream preparations containing bran extract. The best formula is FI which has good physical properties and higher antioxidant activity compared to FII.
Keywords: Cream; Antioxidant; Rice Bran; White Rice.

INTRODUCTION

Antioxidant compounds have a very important role in health. Antioxidants are used in cosmetics, pharmaceuticals, and food. Antioxidants are electron-donor compounds or reductants. This compound has a small molecular weight but can inactivate the development of oxidation reactions, by preventing the formation of radicals. Antioxidants are also compounds that can inhibit oxidation reactions by binding to free radicals and highly reactive molecules. As a result, cell damage will be inhibited (Gulcin, 2020; de Lima Cherubim *et al*., 2020).

Natural antioxidants are antioxidant compounds obtained of them from plants. Natural antioxidants from plants can be classified into three main classes namely phenolic compounds, vitamins, and carotenoids. Various types of plants have been known as sources of natural antioxidants such as herbs, spices, seeds, fruits, and vegetables. In general, antioxidant compounds are phenolic or polyphenolic compounds in the form of flavonoids, terpenoids, cinnamic acid derivatives, tocopherols, and polyfunctional organic acids. Examples of antioxidant compounds are β-carotene, catechins, quercetin, kaempferol, and others (de Lima Cherubim *et al*., 2020; Lourenço *et al*., 2019).

One of the natural antioxidants is oryzanol which is only found in rice bran. Rice bran oil contains fatty acid compounds, phenolic compounds (β oryzanol, ferulic acid), and vitamin E (tocopherols and tocotrienols). Gamma oryzanol is very strong in preventing oxidation and is more effective in preventing free radicals than vitamin E. The content of oryzanol in the gamma form of oryzanol in rice bran is 0.9% - 2.9% (Lourenço *et al*., 2019; Punia *et al*., 2021).

Rice bran or bran is obtained from the brown outer layer (husk) of the rice kernel during rice milling. Rice bran contains 18%–22% oil, contains phytochemical compounds such as oryzanol, phytosterols, tocotrienols, squalene, polycosanol, phytic acid, ferulic acid, and inositol hexa phosphate (Punia *et al*., 2021). Research on the isolation of bioactive compounds and activity testing of rice bran extracts or rice bran oil has been widely reported, including rice bran extracts which have activities as antioxidants, anti-bacterial, anti-cancer, anti-diabetic, etc (Friedman *et al*., 2013; Yu *et al*., 2019; Sivamaruthi *et al*., 2018).

White rice of the Kalpatali and Padi 64 varieties is a type of white rice that is commonly found in the Pasir Pengarayan area. Varieties and places where rice grows are likely to produce rice bran with different levels of bioactive components (Widarta *et al*., 2013; Hartati *et al*., 2015). Research conducted by Iqbal *et al* showed that rice varieties showed differences in the main antioxidant components in their bran. This is due to the correlation between the growth period and irrigation water demand (Iqbal *et al*., 2004).

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Therefore it is suspected that Kalpatali rice bran and 64 rice bran have different antioxidant activities.

Currently, there are many uses of natural ingredients as a source of antioxidants in cosmetic preparations, both oral and topical (Noval *et al*., 2021; Reinard *et al*., 2022; Suena *et al*., 2021). One of the topical antioxidant dosage forms is the cream form. Cream preparations have several advantages including being easier to apply, more comfortable to use on the face, not sticky, and easily washed off with water. In addition, the cream is a suitable preparation for preparations containing antioxidants (Chauhan and Gupta., 2020). This is because the cream is expected to be in contact with the skin for a long time so that the antioxidant compounds in the cream formula can maximally ward off free radicals in the skin.

Based on a search of the literature, there has been no scientific publication that determines the effect of rice varieties on the antioxidant activity of bran from white rice after being formulated in the cream dosage form. This study aimed to formulate and test the antioxidant activity of a cream preparation containing white rice bran extract of two varieties.

METHODOLOGY

Materials

Kalpatali rice bran, Rice bran 64 (obtained from a rice mill in Pasir Pengaraian, Rokan Hulu Regency, Riau), stearic acid, cetyl alcohol, glycerol, triethanolamine, nipagin, nipasol (Bratachem, Indonesia) and distilled water.

Processing of Samples

Rice bran was stabilized using an oven at 100°C for 60 minutes (Damayanthi., 2002). As much as 0.5 kg of rice bran was macerated using ethanol solvent, and left for 3-5 days, then filtered using filter paper. The results obtained were then concentrated with a rotary evaporator to obtain a thick extract from rice bran (Margarita., 2018).

Formulation of Rice Bran Extract Cream Preparation Procedure

All the ingredients needed are weighed according to the formula. Each oil phase (stearic acid, cetyl alcohol, glycerol, and nipasol) and water phase (triethanolamine, nipagin, and distilled water) were heated at 60°C – 70°C in a water bath. Transfer the oil phase to a hot mortar and add the water phase and then grind it homogeneously until it cools down to form a creamy mass. Then the bran extract is added little by little to the cream mass and then homogenized. Cream preparations are put in a wide-mouthed container with a tight lid (Suhery *et al*., 2016).

Physical Evaluation of Bran Extract Cream Preparations

Evaluation of the physical properties of the cream preparation included organoleptic and homogeneity examination, pH, stability test, washability, spreadability, and skin irritation test.

Organoleptic and Homogeneity Examination

Organoleptic examination of cream preparations includes appearance, color, and smell. Checking for homogeneity is carried out by smearing the preparation on a piece of transparent glass, then observing it the preparation must show a homogeneous composition and no specks of agglomerated particles should be seen.

pH Testing

Examination of the pH of the preparation was carried out using a pH meter that had previously been calibrated using a standard buffer solution of pH 4, and a standard buffer solution of pH 7. Measurement of the pH of the preparation was carried out by diluting 1 gram of the preparation with 10 ml of distilled water in a container, then dipping the electrode into the solution and observing the numbers shown by the pH meter (Departemen Kesehatan., 2020).

Physical Stability Testing

Examination of the physical stability of the cream was carried out at two treatment temperatures, namely at room temperature and cold temperature. The cream preparation to be tested was left for two months at room temperature. Every week it is observed whether there is destruction or not. The stability check of the cream was also carried out at 0 to 4^0 C and left for 24 hours and then observed whether damage occurred or not. Creams that do not show refinement are graded as stable creams.

Washability Test

Check the washability of the cream. The preparation is weighed 1 gram, rubbed on the palms of the hands, then washed with a volume of water while rinsing the hands. Water is passed from the burette slowly. Then it is observed visually whether or not there is cream left on the palms. Next, record the volume of water used.

Spreadability Test

Approximately 0.5 grams of preparation is placed carefully on graph paper covered with transparent glass and then left at any time

Table I. The formulas of rice bran extract cream

No	Bahan	F0	FI	FII
1	Rice bran extract (Kalpatali Rice)	-	3.1%	-
2	Rice bran extract (Rice 64)	-	-	3.1%
3	Stearic acid	25%	25%	25%
4	Cetyl alcohol	1%	1%	1%
5	Glycerol	5%	5%	5%
6	Triethanolamine	2%	2%	2%
7	Nipagin	0.1%	0.1%	0.1%
8	Nipasol	0.05%	0.05%	0.05%
9	Aquadest ad	100%	100%	100%

(15 seconds). Then the area given by the preparation was calculated and covered again with a glass plate which was given a certain load (5, 10, 15, 20, 25 g, and 30g) and left for 60 seconds. Then calculate the area given by the preparation.

Skin Irritation Test

A total of 0.1 gram of the preparation is weighed, then rubbed on the skin of the inner arm. Next, the arm is covered with gauze and plaster. After that, the symptoms are seen after 24 hours of use. The irritation test was carried out on 6 panelists (Departemen Kesehatan., 1985).

Antioxidant Activity Test of Rice Bran Extract Cream Preparations

Preparation of DPPH Solution.

A total of 2 mg of DPPH was weighed and dissolved in 2 ml of methanol to obtain a DPPH concentration of 1000 ppm (1000 µg/ml). Then it was diluted with a concentration of 80 µg/ml.

Testing Antioxidant Activity of Preparations.

The antioxidant activity test was carried out using a microplate reader two-fold dilution with the DPPH method. A total of 1 gram of cream preparation was weighed and dissolved in 1 ml of methanol until homogeneous. The sample solution is pipetted, then inserted into the microplate holes in rows A and B as much as 50 µl (the plate consists of rows A-H each of which totals 12 wells but only 3 wells are filled with a sample solution in each row which means 3 repetitions for one solution sample). A total of 50 µl of methanol was added to each well in the B-H row. Pipette line B as much as 50 µl and put it into row C, line C pipetted 50 µl inserted into row D and carried on until row F, row F pipetted 50 µl and then discarded, to obtain concentrations of 1000, 500, 250, 125, 62.5, and 31 .25mg/ml. Rows A-G were added with 80 µl of DPPH at a concentration of 80 µg/ml, then covered with aluminum foil and incubated for 30 minutes in a dark place.

Determination of Percent Inhibition.

Radical scavenging activity was measured as a decrease in the absorbance of DPPH at a wavelength of 520 nm and the data was processed. The % inhibition value is calculated using the formula: % Inhibition = (Abs of control - Abs of sample)/(Abs of control) x 100%
Abs = Absorbance

RESULT AND DISCUSSION

Preparation of extract from white rice bran begins with the process of stabilizing the sample using an oven at 100°C for 60 minutes. The goal is to prevent the sample from going rancid. The bran extract obtained from two varieties of white rice produces a thick extract with a characteristic odor and brown color. On examining the pH of the extract, a pH value of 6 was obtained and this indicated that the pH of the extract was classified as weakly acidic due to the chemical content of rice bran which is acidic. Extract solubility test showed that bran ethanol extract was easily soluble in alcohol and practically insoluble in water.

The white rice bran extract cream formula uses the same base and the same extract concentration, namely 3.1% for each rice variety. extract concentration of 3.1% was obtained from the value of 3 x IC_{100} of the extract. The cream formula can be seen in Table I. The base type used is an oil-in-water base. This is because the type of base can affect the concentration of the active substance and the antioxidant activity of the red rice bran extract cream preparation as reported by Suhery *et al*, 2017.

Evaluations of F0, FI, and FII were carried out including organoleptic, homogeneity, pH, room temperature and cooling stability, spreadability, irritation test, and antioxidant activity. The

Figure 1. Photo of cream preparation F0, FI, dan FII

Table II. The evaluation of cream rice bran extract cream

Formulas	Spreadability test (weight 20 grams)	Irritation test	Physical Stability	Antioxidant activity (% inhibition)
F0 (Base)			No phase	
1st Week	4,906 cm	Non-irritating	separation	31,225 %
8th Week			(Stable)	30,101%
FI			No phase	
1st Week	5,251 cm	Non-irritating	separation	87,231 %
8th Week			(Stable)	86,032 %
FII			No phase	
1st Week	7,598 cm	Non-irritating	separation	64,085 %
8th Week			(Stable)	54,603 %

Table III. The evaluation of cream rice bran extract cream (cont)

Formulas	Homogeneity	pH	Washability (ml)
F0 (Base)			
1st Week	Homogeneous	7,7	30,5 ml
8th Week		7,2	
FI			
1st Week	Homogeneous	7,5	33,7 ml
8th Week		7,1	
FII			
1st Week	Homogeneous	7,5	35,0 ml
8th Week		7,1	

organoleptic test results of the cream base are semi-solid, cream in color, have a characteristic odor, and have not changed during 8 weeks of storage. The purpose of organoleptic evaluation at F0, FI, and FII is to see the consistency, smell, and color of the cream. Based on the results of organoleptic observations at F0, it shows a white color, a characteristic odor, and a semi-solid form. While the physical appearance of FI and FII is almost the same, namely cream color, characteristic odor, and semi-solid form. The results are shown in Figure 1.

The results of the evaluation of the physical properties and antioxidant activity of the cream preparations can be seen in Tables II and III. Evaluation of the spreading power test was carried out to see how much the spreading power and the ability to spread the preparation on the skin surface. The results showed that the spreading power of FII was better than FI because the consistency of FII was softer than that of FI. This dispersion test is carried out manually using the principle of calculating the area increase given by the preparation at a certain time when it is given a

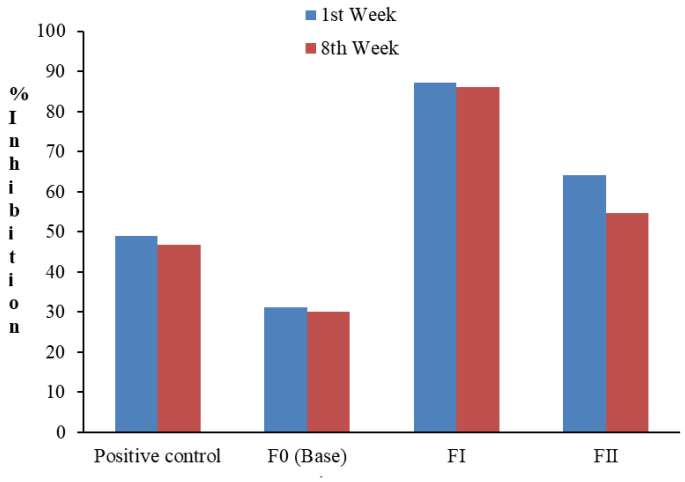

Figure 2. Diagram of antioxidant activity of rice bran cream preparations

heavy load. This spreadability test can show that cream preparations are easily applied to the skin surface without significant pressure on the skin (Suhery *et al*., 2016; Yamlean *et al*., 2019). Homogeneity examination at F0, FI, and FII showed that all the formulas were homogeneous which was characterized by the absence of clumping particles in the cream. The pH examination showed that the pH F0, FI, and FII were 7.9 – 7.2, 7.5 – 7.1, and 7.7 – 7.1, respectively. The pH value of the cream preparation is higher than the pH value of the extract due to the higher base pH value. This is due to the presence of an alkaline component in the cream base. Even though the pH preparations are not included in the pH range of the skin, namely 5.5 – 6.5 (da Silva Favero *et al*., 2019). The irritation test shows that all formulas do not irritate the skin.

Examination of the washability was carried out with running water and showed the volume of water used was 30.5 ml (F0), 33.7 ml (FI), and 35.0 ml (FII). These results indicated that F0, FI, and FII are included in preparations in the easy-to-wash category. The results of the evaluation of washability can be seen in Table 3. Examination of the physical stability of F0, FI, and FII at room temperature and cold temperature showed that all formulas were stable in terms of consistency color, and smell, and did not show any phase separation during storage. While the stability of the antioxidant activity of the cream preparations showed a decrease in activity during storage, namely at week 1 and week 8. This decrease can be caused by variations in room temperature and humidity during storage (Table II).

Antioxidant activity testing on F0, FI, and FII with the comparison preparation was vitamin E cream (containing 0.02% vitamin E). The results showed that the percent inhibition at a concentration of 1000 mg/ml was 31.225% F0, 87.231% FI, and 64.085% FII. While the comparison cream, which contains Vitamin E, has an inhibition percentage of 49.016%. The FI value showed a higher percentage of inhibition compared to the F0, FII, and comparison preparations (Table 2 and Figure 2). This shows that the content of bioactive compounds in the rice bran extract of the Kalpatali variety provides better antioxidant activity than other formulas. Kalpatali variety provides better antioxidant activity than other formulas. Kalpatali rice is a local Gogo rice variety that can grow well on dry land with very limited water availability (Idwar *et al*., 2022). Kalpatali rice is a variety that requires less water than rice 64. This causes differences in the content of active antioxidant components which will affect its antioxidant activity. This statement refers to research conducted by Iqbal *et al* that rice varieties that require the least amount of water show the highest antioxidant activity (Iqbal *et al*., 2004).

CONCLUSION

Antioxidant cream formulation of white rice bran extract showed good physical properties evaluation results. FI showed the highest antioxidant activity of cream preparations, namely cream preparations containing white rice bran extract of the Kalpatali variety.

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