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GLUTINOUS BLACK RICE AND FLOUR  
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SNACKS OF HYPERCOLESTEROLEMIC  
PATIENTS

*By Roro Fauziah*

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**ICE CREAM BASED ON FERMENTED GLUTINOUS BLACK RICE AND FLOUR  
SOYBEAN SOURCE PROTEIN, ISOFLAVON, FIBER, AND ANTOSIANIN AS  
SNACKS OF HYPERCOLESTEROLEMIC PATIENTS**

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**Fauziyah, Roro Nur<sup>1</sup>; Amelia, Nabila Putri<sup>1</sup>; Surmita, Surmita<sup>1</sup>; Suparman, Samsidi<sup>1</sup>**

<sup>1</sup>Nutrition Departement, Health Polytechnic Ministry of Health Bandung Indonesia

### ABSTRACT

*According to Riskesdas (2013), the proportion of population > 15 years who experience hypercholesterolemia is 35.9%. Lestari S research (2016) shows that of 17 people with hypercholesterolemia, 13 (46.4%) have less fiber intake, and 10 (41.7%) have less antioxidant intake. Fermented Glutinous Black Rice and Soy Flour Ice Cream Products that are rich in protein, isoflavones, fiber, and anthocyanins are needed to help reduce blood cholesterol levels which have been proven by several studies to be used as antihypercholesterolemia. This study aims to determine the best formulation of products, data formulation of Fermented Glutinous Black Rice and soy flour, the effect of differences in ice cream formulation on the color, aroma, taste, and texture of the product, as well as knowing the levels of protein, isoflavones, fiber, and anthocyanins of the best formulation product. Design an experimental study research with a Completely Randomized Design (CRD). The research method uses hedonic tests to determine organoleptic properties, kjeldahl for protein testing, literature studies for isoflavone testing, enzymatic gravimetry for fiber testing, and differential pH for anthocyanin tests carried out in February to March 2020. The research was conducted at the Laboratory of Food Technology and Test Organoleptic Laboratory of Poltekkes Bandung, Food Technology Laboratory of Pasundan University, and Testing Laboratory of Bogor Agro Industry Center. Ice cream formulations were obtained from the calculation results, the Formula of Fermented Glutinous Black Rice : soybean flour F1 (85%: 15%), F2 (50%: 50%), F3 (40%: 60%). Kruskal Wallis test results showed there were significant differences in the hedonic test of color and taste. F1 excels at aspects of color, aroma, taste, and texture. It is hoped that further research will be conducted on the effect of giving Fermented Glutinous Black Rice and Soy Flour Ice Cream to samples with blood cholesterol levels above normal.*

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**Keywords:** *Fermented Glutinous Black Rice and Soy Flour Ice Cream, Protein, Isoflavones, Fiber, Anthocyanin*

### Introduction

Not infectious disease (PTM) are chronic diseases that are not transmitted from person to person. One of them is heart disease<sup>1</sup>. WHO (World Health Organization) data for 2015 shows that around one third of all deaths in Indonesia are caused by cardiovascular disease (CVD)<sup>2</sup>. As many as 30% (> 17 million) deaths occur due to heart disease and estimated death due to heart disease reaches 23.6 million deaths in 2030. The prevalence of CHD in Indonesia based on diagnosed by doctors or symptoms of 1.5 percent or about 2,650,340 people<sup>3</sup>.

Abnormalities of blood lipid levels, unhealthy diet / diet and high cholesterol levels are one of the risk factors for cardiovascular and metabolic diseases<sup>1,3</sup>. Hypercholesterolemia is a state of elevated total cholesterol level  $\geq 200$  mg / dl and has a close relationship with the severity of atherosclerosis or the onset of fat in blood vessel channels<sup>4</sup>. Based on the 2013 Basic Health Research, the proportion of population > 15 years who have high cholesterol levels is 35.9%<sup>3</sup>. Diet and antihypercholesterolemia pharmacological therapy can reduce the risk of

developing CHD, and dietary interventions are the first line of therapy recommended. Studies show that nutrient intake can affect blood cholesterol levels<sup>5</sup>. However, based on research conducted by Lestari S (2016), it can be seen from 17 people with hypercholesterolemia there are 13 people (46.4%) have less fiber intake, and 10 people (41.7%) have less antioxidant intake<sup>6</sup>.

Intake of dairy foods is often associated with an increased risk of CHD<sup>7</sup>. Dairy products that are preferred by the public are frozen food products such as ice cream. Ice cream is a cold dessert (frozen dessert) from ingredients made from milk mixed with sweeteners, such as sugar and certain flavors<sup>8</sup>. The content in 100 grams of ice cream consists of 210 kcal of energy, 4 grams of protein, 12.5 grams of fat, 20.6 grams of carbohydrates, 0 grams of fiber and a little natural antioxidants such as vitamin C and vitamin A<sup>9</sup>.

Research in recent years has shown that consumption of protein and dietary fiber can also reduce blood cholesterol levels<sup>5,40</sup>. Soy protein has been shown to have a cholesterol-lowering effect, which is believed to be due to the presence of isoflavones in the protein. Soy isoflavones can reduce the risk of heart disease by helping to reduce blood cholesterol levels<sup>10</sup>. The content of bioactive compounds in soybeans such as isoflavones and anthocyanins can reduce the risk of heart disease and blood vessels<sup>11</sup>. *The Food and Drug Administration* (FDA) recommends consuming at least 25 grams of soy protein to reduce total cholesterol by 5% to 6%<sup>12</sup>. *Indiana Soybean Board* (1998) recommends consuming isoflavones per day at 30-40 mg<sup>13</sup>. The content in 100 grams of soy flour consists of 347 kcal of energy, 35.9 grams of protein, 20.6 grams of fat, 29.9 grams of carbohydrates, and 5.8 grams of fiber<sup>9</sup>.

Fermented Glutinous Black Rice is a very potential commodity as a source of carbohydrates, antioxidants, bioactive compounds, and fibers that are important for health<sup>37</sup>. The content in 100 grams of Fermented Glutinous Black Rice consists of 166 kcal of energy, 3.8 grams of protein, 1 gram of fat, 34.4 grams of carbohydrates, and 0.3 grams of fiber<sup>9</sup>. Fauziyah Research, 2015 showed 257 ppm<sup>14</sup> of anthocyanin in Fermented Glutinous Black Rice. Cholesterol lowered by anthocyanin in this case reaches up to 13.6%<sup>15</sup>.

## Method

The research design used is an experimental study design. The dependent variable is Fermented Glutinous Black Rice and Soy Flour Ice Cream with Fermented Glutinous Black Rice and soy flour formulation 85%: 15%, 50%: 50%, and 40%: 60% influence on the dependent variable namely organoleptic properties, protein content, isoflavones, fiber, and anthocyanin products. The composition of ingredients of the product formulation of Fermented Glutinous Black Rice and Soy Flour Ice Cream can be seen in table 1.

**Table 1. Ingredient for Making Fermented Glutinous Black Rice and Soy Flour Ice Cream**

No	Ingredient	Formula 1 FBGR : Soybean Flour 85% : 15%	Formula 2 FBGR : Soybean Flour 50% : 50%	Formula 3 FBGR : Soybean Flour 40% : 60%
1	FGBR	510 gram	300 gram	240 gram
2	Soybean Flour	90 gram	300 gram	360 gram
3	Full Cream Milk Powder	300 gram	300 gram	300 gram
4	Skim Milk Powder	50 gram	50 gram	50 gram
5	Sugar	100 gram	100 gram	100 gram
6	CMC	8 gram	8 gram	8 gram
7	Salt	¼ sdt	¼ sdt	¼ sdt
8	Water	1000 ml	1000 ml	1000 ml

This research is an experimental study with a Completely Randomized Design (CRD), which was carried out at the Food Technology Laboratory of the Department of Nutrition of the Polytechnic of the Ministry of Health of Bandung, Laboratory of Food Technology at Pasundan University, Bandung, and Testing Laboratory of the Agro Industry Center, Bogor during February - March 2020.

## Result

### Hedonic Test

Based on table 2, the product that has the highest level of preference in the aspect of color is F1 with the Formula of Fermented Glutinous Black Rice and soybean flour at 85%: 15% where 29 panelists (96.7%) said they liked and liked the color produced. *The Kruskal Wallis test* results obtained  $p (0,000) < \alpha (0.05)$ , then *Mann Whitney test* was performed where there were statistically significant differences in F1 and F2 with  $p$  values  $(0,000) < \alpha (0.05)$  and in F1 and F3 with a  $p$  value  $(0,000) < \alpha (0.05)$ , but there is no significant difference between F2 and F3 with a  $p$  value  $(0.857) > \alpha (0.05)$ .

In the aspect of aroma, the product that has the highest level of preference is F1 where as many as 10 panelists (33.3%) said they liked and really liked the aroma produced. *Kruskal Wallis test* results obtained  $p (0.365) > \alpha (0.05)$ .

**Table 2. Hedonic Test Results**

Formula type(%)	Hedonic aspects			
	Color (%)	Aroma (%)	Taste (%)	Texture (%)
Formula 85:15	96.7	33.3	60.0	66.6
Formula 50:50	13.3	26.7	20.0	43.3
Formula 40:60	6.7	26.7	43.4	40.0

From the aspect of taste, the product that has the highest level of preference is F1 where as many as 18 panelists (60.0%) said they liked and liked it very much. *Kruskal Wallis test* results obtained  $p (<0.018) < \alpha (0.05)$ , then *Mann Whitney test* was performed where there were statistically significant differences in F1 and F2 with  $p$  values  $(<0.004) < \alpha (0.05)$ , but there were no differences significant between F1 and F3 with  $p$  values  $(0.163) > \alpha (0.05)$ , and F2 and F3 with  $p$  values  $(0.202) > \alpha (0.05)$ .

The product that has the highest level of preference in the aspect of texture is F1 where as many as 20 panelists (66.6%) said they liked and liked it very much. *Kruskal Wallis test* results obtained  $p (0.162) > \alpha (0.05)$ , it can be concluded statistically there is no different effect of the difference between Fermented Glutinous Black Rice and soybean flour on the texture of ice cream produced. Therefore not done with *the Mann Whitney Test*.

### Analysis of Protein, Isoflavone, Fiber, and Anthocyanin Levels

Samples analyzed were F1 samples with the Formula of Fermented Glutinous Black Rice and soybean flour at 85%: 15%. The results of the analysis of protein, isoflavone, fiber, and anthocyanin levels of Fermented Glutinous Black Rice and Soy Flour Ice Cream can be seen in Table 3.

**Table 3. Results of Analysis of Anthocyanin and Fiber Levels**

Parameter	Result	Unit
Protein	6.8	%
Isoflavon	29.75	Mg
Fiber	5.77	%
Anthocyanin	15.3493	Ppm

Based on table 3, when converted into one portion (100 grams) of Fermented Glutinous Black Rice and Soy Flour Ice Cream products have a protein content of 6.8 grams, isoflavone content of 29.75 mg, fiber content of 5.77 grams, and anthocyanin levels of 1.53493 mg. Comparison of protein, isoflavone, fiber, and anthocyanin levels with adequate nutritional snack can be seen in table 4.

**Table 4. Comparison of Protein, Isoflavone, Fiber and Anthocyanin Levels with Nutrition Adequacy**

Parameter	Nutritional Value Per Portion	Adequacy of Nutrition per serving	Adequacy of Nutrition A day
Protein (g)	6.8	7.5	75
Isoflavon (mg)	29.75	5	50
Fiber (g)	5.77	2.5	25
Anthocyanin (mg)	1.53493	10	100

Note: Adequacy of nutrition in one time is calculated based on the percentage of food snacks (10%) adjusted to the recommendation of adequate nutrition a day.

Table 4 shows that one portion of Fermented Glutinous Black Rice ice cream and soy flour products is sufficient to fulfill 9.1% of daily protein adequacy, 59.5% of daily isoflavone adequacy, 23.1% of daily fiber adequacy, and 1.5% of daily anthocyanin adequacy. Therefore, it is necessary to consume other food sources to fulfil requirement a day.

Based on SNI 01-3713-1995, superior formula ice cream (85% Fermented Glutinous Black Rice : 15% soy flour) has met the requirements for protein quality of ice cream, including containing a minimum protein content of 2.7% w / w, which is 6.8 % b / b<sup>16</sup>.

## Discussion

The research was conducted in February to March 2020 through two stages of testing, namely organoleptic (hedonic) testing and testing of protein, isoflavone, fiber, and anthocyanin levels in the superior formula of Fermented Glutinous Black Rice and Soy Flour Ice Cream products. Organoleptic (hedonic) testing carried out on February 3, 2020 involved 30 rather trained panelists from grade 3 students of the Department of Nutrition of the Polytechnic of the Ministry of Health in Bandung who had obtained organoleptic test material.

This research involves human subjects namely panelists to assess product acceptance. This study was approved by the Ethics Research Committee of the Poltekkes Kemenkes Bandung with No. 07 / KEPK / PE / II / 2020.

## Hedonic Test

Food quality assessment generally depends on several factors including taste, color, texture, and nutritional value, but before these factors are considered visually, color factors are crucial. The color in the visual is generally influenced by the raw material<sup>17</sup>.



Based on the hedonic test of Fermented Glutinous Black Rice and soybean ice cream products, the results showed that in F1 with Fermented Glutinous Black Rice proportion compared with 85% soybean flour: 15%, 29 panelists or 96.7% stated that they liked and liked the color of the product. F2 with a Formula of 50%: 50% as many as 4 panelists or 13.3% said they liked and liked it very much, and in F3 with a Formula of 40%: 60% as many as 2 panelists or 6.7% said they liked and liked the color of ice cream products black and soy flour so that it can be said F1 is a superior product with the highest level of preference among other products.

The expected color of Fermented Glutinous Black Rice ice cream and soy flour products is purple color derived from anthocyanin pigment Fermented Glutinous Black Rice<sup>18</sup>, while the color of cream on ice cream comes from soy flour and milk powder. The more composition of Fermented Glutinous Black Rice is used, the color of ice cream will be more purple.

*Kruskal Wallis* statistical test obtained p value (0.000)  $< \alpha$  (0.05), it can be concluded statistically there is a different counterpart effect between Fermented Glutinous Black Rice and soybean flour on the resulting ice cream color. *Then Mann Whitney test* is performed to determine the differences in the three types of treatment. Based on the results of the Mann Whitney test it can be seen in the treatment of F1 and F2 with (p (0,000)  $< \alpha$  (0.05)) and F1 and F3 treatments (p (0,000)  $< \alpha$  (0.05)) which have differences in the color produced on the Ice product Fermented Glutinous Black Rice cream and soy flour.

The aroma is a sensory sensation experienced by the five senses of smell. In the food industry considers the smell test is very important because it can quickly provide results regarding consumer preferences for products. The aroma of the product is not the main determinant of quality, but it is still an important parameter.

Based on the hedonic test results, on the aspect of product aroma of Fermented Glutinous Black Rice ice cream and soybean flour, F1 with the Formula of Fermented Glutinous Black Rice compared to 85% soybean flour: 15% as many as 10 panelists or 33.3% expressed their liking to the aroma of the product. In the second formula with a Formula of 50%: 50% as many as 8 panelists or 26.7% said they liked, and in the third formula with a Formula of 40%: 60% as many as 8 panelists or 26.7% said they liked the scent of the product. soy.

The expected aroma of Fermented Glutinous Black Rice ice cream and soy flour products is neutral scented, where the aroma of Fermented Glutinous Black Rice and soybean flour is not too overpowering. Based on organoleptic testing (hedonic) from the aspect of aroma, products of Fermented Glutinous Black Rice ice cream and soybean flour with a Formula of 85%: 15% become a superior product compared to other counterparts. *The Kruskal Wallis* statistical test was carried out to determine the effect of the Formula on the resulting aroma. Based on the results of the analysis of the aroma obtained p value (0.365)  $> \alpha$  (0.05), it can be concluded statistically there is no effect of a different Formula between Fermented Glutinous Black Rice and soybean flour on the aroma of ice cream produced. Therefore, the analysis was not continued with *the Mann Whitney Test*.

Taste is part of the test indicator of a sample to determine the level of acceptability of the product produced. Factors affecting the taste of Fermented Glutinous Black Rice ice cream and soy flour products are the composition of food ingredients used such as fermented black glutinous rice, soy flour, and milk powder.

Based on the hedonic test results, on the aspect of product taste of Fermented Glutinous Black Rice ice cream and soy flour, F1 with Fermented Glutinous Black Rice counterpart compared to 85% soybean flour: 15% as many as 18 panelists or 60.0% expressed like and very fond of the taste of the product. In the second formula with a Formula of 50%: 50% as many as 6 panelists or 20.0% expressed like and very like, and as many as 13 panelists or 43.4% expressed like and very very fond of the taste of the products Fermented Glutinous Black Rice ice cream and soy flour in the formula third with a Formula of 40%: 60%.

The expected taste of the products is Fermented Glutinous Black Rice ice cream and soy flour which is sweet and not too unpleasant. The sweet taste produced comes from the

Fermented Glutinous Black Rice fermentation process where during the maturation process, the starch content turns into reducing sugars<sup>17</sup>. In addition, it is obtained from sugar (sucrose) which serves to give sweetness and also improve the taste of ice cream<sup>19</sup>. The unpleasant taste is obtained from the natural taste of soy flour because of the lipoxidase enzyme in soy. This happens because the lipoxidase enzyme hydrolyzes or breaks down soybean fat into compounds that cause odor. In addition to unpleasant taste, the causative factors for "off-flavor" in ice cream are the bitter taste and lime flavor caused by the presence of glycoside compounds in the form of isoflavones, soyasaponin, and sapogenol in soybean seeds<sup>20</sup>. Based on organoleptic (hedonic) testing from the aspect of taste, Fermented Glutinous Black Rice and Soy Flour Ice Cream products with a Formula of 85%: 15% become a superior product compared to other counterparts.

In addition to organoleptic testing, statistical testing with the Kruskal Wallis Test was also carried out to determine the effect of Fermented Glutinous Black Rice with soybean flour on the resulting ice cream flavor. Based on the results of the analysis of the taste obtained p value (0.018)  $< \alpha$  (0.05), it can be concluded statistically there is a different counterpart effect between Fermented Glutinous Black Rice and soybean flour on the ice cream flavor produced. This shows that there are significant differences in the three product Formulas, so it is continued with the Mann Whitney Test to determine the location of the differences in the three types of treatment. Based on the results of the Mann Whitney test, it can be seen that the treatment of F1 and F2 with p value (0.004)  $< \alpha$  (0.05) has a statistically significant difference in taste produced in Fermented Glutinous Black Rice ice cream and soybean flour products.

Based on the hedonic test results on the product texture aspect of Fermented Glutinous Black Rice ice cream and F1 soybean flour with Fermented Glutinous Black Rice proportion to 85%: 15% soybean flour as many as 20 panelists or 66.6% expressed like and very fond of the product texture. In the second formula with a Formula of 50%: 50% as many as 13 panelists or 43.3% said they liked, and as many as 12 panelists or 40.0% expressed their liking for the texture of the product. Fermented Glutinous Black Rice and soy flour in F1 with a Formula of 85%: 15%

The texture expected from Fermented Glutinous Black Rice and soybean ice cream is soft when in the mouth<sup>21</sup>. The soft texture of ice cream is greatly influenced by the composition of the mixture, processing, and storage of ice cream<sup>22</sup>. Therefore, the use of stabilizers, emulsifiers and homogenization processes greatly influences the texture of ice cream<sup>19</sup>. Statistical tests were conducted to determine the effect of Fermented Glutinous Black Rice with soybean flour on the resulting ice cream texture, using the *Kruskal Wallis test*. Based on the analysis of the texture obtained p value (0.162)  $< \alpha$  (0.05), it can be concluded statistically there is no effect of a different Formula between Fermented Glutinous Black Rice and soybean flour on the ice cream texture produced. Therefore, the analysis was not continued with the *Mann Whitney Test*.

#### **Analysis of Protein, Isoflavone, Fiber, and Anthocyanin Levels**

Protein content of Fermented Glutinous Black Rice and Soy Flour Ice Cream was analyzed quantitatively using the Kjeldahl method. The results of the analysis are then compared with the adequacy of protein a day according to AKG 2019<sup>23</sup> and the adequacy of protein for snacks with a percentage of 10% of daily adequacy, so that for protein one product portion of 6,8146 grams can meet adequacy in one time by 91% and in a day by 9.1%. This shows that in fulfilling the adequacy of protein hypercholesterolemia sufferers can consume one serving (100 grams / 2 cups) superior ice cream formula for once snacking.

Proteins are macro molecules consisting of long chains of amino acids, which are bound to one another in peptide bonds<sup>24</sup>. Soy protein is rich in amino acids glycine and arginine which have a tendency to reduce blood insulin acid followed by a decrease in cholesterol synthesis<sup>11</sup>.

The largest protein contributor between the two main food ingredients is soy flour. The protein content in 100 grams of soy flour is 35.9 grams, while the protein content in 100 grams

of Fermented Glutinous Black Rice is 3.8 grams<sup>9</sup>. Fermented Glutinous Black Rice and Soy Flour Ice Cream products have a higher protein content compared to the Fermented Glutinous Black Rice flavored ice cream products on the market which only has 2 grams of protein per 100 ml.

The contribution of processed soybeans to the protein content of a product can be said to be very large, based on research by Pamungkasari (2008) showing sweet potato ice cream with soy milk variation has a protein content of 6.6636%<sup>25</sup>. The research of Taufik et al (2018) also showed that black mulberry fit bar products using soy flour as a mixed food ingredient had protein content of 11.97%<sup>26</sup>. Based on this, Fermented Glutinous Black Rice and Soy Flour Ice Cream products have the advantage of being made from ingredients that have high protein content so that it can be used as an alternative to high protein snack.

The isoflavone content of Fermented Glutinous Black Rice and Soy Flour Ice Cream was analyzed quantitatively using literature studies. The results of the analysis are then compared with the adequacy of isoflavones a day according to the recommendation of the Indiana Soybean Board<sup>13</sup> and the adequacy of isoflavones for snacks with a percentage of 10% of the adequacy of the day, so that for isoflavones a product portion of 29,753 mg can meet the adequacy of one time 595% snack and in a day equal to 10% of the adequacy of the day 59.5%. This shows that in fulfilling the adequacy of isoflavones in patients with hypercholesterolemia, it is enough to consume half a portion (50 grams / 1 cup) of superior formula ice cream in once snacking.

Isoflavones are a group of polyphenolic antioxidant compounds called flavonoids. Isoflavones are often referred to as phytoestrogens. Isoflavones in processed non-fermented soybeans are generally in the form of glycosides, which are 64% genistin, 23% daidzin, and 13% glyceitin<sup>27</sup>. Isoflavones can reduce blood cholesterol levels because they have estrogenic and antioxidant properties. As estrogenic, isoflavones reduce cholesterol by increasing HDL, reducing LDL and TG in the blood, and increasing LDL receptors in the liver<sup>28</sup>.

The largest isoflavone contributor between the two main food ingredients is soy flour. The content of isoflavones in 100 grams of soy flour is 172.55 mg<sup>29</sup>, whereas Fermented Glutinous Black Rice does not contain isoflavones. Based on this, the product of Fermented Glutinous Black Rice and Soy Flour Ice Cream has the advantage of being made from ingredients that have high isoflavone levels so that it can be used as an alternative to high-isoflavone snack foods.

The fiber content of Fermented Glutinous Black Rice and Soy Flour Ice Cream was analyzed quantitatively using the enzymatic method of gravimetry. The results of the analysis are then compared with the adequacy of fiber a day according to AKG 2019<sup>23</sup> and the adequacy of fiber for snacks with a percentage of 10% of daily adequacy, so that for fiber one portion of the product of 5.77 grams can meet the adequacy of one time snack of 231% and 23.1% in a day. This shows that in fulfilling the adequacy of fibers of hypercholesterolemia sufferers, it is enough to consume half a portion (50 grams / 1 cup) of superior ice cream formula in one break.

Dietary fiber is defined as the skeletal remnants of plant cells that are resistant to hydrolysis by human digestive enzymes, which consist mainly of pectin, cellulose and hemicellulose and lignin<sup>38</sup>. Food fiber provides many beneficial physiological effects, one of which can reduce blood cholesterol by reducing cholesterol synthesis because HMG-CoA reductase enzymes are inhibited when insulin secretion is reduced due to reduced calorie intake because it feels full longer<sup>39</sup>.

The two main ingredients, namely Fermented Glutinous Black Rice and soy flour, both have a high fiber content, meaning they are the biggest contributors to the fiber content in ice cream products. The fiber content in 100 grams of Fermented Glutinous Black Rice is 5.9 grams, while the fiber content in 100 grams of soy flour is 5.8 grams<sup>9,14</sup>.

The contribution of Fermented Glutinous Black Rice to the fiber content of a product can be said to be very large, based on research by Fajriyanti (2018) showing Black Tapai Berry Ice Sherbet with Fermented Glutinous Black Rice raw material has a fiber content of 3.25 grams



100 grams<sup>31</sup>. Slanikovita's research (2018) also shows that muffin products made from Fermented Glutinous Black Rice and black rice have a fiber content of 5.8 grams / 100 grams<sup>32</sup>. Based on this, the product of Fermented Glutinous Black Rice and Soy Flour Ice Cream has the advantage of being made from ingredients that have high fiber content so that it can be used as an alternative to high fiber snack foods.

Anthocyanin levels of Fermented Glutinous Black Rice and Soy Flour Ice Cream products were analyzed quantitatively using the pH differential method. The results of the analysis are then compared with the adequacy of daily anthocyanin according to research recommendations Elisa et al (2013)<sup>33</sup> and the adequacy of anthocyanin for snacks with a percentage of 10% of daily adequacy, so that for anthocyanin one product portion of 1.53493 mg only meets adequacy in one time interval of 15.15% and 1.5% in a day. This shows that in fulfilling the adequacy of anthocyanin, hypercholesterolemia sufferers can consume two servings (200 grams / 4 cups) of superior formula ice cream in two breaks. Therefore, it is necessary to consume other food sources high in anthocyanin to meet the adequacy of daily anthocyanin.

Anthocyanin is a phenolic compound that belongs to the flavonoid group and functions as an antioxidant, plays an important role for human health<sup>38</sup>. One of them can inhibit the enzyme HMG-CoA reductase which controls the biosynthetic pathway of cholesterol in the liver, then inhibits the formation of mevalonate so that the subsequent stages of cholesterol synthesis can be inhibited and cholesterol formation can decrease<sup>34</sup>. This was proven by Emawati's (2004) research that antioxidants can significantly reduce total body fat, reduce total cholesterol, triglyceride, and LDL (low density lipoprotein) levels, and increase HDL (high density lipoprotein) levels ( $p < 0.005$ )<sup>35</sup>.

The largest anthocyanin contributor between the two main food ingredients is fermented black glutinous rice. Fermented Glutinous Black Rice has the potential as an anthocyanin carrier which is a pigment with red color and is one of the phenolic compounds<sup>36</sup>. The content of anthocyanin in 100 grams of Fermented Glutinous Black Rice is 25.7 mg, while soybean flour contains only a small amount of anthocyanin<sup>14</sup>.

The contribution of Fermented Glutinous Black Rice to a product can be said to be very large, based on research by Fajriyanti (2018) showing Black Tapai Berry Ice Sherbet with Fermented Glutinous Black Rice raw material has anthocyanin levels of 22.1 mg / 100 g<sup>31</sup>. Slanikovita's research (2018) also shows muffin products made from Fermented Glutinous Black Rice and black rice have a fiber content of 21,918 mg / 100 g<sup>32</sup>. Based on this, the product of Fermented Glutinous Black Rice and Soy Flour Ice Cream has the advantage of being made from ingredients that have high levels of anthocyanin so that it can be used as an alternative to high-anthocyanin snack foods.

## Conclusion

There is an effect of different differences on the organoleptic properties of Fermented Glutinous Black Rice and Soy Flour Ice Cream from the aspect of color and taste. Based on the hedonic test results, F1 with an 85%: 15% Formula is superior in all aspects namely color, aroma, and taste, and texture. In fulfilling the adequacy of intermittent diets of hypercholesterolemia patients, one serving of ice cream (100 grams / 1 cup) accounts for 9.1% of protein adequacy, 59.5% of isoflavone adequacy, 23.1% of fiber adequacy, and 1.5% of anthocyanin adequacy. Therefore, it is necessary to consume other food sources that contain high anthocyanin to meet the adequacy of daily anthocyanin.

This product cannot be applied as an alternative to lower blood cholesterol in hypercholesterolemia sufferers because it has only been examined from the aspect of preference (hedonic) and nutrient content. Therefore, researchers expect further research to be conducted on the effect of giving Fermented Glutinous Black Rice and Soy Flour Ice Cream products to samples with blood cholesterol levels exceeding normal, shelf life, total solids, melting time,

and overrun of ice cream products. In addition, prevention of aromas and unpleasant taste in ice cream is necessary to prevent due to the presence of soy flour. It is hoped that this product can also be developed and introduced to the public as a source of protein, isoflavone, fiber, and anthocyanin ice cream products by collaborating with various related parties such as home or commercial industries.

#### Thank-You Note

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#### Reference

1. Kementerian Kesehatan RI. Profil Kesehatan Indonesia Tahun 2017. Jakarta: Kementerian Kesehatan RI; 2018. 107-108 p. Available from: <http://www.kemkes.go.id>
2. WHO - World Health Organization. Global health observatory data, Indonesia country profile; 2015.
3. Balitbangkes KR. Riset Kesehatan Dasar, RISKESDAS. JAKARTA: Badan Penelitian dan Pengembangan Kesehatan Departemen Kesehatan Republik Indonesia; 2013. 103 p.
4. Stapleton PA, Goodwill AG, James ME, Brock RW, Frisbee JC. *Hypercholesterolemia and microvascular dysfunction: Interventional Strategies*. J Inflamm. 2010;1–10.
5. Brown L, Rosner B, Willett WW, Sacks FM. *Cholesterol-lowering effects of dietary fiber: a meta-analysis* 1, 2. 1999;30–42.
6. Lestari S. Hubungan Asupan Serat, Antioksidan, dan Hiperkolesterolemia pada Pasien yang Berobat di Pusesmas Wilayah Kecamatan Cimahi Utara Kota Cimahi. Poltekkes Kemenkes Bandung Jurusan Gizi; 2016.
7. Dalmeijer GW, Struijk EA, Van Der Schouw YT, Soedamah-Muthu SS, Verschuren WMM, Boer JMA, Geleijnse JM, dan Beulens JWJ. *Dairy intake and coronary heart disease or stroke - A population-based cohort study*. Int J Cardiol. 2013;167(3):925–9. Available from: <http://dx.doi.org/10.1016/j.ijcard.2012.03.094>
8. Goff, Douglas H, Hartel, W R. *Ice Cream*. 7th ed. Springer; 2013.
9. Persatuan Ahli Gizi Indonesia. Tabel Komposisi Pangan Indonesia. JAKARTA: PT Elez Media Komputindo; 2017.
10. Koswara S. Isoflavon, Senyawa Multi Manfaat dalam Kedelai. 2006;1–7. Available from: <http://www.ebookpangan.com>
11. Jenkins DJA, Kendall CWC, Jackson CJC, Connelly PW, Parker T, Faulkner D, Vidgen E, Cunnane SC, Leiter LA, dan Josse RG. *Effects of high- and low-isoflavone soyfoods on blood lipids, oxidized LDL, homocysteine, and blood pressure in hyperlipidemic men and women*. Am J Clin Nutr. 2002;76(2):365–72. Available from: <http://www.embase.com/search/results?subaction=viewrecord&from=export&id=L34804058>
12. Gray N. *Soy Protein may lower cholesterol*. Solae Study Am J Clin Nutr. 2010;
13. Astuti S. Isoflavon Kedelai dan Potensinya sebagai Penangkap Radikal Bebas. Jurnal Teknologi Industri dan Hasil Pertanian. 2008;13(2):126–36.
14. Fauziyah RN. Hubungan Konsumsi Tape Ketan Hitam dengan Pencegahan Kejadian Sindroma Metabolik pada Usia 40 Tahun Ke Atas Di Kabupaten Bandung Barat, Provinsi Jawa Barat. Universitas Indonesia; 2015.
15. Wahyuningsih S, Wulandari L, Wartono MW, Munawaroh H, Ramelan AH. *The Effect of pH and Color Stability of Anthocyanin on Food Colorant*. IOP Conf Ser Mater Sci Eng. 2016;
16. Badan Standarisasi Nasional. SNI 01-3713-1995.
17. Winarno FG. Kimia Pangan dan Gizi. Jakarta: Gramedia Pustaka; 2002.
18. Misnawi S. 2003. *Effect of cocoa liquor roasting on polyphenol content, hydropobicity astringenc*. ASEAN Food Journal 12(2):103-113. Nasional BS.

19. Padaga ME, Sawitri ME. Membuat Es Krim Yang Sehat. Surabaya: Trubus Agrisarana; 2005.
20. Koswara S. Teknologi Pengolahan Kedelai (Teori dan Praktek). 2009; Available from: <https://ebookpangan.com>
21. Webb BH, Alford. *Fundamental of Dairy Chemistry*, 2<sup>nd</sup> edition. Westport, Connecticut: The AVI Publishing Co. Inc; 1980.
22. Campbell JR, Marshall RT. *The Science of Providing Milk for Men*. New York: Mc Graw-Hill Book Company; 1975.
23. Peraturan Menteri Kesehatan Republik Indonesia Nomor 28 Tahun 2019 Tentang Angka Kecukupan Gizi Yang Dianjurkan Untuk Masyarakat Indonesia.
24. Ayustaningwarno F. Teknologi Pangan: Teori Praktis dan Aplikasi. Yogyakarta: Graha Ilmu; 2014.
25. Pamungkasari D. Kajian Penggunaan Susu Kedelai Sebagai Substitusi Susu Sapi Terhadap Sifat Es Krim Ubi Jalar (*Ipomoea Batatas*). Skripsi: Fakultas Pertanian Universitas Sebelas Maret; 2008.
26. Taufik Y, Achyadi NS, Khairunnisa DI. Pengaruh Konsentrasi Bubur Buah Dan Tepung Kedelai (*Glycine Max*) Terhadap Karakteristik *Fit Bar Black Mulberry (Morus Nigra L.)*. *Pasundan Food Technology Journal*. 2018;5(1): 10-17.
27. Astawan M. Sehat Dengan Hidangan Kacang dan Biji-bijian. JAKARTA: Penebar Swadaya; 2009.
28. Grubers, Cristian J. *Production and Action of Estrogen*. N Engl J Med. 2002;346. Available from: <http://www.nejm.org/cgi/reprint/346/5/340>
29. Bhagwat S, Haytowitz DB, Holden JM. *USDA Database for the Isoflavone Content of Selected Foods*. US Dep Argiculture. 2015.
30. Grundy SM. *Nutrition in the management of disorders of serum lipids and lipoproteins*. In: *Modern Nutrition in Health and Disease*. 1st ed. Philadelphia: Lippincott Williams and Wilkins; 2006. p. 1076–92.
31. Fajriyanti N. Produk *Black Tapai Berry Ice Sherbet* Sumber Antosianin Dan Serat Berbasis Tape Ketan Hitam dan Stroberi Sebagai Alternatif Pencegah Kegemukan. Skripsi: Poltekkes Kemenkes Bandung Jurusan Gizi; 2018.
32. Slanikovita AK. Produk *Muffin* Sumber Antosianin Dan Serat Berbasis Tape Ketan Hitam Dan Beras Hitam Sebagai Alternatif Makanan Selingan Pada Obesitas Sentral. Skripsi: Poltekkes Kemenkes Bandung Jurusan Gizi; 2018.
33. Elisa P, Fulvio M, Johnson, Creina S. *The Case for Anthocyanin Consumption to Promote Human Health: A Review*. *Compr Rev Food Sci Food Saf*. 2013;
34. Zamora-Ros R, Knaze V, Luj'an-Barroso L, Slimani N, Romieu I, Fedirko V, de Magistris MS. *Estimated dietary intakes of flavonols, flavanones and flavones in the European Prospective Investigation into Cancer and Nutrition (EPIC) 24 –hour Dietary Recall Cohort*. *Br J Nutr*. 2011;106(12):1915–25. Available from: <http://www.ncbi.nlm.nih.gov/pubmed/21679483>
35. Ernawati. Efek Pemberian Ekstrak Teh Hijau (*Camellia sinesis (L) O. Kuntze*) var. *Assamica* Terhadap Total Lemak Tubuh dan Profil Lipid Wanita Dewasa Overweight dan Obesitas. *Jurnal Gizi Klinis Indonesia*. 2004;
36. Misnawi S. 2003. *Effect of cocoa liquor roasting on polyphenol content, hydropobicity astringenc*. *ASEAN Food Journal*12(2):103-113. Nasional BS.
37. Fauziah, Roro Nur, Putri, Mardiyah Maulida, Surmita. 2020. Effect of Pie Based on Fermented Black Glutinous Rice and Sweet Purple Potato to Frequency of Defecation in Adolescents with Constipation. *International Medical Journal*. Vol 25, Issue 04. Artikel <https://www.seronijihou.com/volume/IMJ/25/4/effect-of-pie-based-on-fermented-black-glutinous-rice-and-sweet-purple-potato-to-frequency-of-defecation-in-adolescents-with-constipation-5ec80c6fdc2fa.pdf>
38. Trinovani, Elvi, Afifah Riska Rafa, Fauziah, Roro Nur. 2020. Determination of Antosianin Total Levels and Antioksidant Activities in Black Glutinous Rice Extract and Fermented

- Black Glutinous Extract. International Medical Journal. Vol 25, Issue 05. Artikel <https://www.seronijihou.com/volume/IMJ/25/5/determination-of-antosianin-total-levels-and-antioxidant-activities-in-black-glutinous-rice-extract-and-fermented-black-glutinous-rice-extract-5ec8099a8eb18.pdf>
39. Kusmiyati, Mimin, Trinovani, Elvi, Fauziyah, Roro Nur. 2020. Activity of Mixed Ethanol Extract Selected Black Tea (*Camelia sinesis L.*) and Stevia (*Stevia rebaudiana B.*) as an Alternative Anti Diabetes Herbal Medicine. International Medical Journal. Vol 25, Issue 06. Artikel <https://www.seronijihou.com/volume/IMJ/25/6/activity-of-mixed-ethanol-extract-selected-black-tea-camelia-sinensis-l-and-stevia-stevia-rebaudiana-b-as-an-alternative-anti-diabetes-herbal-medicine-5ef522fdaa75e.pdf>
40. Fauziyah, Roro Nur, Mimin AMinah, Osman Syarief, Holil M Par'I, Widi Hastuti, Surmita. 2020. Effectiveness of Steamed Brownies Base on Fermented Black Glutinous Rice on Decreased Waist Circumference in Abdominal Obesity. Jurnal Ilmu dan Teknologi Kesehatan. Vol x No x. Artikel <http://ejurnal.poltekkesjakarta3.ac.id/index.php/jitek>



# ICE CREAM BASED ON FERMENTED GLUTINOUS BLACK RICE AND FLOUR SOYBEAN SOURCE PROTEIN, ISOFLAVON, FIBER, AND ANTOSIANIN AS SNACKS OF HYPERCOLESTEROLEMIC PATIENTS

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