Chemical Analysis Vitamin C and Antioxidant Activity of Brownies by Adding Rosella Powder on Cheese Cream For Strengthen Nutritional Content

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**Abstract.** The improved nutritional properties of brownies are a nowadays trend in the food industry. The focus of this research was to increase the nutritional value of brownies by adding rosella powder on the cheese cream, canna flour, and chocolate used increases antioxidants, vitamins, and minerals. The purpose was specifically to determine the effect of rosella powder addition on the consumer acceptance, vitamin C, antioxidant, moisture, fat, and protein content of brownies. The design of experiments applied was Completely Randomized Design (CRD) 1 factor that was various concentrations of rosella powder added (0%, 5%, 10%, and 15%). Data results of the research were analyzed by using ANOVA at the level of α = 0.05, and then followed by DMRT test . The chemical analysis of moisture, fat, and protein content using thermogravimetry, Soxhlet, and Kjeldahl methods, following the method of AOAC. The 2,2-diphenyl-1-picrylhydrazyl (DPPH) is a stable free radical compound, so it is used to test compounds that have antioxidant and vitamin activity. Analysis of DPPH-radical scavenging activity using a UV-visible spectrophotometer. The selected formulation of canna flour brownies with the addition of rosella powder on cheese cream is a formulation with the addition of 5 % rosella powder (P2) scor color 4,55±0,27, flavor 4,50±0,26, taste 4,73±0,29, and texture 4,45±0,44.. The results showed that the carbohydrate, protein, fat, ash, water, vitamin C, and antioxidant activity content was 34.29%, 6.65%, 25.93, 2.16, 21.97%, 2.49%, and 40.60%. The addition of rosella powder effectively makes brownies a functional food that is beneficial for health.

Keywords: Brownies, canna, flour, rosella, antioxidant, vitamin C.

# 1. Introduction

Increasing the nutritional content of brownies is a current trend in the food industry. The use of ingredients that have high nutritional value attracts health-savvy consumers. Currently, consumers choose products that have health benefits for their bodies, for example products that contain vitamin C and antioxidants because they are useful for increasing the body's resistance to disease. The focus of this research is an effort to increase the nutritional value of brownies by adding rosella powder to cream cheese, canna flour, and chocolate, all of which are used to increase the antioxidant, vitamin and mineral content of the brownies produced.

In general, processed brownies are made from wheat flour, butter, eggs, milk and chocolate which contain high fat. As in [1] research, the brownies studied contained 14 g of fat, research by [2] in the brownies formula without the addition of treatment ingredients produced 27.12 g of fat, research by Muhariyani (2016) produced brownies with 14 g of fat, and according to [3] good brownies produces 26.93% fat. Brownies ingredients contribute fat, for example compound chocolate from cocoa beans contains 50-70% cocoa butter (cocoa butter)[4] and chocolate powder contains 18-23% fat [5]. The fat components contained in brownies cause brownies to be susceptible to oxidation. This kind of problem is very important because it can cause the organoleptic quality of brownies to decrease, therefore it is necessary to have a food additive that acts as an antioxidant or prevents oxidation [6].

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The trend of brownies innovation by adding a layer of cream cheese can increase consumer interest. Cream cheese is a type of soft cheese made from acid coagulation, with the role of the activity of lactic acid bacteria. The texture of cream cheese is soft, smooth and creamy, and has a savory taste. In order to improve the quality of cheese cream, rosella (hisbiscus sabdariffa) is added which can improve the taste and flavor.

The texture characteristic of brownies is harder than other cakes, meaning it does not require expansion or ingredients that have the potential to develop dough, so using flour that does not contain gluten is not expected to be a problem. Gluten is a protein found in cereals such as wheat, barley and oats, where these cereals are still dependent on imports. The risk of consuming gluten in some people results in celiac disease, non-celiac gluten sensitivity, gluten ataxia, dermatitis herpetiformis, and sensitivity to foods containing gluten [4]. Canna flour has chemical compounds and a relatively high carbohydrate content, so canna flour has the potential to be a basic ingredient in processing steamed brownies products and as a substitute for wheat flour. Previous research shows that using canna flour in making brownies can increase the carbohydrate and mineral content such as phosphorus in brownies [15], [17]. Other research by Setiawan et al (2018) also showed similar results that the use of canna flour in making brownies can increase the carbohydrate content and antioxidant activity in brownies. The energy value per 100 grams of brownies is 434 kcal, more than rice (335 kcal/100 grams) or noodles (339 kcal/100 grams). The energy in brownies generally comes from carbohydrates (namely flour and sugar) and fat (Astawan, 2013)

# 2. Method

*Materials*

The ingredients used in making brownies in this study were chocolate powder (Tulip brand), compound chocolate (Chocolatier dark compound chocolate batons brand), cream cheese (Cheesy brand produced by PT DAIRYGOLD Indonesia), sugar (GULAKU brand), margarine, rosella powder ( Hibiscus sabdarifa brand from javaplants), purebred chicken eggs, canna flour (My produce brand "Kusuka Ubiku" from Bantul), margarine (Simas brand) and ovalet (Koepoe Koepoe brand). The chemicals used in this research test were Petroleum ether (100 ml Merck 101769), cold distilled water (pure water brand), Aquades (pure water brand), 0.1 N HCL (100 ml), K2SO4 (CP 500 g Rofa Center Laboratory), HCL (HCL analyzer 2.5 L), boiling stone (boiling chips 3-4 mm), BCG MR indicator 10 ml, Methanol PA (MERCK 1.00731.2500), DPPH reagent (Aldrich sigma 25 mg), and brownies samples, Aquades (pure water brand), starch indicator for analysis 100 ml, 10 ml 0.1 N iodine solution.

*Equipment/Instrument*

The tools used in making brownies in this research were a sieve, basin, rag, gas stove, baking pan, mixer (Philips brand), steam pan, steam pan, knife, spoon, spatula, and scales. The equipment used for testing in this research was a cup, desiccator, crucible, baking sheet, analytical balance, tongs, spatula, thermogravimetric oven, spatula, furnace, filter paper, fat flask, soxhlet, burette, desilator, 50 ml Erlenmeyer, 250 ml Erlenmeyer, 100 ml measuring cup, distillation flask, Kjeldahl flask, mortar, analytical balance, dropper pipette and stand, 5 ml measuring flask, 10 ml measuring flask, 50 ml measuring flask, micropipette, aluminum foil, incubator and spectrophotometer, blender, funnels, and dropper pipettes.

*Sample preparation*

There are 4 formulas used to make these brownies with varying proportions of roselle powder. The four formulas can be seen in Table 1.

Tabel 1. Formula brownies tepung ganyong

|  |  |  |  |
| --- | --- | --- | --- |
| Formula | Canna Flour | Cheese krim | Rosela Powder |
| P0 | 85 gr | 100 gr | 0 gr |
| P1 | 85 gr | 100 gr | 5 gr |
| P2 | 85 gr | 100 gr | 10 gr |
| P3 | 85 gr | 100 gr | 15 gr |

*Chemical Analysis*

Chemical Analysis includes water content analysis, Ash Content Analysis, Fat Content analysis, Protein Content analysis, Carbohydrate Analysis [24], Analysis of Antioxidant Activity, analysis of Vitamin C Levels, Organoleptic Analysis [24],

*Sensory analysis*

Carried out using the panelist's preference test method for color, flavor, taste, texture and overall. Hedonic testing uses a scoring of 1-5 where 1: doesn't like it very much, 2: doesn't like it, 3: likes it a bit, 4: likes it, 5: likes it a lot. The number of panelists used was 40 untrained panelists. Samples were tested sensory on all panelists. After the sensory test was carried out, statistical data analysis was carried out using the ANOVA test and continued with the DMRT test.

# 3. Results and Discussion

*Sensory analysis*

In the organoleptic test that was carried out, the results showed that the sample of canna flour brownies with the addition of cream cheese to rosella with formulation P1, namely 85 grams of canna flour with the addition of 5 grams of rosella to 100 grams of cream cheese, was the formulation most liked by the panelists. The results of the sensory analysis can be seen in Table 2.

Table 2. Results of sensory analysis of canna flour brownies with the addition of rosella to cream cheese

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Sampel  Code | Color | Flavor | Taste | Texture |
| P0 | 4.05c ± 0,32 | 4.45c±0,22 | 3.93c±0,21 | 3.80a±0,27 |
| P1 | 4.55d  ±0,27 | 4.50c±0,26 | 4.73d±0,29 | 4.45a±0,44 |
| P2 | 3.58b±0,29 | 3.25ab±0,32 | 3.60b±0,27 | 3.53a±0,27 |
| P3 | 2.88a±O,37 | 2.63a±0,34 | 2.40a±0,45 | 3.30a±0,33 |

Note: The same notation (a-d) in the same column shows that there is no significant difference at α = 0.05

Sensory analysis carried out using the panelist's preference test method for color, taste, taste, texture and overall. Sensory analysis involves 40 untrained panelists panelists by choosing a score for each parameter 1-5 from four formulas. A score of 1 means: really don't like it, 2: don't like it, 3: like it a bit, 4: like it, 5: like it a lot. data analysis using the ANOVA test and continued with the DMRT test.

The results of the organoleptic assessment of the five parameters of the four samples show that all samples are not in the same notation (a-d). This shows that the colors of the four samples have real differences or are significantly different, which means that all samples have differences in terms of color. This can happen because the brownies cream cheese filling has been added with rosella powder. Generally, the color of cream cheese is white, the addition of rosella will affect the color of the cream cheese. The more rosella content added to the cream cheese, the more intense the red color of the cream cheese will be. Rosella contains anthocyanin pigments which contribute to the red color. The color is also influenced by the compound chocolate component added when making the brownies dough. The more compound chocolate dose added to the dough, the darker the black color of the brownies [3]. From the results of the analysis of color parameters, it can be concluded that the best formulation that is most preferred in terms of color is sample P1 (5% rosella powder).

Flavor is a sensory response when volatile compounds enter the nose so that they can be felt and responded to by the olfactory system [1]. Based on Table 2, it is known that the results of sensory tests on the flavor parameters of brownies samples P2 and P3 have significant differences (notation ab and a), this is because in samples P2 and P3 there is a fairly high level of rosella added to the cheese cream, namely 10 g and 15 g. The higher the level of rosella added to the cheese cream, the more intense the sour flavor of the rosella will be mixed with the flavor of the cheese cream. The flavor of the brownies samples P0 and P1 have same notation (c), does not have a real difference, this is because the level of rosella added to the cheese cream is not too high, namely only 5 g/100 g of cheese cream so the sour flavor of the rosella is not too strong and the flavor of the cheese cream is still dominate. The brownies that have the highest preference for flavor parameters are sample P1 (5% rosella powder).

Based on Table 2, parameter taste from four samples have significantly different. This can happen because the brownies cream cheese filling has been added with rosella powder. Generally, cream cheese is white with a creamy texture and has a savory taste. Adding rosella to the cream cheese makes the cream cheese taste sour, fresh and savory. This is due to the presence of a sour-tasting component in the rosella flower petals. According to [16], the sour taste in rosella flowers is a combination of the dominant acid compound components, namely ascorbic acid (vitamin C), citric acid and malic acid. The taste is also influenced by the savory cream cheese filling plus rosella acid so that it will combine with the sweet taste and typical chocolate taste found in brownies. Brownies have two absolute taste combinations in brownies due to the presence of two ingredients, namely sugar and chocolate, the sweet taste in brownies is caused by the addition of sugar and the distinctive taste of chocolate is influenced by the addition of chocolate ingredients (Astuti, 2018). The brownies that have the highest liking parameters in terms of taste parameters are sample P1 (5% rosella powder).

Based on Table 2, it is known that the results of sensory analysis on texture parameters are not significantly different. This is because the four brownies formulations use the same basic flour ingredients and in the same quantities. Formula P1 is the best score texture 4.45 (like) while the brownies that have the lowest favorite parameters are in terms of texture is sample P3, (addition of 15 g rosella to 100 g cheese cream).

The brownies that have the highest score of parameters in all formula is P1 (addition of 5 g of rosella to 100 g of cheese cream) with score color 4,55±0,27, flavor 4,50±0,26, taste 4,73±0,29, and texture 4,45±0,44. Formula P1 is most favored by panelists and will be followed by chemical analysis to determine its chemical content.

*Chemical analysis*

Determination of the water content of steamed canna flour brownies with the addition of rosella to cream cheese was carried out by referring to SNI 01-2891 (1992) regarding how to test food and drinks at the oven method (Thermogravimetric) water content testing point. Table 3 is the result of chemical analysis on sample P1 (5% rosella powder). The water content of steamed canna flour brownies with the addition of rosella to cream cheese shows that the water content of steamed canna flour brownies with the addition of rosella to cream cheese is 21.97%. The water content in brownies is not too high because canna flour which is used as a basic ingredient in making brownies has a water content that is not too high compared to the water content of wheat flour, which is 9.824% and the water content of wheat flour is 13.709% [1]. The water content is also influenced by the cream cheese used as filling in the brownies. According to Sughita and Widarta (2013) the water content of cream cheese is 55%. Research conducted previously also states that the water content is influenced by the steaming time, the longer the steaming time, the more water content is lost from the food [15]. The water content in steamed canna flour brownies with the addition of rosella in cream cheese does not exceed the limits of SNI 8372:2018 Sweet bread, where the max water content. 40%.

Table 3. Results of Chemical Analysis Bwonies Sample P1

|  |  |  |
| --- | --- | --- |
| Parameters | Results | Standard value |
| Water content (%) | 21,97 ± 0,03 | 40 %\* |
| Ash content (%) | 2,16 ± 0,01 | 0,1%\* |
| fat (%) | 25,93 ± 0,03 | - |
| Total Proteine (%) | 6,65 ± 0,03 | - |
| carbohydrate (%) | 34,29 ± 0,06 | - |
| Vitamin C (%) | 2,49 ± 0,077 | - |
| Antioxidant activity(%) | 40,60 ± 0,024 | - |

Note \* : base on SNI 8372:2018 Roti Manis

Determination of the ash content of steamed canna flour brownies with the addition of rosella to cream cheese was carried out by referring to SNI 01.3840 (1995) concerning how to test food and drinks at the ash content testing point using the oven method (Thermogavimetri). Based on Table 3, the results of the ash content analysis show that the ash content of steamed canna flour brownies with the addition of rosella in cream cheese is 2.16%, this is not in accordance with the SNI 01.3840-1995 reference which states that the maximum ash content of brownies is 1%. The ash ontent in brownies is quite high because the ash content of canna flour is quite high compared to wheat flour, the ash content of canna flour is 1.12% [21], while the ash content of wheat flour is 0.60% [19]. According to research by Adhi and Triyanti (2014), the amount of ash content in a food product is influenced by the ash content of the constituent materials used in making the food product.

Determination of the fat content of steamed canna flour brownies products with the addition of rosella t cream cheese was carried out using the Soxhlet method. Based on Table 3, the results of fat content analysis show that steamed canna flour brownies with the addition of rosella to cream cheese have a fat content of 25.93%. According to SNI 01-2973, the maximum fat content in brownies is 26.93%, this shows that the fat content in steamed canna flour brownies with the addition of rosella in cream cheese still meets the standards set by the industry department in national standards (SNI 01 -2973). The fat content of steamed canna flour brownies with the addition of rosella in cheese cream is rather high but does not exceed the specified standard limits. The high fat content is influenced by the components of the brownies product, one of which is cream cheese.

Cream cheese has a fairly high fat content because it is made from almost 50% cow's milk fat, the fat content of cream cheese is 35%. Fat content is also influenced by other ingredients, namely margarine. Margarine acts as an emulsifier which will cause fat to disperse so that it forms small and even air bubble cells. The addition of margarine will cause the cake to rise more than the addition of butter, this is because margarine has a higher capacity to retain gas in the dough compared to butter.

Determination of the protein content of steamed canna flour brownies products with the addition of rosella to cream cheese was carried out using the Micro Kjeldal method. Based on Table 3, the results of the analysis of the protein content of steamed canna flour brownies with the addition of rosella to cream cheese which was carried out by the laboratory of the Faculty of Food Technology, Gadjah Mada University, show that the protein content of steamed canna flour brownies with the addition of rosella to cream cheese was 6.65%. According to SNI 01-2973, the maximum fat content in brownies is 9%, this shows that the protein content in steamed canna flour brownies with the addition of rosella in cream cheese still meets the standards set by the industry department in national standards (SNI 01-2973 ).

The recommended protein intake in a food is in the range of 10-15% so it can be concluded that the protein content in canna flour brownies with the addition of rosella to cream cheese has met the protein intake [24]. Canna flour only has a protein content of 0.70%/100 grams, but the protein content of cream cheese is 3.18% [21]. Protein levels are also influenced by other ingredients, including eggs which contain 16% protein [22].

Determination of the fat content of canna flour steamed brownies products with the addition of rosella to cream cheese was carried out using the by difference method. High and low carbohydrate levels using the by difference method are influenced by other proximate levels which include water content, ash content, fat content and protein content.

Based on Table 3, the results of the analysis of the carbohydrate content of steamed canna flour brownies with the addition of rosella to the cream cheese which was carried out by the laboratory of the Faculty of Food Technology, Gadjah Mada University, show that the protein content of steamed canna flour brownies with the addition of rosella to the cream cheese was 34.29%. Based on the SNI 01-2973 reference, the maximum carbohydrate content in brownies is 40%, this shows that the carbohydrate content contained in steamed canna flour brownies with the addition of rosella in cream cheese still meets the standards set by the industry department in the national standard (SNI 01-2973). The carbohydrate content in this study was quite high but did not exceed the SNI limit. The high carbohydrate content was influenced by the basic ingredient for making brownies, namely canna flour. Canna tuber flour contains 85% carbohydrates.

Determination of the antioxidant activity of steamed canna flour brownies products with the addition of rosella to cream cheese was carried out using the DPPH method. Based on Table 3, the results of the analysis of the antioxidant content of steamed canna flour brownies with the addition of rosella to the cream cheese which was carried out by the laboratory of the food technology faculty at Gadjah Mada University show that the antioxidant activity of steamed canna flour brownies with the addition of rosella to the cream cheese was 40.60%. The antioxidant activity of steamed brownies ranges between 23.04-64.34%.

The antioxidant activity of canna flour steamed brownies with the addition of rosella to cream cheese is influenced by the components of the brownies, one of which is the presence of anthocyanin in rosella flower petal powder. The highest anthocyanin content from rosella petals was obtained amounted to 66,8 - 88.9 mg/L [15]. According to Seveline (2019), the greater the concentration of rosella added to a food, the greater its antioxidant value. Antioxidants are compounds that act as inhibitors and antidotes to oxidation caused by free radicals. Antioxidants work by capturing free radicals so that free radicals do not have the opportunity to attach to and damage DNA. Antioxidants in chocolate powder from Jogjakarta in the range 2,6421%- 63,4851.

The antioxidant analysis was carried out by measuring the inhibitory activity value against DPPH free radicals using the UV-Vis spectrophotometric method. The principle of this method is that the interaction of antioxidants with DPPH, either by transferring electrons or hydrogen radicals to DPPH, will neutralize the free radical character of DPPH, if all the electrons in the DPPH free radicals become paired then the color of the solution changes from dark purple to bright yellow[13].

Prevention of damage caused by free radical damage to the human body can be done by producing antioxidants endogenously in the defense system. However, the levels of existing antioxidants are not able to against free radicals that cause disease, one of which is due to oxidative stress. To overcome this problem, then additional antioxidants are needed from outside the body. Antosianin as antioxidants in rosela petal in form glukoside contain of *cyanidin-3 sambubioside, delphinidin- 3-glucose,dan delphinidin-3-sambubioside*. Antioxidant value from this research is 40% higher.

Determination of vitamin C levels in steamed canna flour brownies products with the addition of rosella to cream cheese was carried out using the iodine titration method. Based on Table 3, the results of the analysis of the vitamin C content of steamed canna flour brownies with the addition of rosella to the cream cheese show that the vitamin C content of steamed canna flour brownies with the addition of rosella to the cream cheese was 2.49%. The levels of antioxidant from vitamin C in steamed canna flour brownies with the addition of rosella to cream cheese are influenced by the components that make up the brownies, one of which is the presence of anthocyanins in rosella flower petal powder. According to research by Umami (2010), the levels of vitamin C in rosella are 260-280 mg.

# 4. Conclusions

The addition of rosella to steamed brownies cream cheese produced antioxidant activity (DPPH analysis method) of 40.60 ± 0.024, vitamin C content (Iodine titration method) of 2.49 ± 0.07, water content (thermogravimetric analysis method) of 21.97 ± 0.03%, ash content (thermogravimetric analysis method) 2.16 ± 0.01, fat content (Soxhlet method) 25.93 ± 0.03, total protein (Micro Kjeldal method) 6.65 ± 0.03, and carbohydrates (by different method) was 34.29 ± 0.06.

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