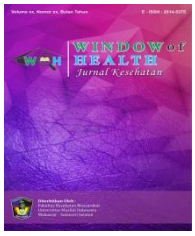
Window of Health : **Jurnal Kesehatan, Vol. 8 No. 3 (July, 2025) : 323-333** **E-ISSN 2614-5375**

Window of Health Jurnal Kesehatan
journal homepage : www.jurnal.fkmumi.ac.id



ARTICLE RESEARCH
URL artikel: http://jurnal.fkmumi.ac.id/index.php/woh/article/view/woh8308

Anthocyanin and Organoleptic Analysis of Red Bean Flour Steamed Sponge Cake with the Addition of Butterfly Pea Flower Extract (*Clitoria ternatea* Linn.)

Rizki Febrianti[1], Ninna Rohmawati[2], [C]Septy Handayani[3]
[1,2,3]Nutrition Study Program, Faculty of Public Health, Universitas Jember, Jember, Indonesia
Email Corresponding Author ([C]): septyhandayani@unej.ac.id
rizkifebi1322@gmail.com[1], ninnarohmawati@unej.ac.id[2], septyhandayani@unej.ac.id[3]

ABSTRACT

Butterfly pea flower is a plant that is commonly found by the public in abundant quantities, which contains anthocyanins, so it is useful for improving human health, acting as an antioxidant, anti-diabetic, anti-obesity, anti-inflammatory, anti-cancer, anti-allergic, anti-arthritis, and anti-hyperglycemic, and treats various diseases, one of which is diabetes mellitus. Type 2 diabetes mellitus predominantly occurs due to lifestyle, so it is susceptible to the whole community and is predicted to increase by 2030. This research aims to determine the anthocyanin and organoleptic levels of steamed red bean flour cake with the addition of butterfly pea flower extract. Measurement of anthocyanin levels uses the AOAC Official method 2002.02 analysis method, and for organoleptic testing uses the hedonic scale test form. Anthocyanin levels increased with the addition of butterfly pea flower extract. Anthocyanin levels experienced a significant increase. The results of organoleptic tests on steamed red bean flour sponge cake with the addition of butterfly pea flower extract showed that the aroma, taste, and texture were not different, while the color was different. The best formulation based on the MPE method is X_3 with a recommended consumption of 1 piece or 50 grams.

Keywords: Anthocyanin; butterfly pea flower extract; steamed sponge cake; red bean flour; organoleptic

PUBLISHED BY :
Public Health Faculty
Universitas Muslim Indonesia
Address :
Jl. Urip Sumoharjo Km. 5 (Kampus II UMI)
Makassar, Sulawesi Selatan.
Email :
jurnalwoh.fkm@umi.ac.id
Phone :
+62 82188474722

Article history
Received 11 July 2024
Received in revised form 11 May 2025
Accepted 21 July 2025
Available online 22 July 2025

INTRODUCTION

Butterfly pea flowers (Clitoria ternatea Linn.) are a common plant found in yards, plantations, and rice paddy fields in abundant quantities, but their use is not widely found among Indonesians. This flower is beneficial to the community, including as a natural dye and traditional medicine to improve human health and treat various diseases(1). All parts of the butterfly pea flower contain anthocyanins obtained through extraction(2). Based on research, the anthocyanin content in butterfly pea flower extract is 142.02 mg/L(3). Anthocyanins have various properties such as antioxidants, antidiabetics, anti-obesity, anti-inflammatory, anticancer, anti-allergic, anti-arthritis, and anti-hyperglycemic(1,4). Based on this explanation, administering butterfly pea flower extract can provide benefits as a natural colorant and can treat various diseases, one of which is diabetes mellitus(5).

Diabetes Mellitus (DM) is a disease that is susceptible to people throughout the world, and the WHO predicts that developing countries will be significantly impacted by the incidence of DM in the 21st century, because more than 70% of DM patients live in developing countries(6). The World Health Organization predicts that in 2030, the number of diabetes mellitus sufferers will increase from 8.4 million in 2020 to 21.3 million. Indonesia ranks seventh in the world for the highest prevalence of diabetes mellitus(7). There are various types of DM, one of which is type 2 DM, which predominantly occurs due to people's lifestyles, such as a poor diet(8). One-third of Indonesian teenagers frequently consume cakes, bread, fried foods, and crackers. According to research by the Center for Agricultural Data and Information Systems, wet cakes have a higher consumption value than dry cakes, equivalent to 1,431 pieces/week or equivalent to 74,626 pieces/year, while dry cakes are 0.438 pieces/week(5). One type of wet cake snack favored by the Indonesian people is steamed sponge cake(9). Steamed sponge cake is a snack made from wheat flour. One effort to utilize local foods and provide variety and additional nutritional value to steamed sponge cake is by substituting wheat flour with red bean flour(9). Red bean flour is easy to find and obtain due to its high production yield(10). Red bean flour is made from red beans, which 100 g of red beans contain 7.21 mg of anthocyanin; 56.20 g of carbohydrates; 22.10 g of protein; 4.00 g of fiber, and 1.10 g of fat(10).

The public interest in steamed sponge cake has the potential to further support public health by modifying it with the addition of butterfly pea flower extract containing anthocyanin and substituting red bean flour as an innovation in utilizing local food and increasing nutritional value, which synergizes in improving public health because it acts as an antioxidant. Therefore, a study will be conducted on the analysis of anthocyanin levels and organoleptic properties of red bean flour steamed sponge cake with the addition of butterfly pea flower extract. (*Clitoria ternatea* Linn).

METHOD

The type of research used is experimental research. The research was conducted in two places, namely the Food Analysis Laboratory of Jember State Polytechnic for the analysis of anthocyanin content and the implementation of organoleptic tests on non-DM people aged 19-25 years in Taman District, Sidoarjo, in February-April 2024. The tools used in this study were steamers, baking pans, digital scales, mixers, sieves,

choppers, pans, alcohol thermometers, spoons, measuring cups, basins, and vials. The materials used were butterfly pea flower extract, bottled drinking water, wheat flour, granulated sugar, free-range chicken eggs, red bean flour, SP, vanilla, palm oil, methanol, 1% HCL, KCL, and sodium acetate, pH 4.5. The preparation of butterfly pea flower extract begins with washing and drying for ± 12 hours, then weighing 30 g of dried butterfly pea flowers and grinding using a chopper for 3 minutes, then adding 600 ml of water at a temperature of 60°C for 15 minutes, and producing butterfly pea flower extract(11). The first step in making steamed sponge cake is mixing 35 g of granulated sugar, 5 g of SP, 1 g of vanilla, and 100 g of eggs with a mixer until fluffy for about 15 minutes, reducing the mixer speed and adding 80 g of wheat flour, 10 g of red bean flour, butterfly pea flower extract (0 g; 15 g; 30 g; 45 g) and mineral water (45 g; 30 g; 15 g; 0 g) and 40 g of oil until well mixed, then turn off the mixer, then put the mixture into a steaming pan for 15 minutes at a temperature of 70°C.

Anthocyanin testing uses the AOAC Official method 2002.02(12) analysis method which begins with the extraction of 25 mg followed by dissolution in 5 mL of methanol with 1% HCL. Add 1.0 ml of extraction solution add 5.0 mL of extraction solution to vial 1, add KCL solution pH 10, add sodium acetate solution pH 4.5 to vial 2, stir until homogeneous, then let stand for 30-60 minutes. Then, each solution is measured for absorbance at a maximum wavelength of 700 nm. Organoleptic testing uses a hedonic scale test form with 30 untrained panelists according to the inclusion and exclusion criteria. Data analysis was carried out to determine the anthocyanin content of red bean flour steamed sponge cake with the addition of butterfly pea flower extract at a maximum wavelength of 700 nm in UV-Vis spectrophotometry, for data processing, anthocyanin levels using the Kruskal-Wallis non-parametric test, and continued with the Mann-Whitney test. Organoleptic data analysis was conducted to measure panelists' acceptance of color, aroma, taste, and texture. Data processing was performed using the Friedman test followed by the Wilcoxon Signed Rank Test. The research has received ethical clearance from the Health Research Ethics Committee (KEPK) of the Faculty of Dentistry, University of Jember, No. 2464/UN25.8/KEPK/DL/2024.

RESULTS

Anthocyanin

Based on the detailed formulation outlined in Table 1, it can be clearly observed that the differences in concentration across the four treatment groups, namely X0, X1, X2, and X3, are primarily attributed to the varying proportions of butterfly pea flower (Clitoria ternatea) extract and the corresponding adjustments in the volume of mineral water incorporated. These two components, used as part of the liquid phase in the batter formulation, are systematically modified to examine their effects when added to the overall mixture of ingredients used in the preparation of steamed sponge cakes made from red bean flour. The addition of butterfly pea flower extract in particular serves both as a functional and natural coloring agent, while the mineral water volume is adjusted accordingly to maintain consistency in the batter's total liquid content, thereby allowing for controlled comparison of sensory and physical attributes across all treatment levels.

The formula for making red bean flour steamed sponge cake with the addition of butterfly pea flower extract is shown in Table 1.

Table 1 Formula for Making Red Bean Flour Steamed Sponge Cake with the Addition of Butterfly Pea Flower

Material	Formula (Grams)			
	X_0	X_1	X_2	X_3
Cakra kembar wheat flour	80	80	80	80
Moringa red bean flour	10	10	10	10
Gulaku granulated sugar	35	35	35	35
Chicken eggs	100	100	100	100
Koepoe koepoe baking powder	5	5	5	5
koepoe koepoe vanili extract	1	1	1	1
Butterfly pea flower extract	0	15	30	45
Mineral water	45	30	15	0
Sunco palm oil	40	40	40	40

Quantitative analysis of red bean flour steamed sponge cake with the addition of butterfly pea flower extract was carried out by determining the anthocyanin content using UV-Vis spectrophotometry with a wavelength of 700 nm. The results of the anthocyanin content are presented in Table 2.

Table 2 Anthocyanin Analysis Results

Steamed Sponge Cake	Replication	Anthocyanin (mg/100 g)	Average (mg/100 g)
X_0	I	2,80 ± 0,14	
	II	2,70 ± 0,00	2,80 ± 0,05
	III	2,80 ± 0,00	
X_1	I	8,10 ± 0,14	
	II	8,30 ± 0,00	8,20 ± 0,05
	III	8,20 ± 0,00	
X_2	I	13,40 ± 0,14	
	II	13,30 ± 0,14	13,40 ± 0,09
	III	13,50 ± 0,00	
X_3	I	16,10 ± 0,42	
	II	16,30 ± 0,14	16,20 ± 0,28
	III	16,20 ± 0,28	

Based on the results of research that has been carried out on red bean flour steamed sponge cake with the addition of butterfly pea flower extract (*Clitoria ternatea Linn.*) By UV-Vis spectrophotometry, the average anthocyanin content in X_0 was 2.80 ± 0.05 mg, X_1 was 8.20 ± 0.05 mg, X_2 was 13.40 ± 0.09 mg, and X_3 was 16.20 ± 0.28 mg. From the results of the sample analysis, there were differences in anthocyanin levels in the four samples, this was caused by differences in the addition of butterfly pea flower extract added, namely X_0 was 0 grams, X_1 was 15 grams, X_2 was 30 grams, and X_3 was 45 grams. The increase in anthocyanin levels is shown in Figure 1.

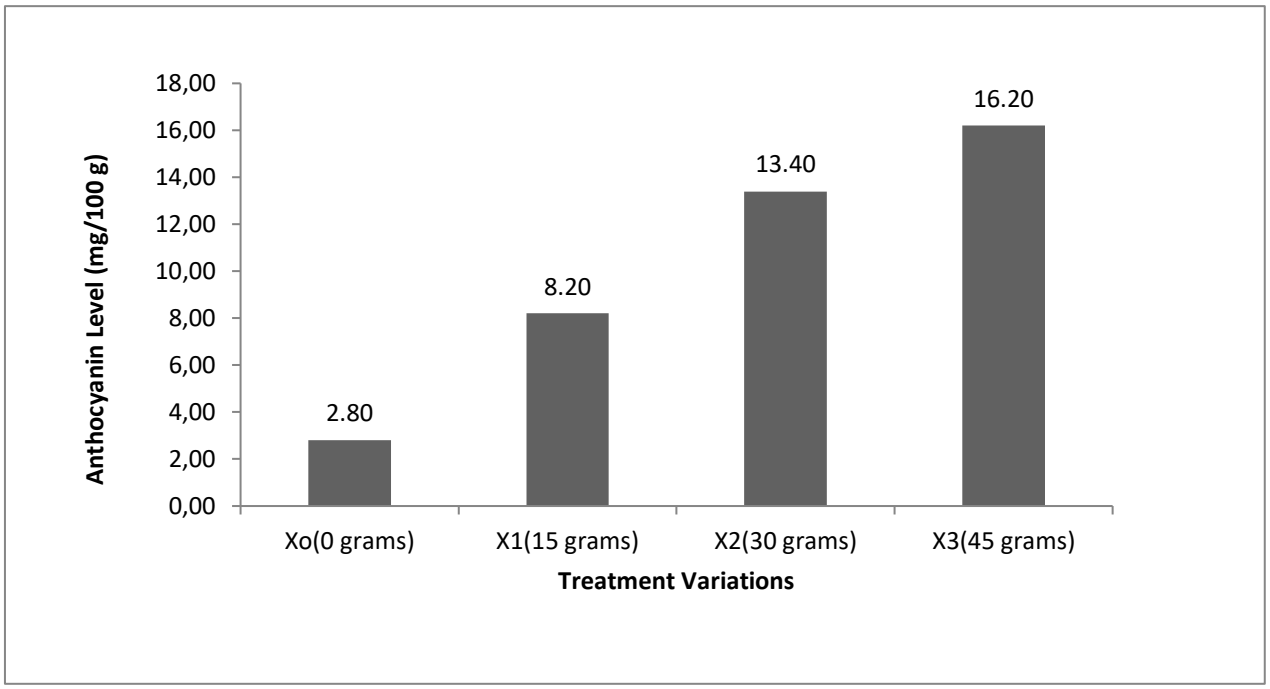


Figure 1. Anthocyanin Analysis

Organoleptic Test

Steamed sponge cake product made from red bean flour with the addition of butterfly pea flower extract, paying attention to the organoleptic results in Table 3.

Tabel 3 Organoleptic Test Results

Sample	Color	Aroma	Taste	Texture
X_0	Yellow	Characteristic	Characteristic	Rises
X_1	Milky green/light green	Characteristic	Characteristic	Rises
X_2	Green tosca	Characteristic	Characteristic	Little dense
X_3	Blue tosca	Characteristic	Characteristic	Dense

Based on the results of organoleptic tests on red bean flour steamed sponge cake with the addition of butterfly pea flower extract, it shows that the aroma, taste and texture are not different, while the color is different.

Consumption Recommendations

Consumption recommendations were determined based on the best formulation of red bean flour steamed sponge cake with the addition of butterfly pea flower extract using the ranking test method or exponential comparison method (MPE)(13), which is a method for determining the selected formula based on the weighting of anthocyanin content values and organoleptic tests of 30 untrained panelists. The determination of the best formulation of red bean flour steamed sponge cake with the addition of butterfly pea flower extract can be seen in Table 4.

Table 4 Determining the Best Formulation

Parameters	Percentage	Component Alternative Scores							
		X_0		X_1		X_2		X_3	
		Result	Score	Result	Score	Result	Score	Result	Score
Anthocyanin	50%	2,80	1,40	8,20	4,10	13,40	6,70	16,20	8,10
Color	15%	3,40	0,51	3,17	0,48	3,60	0,54	4,20	0,63
Flavor	10%	3,43	0,34	3,50	0,35	3,50	0,35	3,53	0,35
Taste	10%	4,10	0,41	3,93	0,39	3,70	0,37	3,90	0,39
Texture	15%	4,10	0,62	3,90	0,59	3,67	0,55	3,73	0,56
Total Score	100%		3,28		5,91		8,51		10,03
Ranking			4		3		2		1

DISCUSSION

Anthocyanin

In this study, samples of butterfly pea flowers that have been extracted were used to obtain their anthocyanin levels. Anthocyanin is one of the pigment compounds that is soluble in water(14). Anthocyanins are antioxidants that are beneficial for humans and can play a role in reducing the risk of degenerative diseases. In general, anthocyanin compounds are found in plants that contain purple, red, and dark red colors, as well as in some types of ornamental plants, one of which is the butterfly pea flower(2). The addition of butterfly pea flower extract was carried out with 4 different treatments, namely X_0 of 0 grams, X_1 of 15 grams, X_2 of 30 grams, and X_3 of 45 grams as in table 1 which shows the formula for each sample given a different treatment in the amount of butterfly pea flower extract added. Table 2 shows that as the addition of butterfly pea flower extract in making red bean flour steamed sponge cake increases, the anthocyanin levels increase. Figure 1 shows a graph of the increase in the average anthocyanin levels in red bean flour steamed sponge cake products with the addition of butterfly pea flower extract. The highest average anthocyanin content was in red bean flour steamed sponge cake with the addition of 45 grams of butterfly pea flower extract (X_3) and the lowest average anthocyanin content was in red bean flour steamed sponge cake without the addition of butterfly pea flower extract (X_0).

Anthocyanin levels increased with the addition of butterfly pea flower extract. The addition of butterfly pea flower extract affected the anthocyanin content in red bean flour steamed sponge cake products. This is in line with Zainedi's (2022) research, which found that the higher the addition of butterfly pea flower extract, the higher the anthocyanin levels in marshmallow products, which have anthocyanin levels of 0.38 mg/L – 8.99 mg/L. Based on the research, the higher the addition of butterfly pea flower extract, the higher the antioxidant activity in steamed sponge cake products(5). As known, anthocyanin levels and antioxidant activity are interrelated, so the higher the anthocyanin levels, the higher the antioxidant activity(15). Based on laboratory results, the average anthocyanin content of red bean flour steamed sponge cake from each addition of butterfly pea flower extract X_0, X_1, X_2, and X_3 was 2.8, 8.2, 13.4, and 16.2 mg/100 g, respectively. These results for X_1, X_2, and X_3 have met the minimum level of anthocyanin consumption to reduce the risk of chronic disease, namely 20% as a snack(16).

Organoleptic

Organoleptic testing is a food quality assessment technique that uses the senses. Organoleptic testing using human senses is carried out to assess the quality and safety of food and beverages(17). The sensory process primarily utilizes the human senses to measure a product's acceptability. Evaluation in this test requires sensory abilities such as detecting, recognizing, distinguishing, comparing, and assessing likes or dislikes of the tested product(18). Tests included color, aroma, taste, and texture at four levels of red bean flour steamed sponge cake with the addition of butterfly pea flower extract.

Color

Color is one of the important aspects in the acceptance of a food product(19). Based on the results of the Hedonic Scale Test on the color of red bean flour steamed sponge cake with the addition of butterfly pea flower extract, the highest color organoleptic value is treatment X_3 which is a red bean flour steamed sponge cake with the addition of 45 g of butterfly pea flower extract. The red bean flour steamed sponge cake with treatment X_3 has an average of 4.2. While the lowest average color acceptance value is owned by treatment X_1 which is a red bean flour steamed sponge cake with the addition of 15 grams of butterfly pea flower extract. The red bean flour steamed sponge cake with treatment X_1 has an average of 3.17 or is somewhat preferred by the panelists.

Table 3 shows that the color produced from the butterfly pea flower extract added to the red bean flour steamed sponge cake varies. Treatment X_0 produces a yellow sponge cake, this is because the red bean flour steamed sponge cake is not given the addition of butterfly pea flower extract. Treatment X_1 produces a milky green/bright green sponge cake, this is because the original color of the sponge is yellow and is given a thick blue butterfly pea flower extract of 15 grams. Treatment X_2 produces a turquoise green sponge cake, this is because the original color of the sponge is yellow and is given a thick blue butterfly pea flower extract of 30 grams. Treatment X_3 produces a turquoise blue sponge cake, this is because the original color of the sponge is yellow and is given a thick blue butterfly pea flower extract of 45 grams.

The extract from butterfly pea flowers produces a deep blue color that comes from the anthocyanin compound content(20). The results of the study showed that the higher the concentration of butterfly pea flower extract, the more intense the color will be. This is in accordance with the research showed that the higher the addition of butterfly pea flower extract will strengthen the intensity of the blue color in red bean flour steamed sponge cake and increase the level of panelists' preference for the color of the red bean flour steamed sponge cake. The blue color in the red bean flour steamed sponge cake product arises from the presence of anthocyanins in butterfly pea flowers(1).

Aroma

Aroma is one of the parameters of organoleptic testing carried out using the sense of smell. Aroma is a reaction of a product that affects the acceptance of a food product before consumption(21). Based on the results of the Hedonic Scale Test on red bean flour steamed cake with the addition of butterfly pea flower extract, the highest organoleptic aroma value was treatment X_3 which was a red bean flour steamed cake with the addition of 45 g of butterfly pea flower extract. The red bean flour steamed cake with treatment X_3 had an average of 3.53 or was somewhat preferred by the panelists. Meanwhile, the lowest average value of aroma acceptance was owned by treatment X_0, namely red bean flour steamed cake without the addition of butterfly pea flower

extract. The red bean flour steamed cake with treatment X_0 had an average of 3.43 or was somewhat preferred by the panelists.

Based on the research result it is explained that butterfly pea flowers do not have a distinctive aroma, even the water extract of butterfly pea flowers produces a slightly unpleasant aroma(22). In this study, the addition of butterfly pea flower extract did not affect the aroma of steamed sponge cakes. Table 3 shows that the aroma produced from butterfly pea flower extract added to red bean flour steamed sponge cakes both X_1, X_2, and X_3 is the typical aroma of sponge cakes. This is evidenced by the average level of panelists' preference for the aroma at all treatment levels which is almost the same, ranging from 3.43-3.53 or somewhat preferred by panelists. According to research, the high level of preference for red bean flour steamed sponge cakes with butterfly pea flower extract is due to the anthocyanin content in butterfly pea flowers which does not change the aroma of a food product so it is appropriate to be used as a local natural dye(22). In addition, the level of preference related to the organoleptic aroma is influenced by the addition of vanilla powder in the process of making red bean flour steamed cake so that it provides an aroma and taste that is liked by the panelists(23).

Taste

Taste is one of the factors that can determine the acceptance of a product by the sense of taste, namely the tongue(24). Based on the results of the Hedonic Scale Test on red bean flour steamed sponge cake with the addition of butterfly pea flower extract, the highest organoleptic taste value is treatment X_0 which is a red bean flour steamed sponge cake without the addition of butterfly pea flower extract. The red bean flour steamed sponge cake with treatment X_0 has an average of 4.1 or is liked by the panelists. While the lowest average value of taste acceptance is owned by treatment X_2, namely red bean flour steamed sponge cake with the addition of 30 g of butterfly pea flower extract. The red bean flour steamed sponge cake with treatment X_0 has an average of 3.7 or is somewhat liked by the panelists.

According to research, the panelists' preference for the taste of red bean flour steamed sponge cake was influenced by the concentration of butterfly pea flower extract added(22). Butterfly pea flowers have the advantage of providing very little taste and aroma that might reduce sensory value(1). Table 3 shows that the taste produced by butterfly pea flower extract added to red bean flour steamed sponge cakes, whether X_0, X_1, X_2, or X_3, is the typical sponge cake taste. The taste and aroma of butterfly pea flower extract can be masked by the addition of other ingredients such as vanilla which provides an aroma and taste that is preferred by panelists(23).

Texture

Texture is a form of physical stimulation in a product. Some textural properties such as rough, smooth, and smooth from the surface of a product(21). Based on the results of the Hedonic Scale Test on red bean flour steamed sponge cake with the addition of butterfly pea flower extract, the highest organoleptic texture value is treatment X_0 which is a red bean flour steamed sponge cake without the addition of butterfly pea flower extract. The red bean flour steamed sponge cake with treatment X_0 has an average of 4.1 or is preferred by panelists. While the lowest average organoleptic value belongs to treatment X_2 which is a red bean flour steamed sponge

cake with the addition of 30 g of butterfly pea flower extract. The red bean flour steamed sponge cake with treatment X_2 has an average of 3.67 or is somewhat preferred by panelists.

Table 3 shows that the textures resulting from the addition of butterfly pea flower extract to the red bean flour steamed sponge cake vary. Treatment X_0 produces a sponge cake with a perfectly fluffy texture or not flat, this is because the red bean flour steamed sponge cake is not given the addition of butterfly pea flower extract. Treatment X_1 produces a sponge cake with a fluffy texture or not flat, this is due to the addition of 15 grams of butterfly pea flower extract. Treatment X_2 produces a sponge cake with a slightly flat texture, this is due to the addition of 30 grams of butterfly pea flower extract. Treatment X_3 produces a sponge cake with a flat texture or not flat. this is due to the addition of 45 grams of butterfly pea flower extract.

Based on research, it was concluded that the higher the amount of butterfly pea flower given did not affect the preference rating for color and aroma, but it would cause a decrease in the softness of the texture and the rise ability of the steamed sponge cake dough because butterfly pea flowers have a high water and fiber content(22). This caused the highest organoleptic rating in treatment X_0 or red bean flour steamed sponge cake without the addition of butterfly pea flower extract.

Consumption Recomendation

Based on the results of the exponential comparison method in table 4, it can be seen that the best formulation of red bean flour steamed cake with the addition of butterfly pea flower extract is treatment X_3 with a proportion of 45 g of butterfly pea flower extract added. Determining the recommended consumption of red bean flour steamed cake with the addition of butterfly pea flower extract to obtain anthocyanin levels according to needs requires considering the ideal energy and nutrient contributions at each meal. The amount required at each meal is 20% at breakfast, 30% at lunch, 30% at dinner, and 20% at snacks(16).

The effective anthocyanin requirement for maintaining health and reducing the risk of chronic diseases is by consuming 19.8 – 64.9 mg of anthocyanin for women and around 18.4 – 44.1 mg for men(25). Based on the results of research, administering black rice bran extract to mice at 200 mg/kg BW can reduce blood sugar levels by 71.32%. This is because the anthocyanin content in black rice bran extract is 3.284 mg/100 g. The recommended consumption of anthocyanin as a snack needs to meet 20% of the anthocyanin consumption requirement so that it is effective in maintaining health and reducing the risk of chronic diseases, one of which is diabetes mellitus, which is 3.284 mg/100 g. The average anthocyanin content in 1 piece of steamed sponge cake weighing 50 grams at X_0, X_1, X_2, and X_3 respectively is 1.4 mg, 4.1 mg, 6.7 mg, and 8.1 mg. The results of X_1, X_2, and X_3 have met the minimum anthocyanin requirement as a snack, namely 4.1 mg, 6.7 mg, and 8.1 mg. The recommendation for consuming red bean flour steamed sponge cake with the addition of butterfly pea flower extract as a snack is one piece/day or 50 grams

CONCLUSIONS AND RECOMMENDATIONS

The anthocyanin content of red bean flour steamed sponge cake increased with the addition of butterfly pea flower extract. The anthocyanin content increased significantly. There was an effect of red bean flour

steamed sponge cake with the addition of butterfly pea flower extract on color and taste, while there was no significant difference in aroma and texture. The best formulation to meet anthocyanin consumption in women and men was the X_3 formulation with the addition of 45 grams of butterfly pea flower extract. The recommended consumption is 1 piece of 50 grams.It is necessary to develop innovations in processing other products using butterfly pea flowers, paying attention to the proportion of adding red bean flour and butterfly pea flowers, and measuring the specific volume for the organoleptic texture of steamed sponge cake products.

REFERENCES

1. Marpaung AM. An Overview of The Benefits of (*Clitoria ternatea* L.) For Human Health. J Funct Food Nutraceutical. 2020;1(2):63–85.
2. Rifqi M. Anthocyanin Extraction from Butterfly Pea Flower (*Clitoria ternatea* L.). Pas Food Technol J [Internet]. 2021;8(2):45–50. Available from: https://core.ac.uk/download/pdf/511489848.pdf
3. Ichsan OAN, Wulandari YW. The Effect of Drying Duration and Maceration Temperature on the Anthocyanin Content of Butterfly Pea Flower (*Clitoria ternatea* L.). 2021;1–20.
4. Indriyati F et al. Systematic Review: The Potential of Butterfly Pea Flower (*Clitoria ternatea* L.) as Antidiabetic. Generics J Res Pharm Accept 4 Mei. 2022;2(1):1–8.
5. Sejati NIP, Mulyono RA. Characteristics of Steamed Cake with the Addition of Butterfly Pea Flower Extract and Petals. J Akad Baiturrahim Jambi. 2022;11(2):175.
6. Anwar ANIA, Azis Beru Gani, Armanto Makmun, Andi Dhedie Prasatia Sam, Indah Lestari Daeng Kanang. Overview of Diabetes Mellitus Amputation Patients at Ibnu Sina Hospital Makassar from 2019-2023. Fakumi Med J J Mhs Kedokt. 2023;3(8):573–80.
7. Nasution, F; Andilala; Siregar A. Risk Factors for The Event of Diabetes Mellitus. J Ilmu Kesehat. 2021;9(2):94–102.
8. Murtiningsih MK, Pandelaki K, Sedli BP. Lifestyle Factors as Risk Factors for Type 2 Diabetes Mellitus. e-CliniC. 2021;9(2):328.
9. Agustina N, Fitriani S. Utilization of Red Beans and White Sweet Potatoes as Ingredients for Steamed Cake. J Ilm Teknol Pertan Agrotechno. 2021;6(2):62.
10. Rizka Erwinda Sari NM, Wisaniyasa NW, Sri Wiadnyani AAI. S Analysis of Nutrients, Fiber, and Anthocyanins in Red Bean Flour and Red Bean Sprout Flour (*Phaseolus vulgaris* L.). J Ilmu dan Teknol Pangan. 2020;9(3):282.
11. Purwonto Safira MU, Aprilia K, Sulistiyani. Antioxidant Activity of Butterfly Pea Flower Extract (*Clitoria ternatea* L.) In Inhibiting Lipid Peroxidation. Curr Biochem. 2022;9(1):26–37.
12. Aragani W. Measurement and Calculation of Total Anthocyanin Content in Purple Sweet Potato Cendol. 2019
13. Hanif AA, Fauziyah A, Nasrulloh N. The Effect of Guava Addition on Vitamin C Content, Antioxidant Activity, and Organoleptic Properties of Tomato Ice Cream. Ghidza J Gizi dan Kesehat. 2021;5(2):171–8.
14. Kunnaryo HJB, Wikandari PR. Anthocyanins in Fermentation Production and Their Role as Antioxidants. Unesa J Chem. 2021;10(1):24–36.
15. Husna A, Lubis YM, Erika C. Extraction of Natural Dye from Butterfly Pea Flower (*Clitoria ternatea* L.) with Variations in Solvent Type and Extraction Time. J Ilm Mhs Pertan. 2022;7(2):410–9.
16. Melani V, Ronitawati P, Swamilaksita PD, Sitoayu L, Dewanti LP, Hayatunnufus F. Lunch and Snack Consumption in Relation to Work Productivity and Nutritional Status of Teachers. J Nutr Coll. 2022;11(2):126–34.

17. Ismanto H. Organoleptic Test of Shrimp Crackers (L. *vannamei*) Results of Vacuum Frying. J AgroSainTa Widyaiswara Mandiri Membangun Bangsa. 2023;6(2):53–8.

18. Gusnadi D, Taufik R, Baharta E. Organoleptic Test and Acceptance of Cassava Tapai-Based Mousse as an MSME Commodity in Bandung Regency. J Inov Penelit. 2021;1(12):2883–8.

19. Subhan, Arfi F, Ummah A. Qualitative Test of Synthetic Dyes in Traditional Snacks from Ketapang Area, Banda Aceh City. Amina. 2020;1(2):67–71.

20. Putu Anggun Cipta Rosalita Jelantik N, Cahyaningsih E. Antioxidant potential of telang flowers (*Clitoria ternatea* L.) as an inhibitor of hyperpigmentation due to ultraviolet exposure. J Ilm Farm. 2022;18(1):45–54.

21. Manzalina N, Sufiat S, Kamal R. Consumer Acceptance of the Flavor of Kawista Fruit Ice Cream (*Limonia acidissima*). Media Pendidikan, Gizi, dan Kuliner. 2019;8(2):20–7.

22. Nirmalawaty A, Sri Mahayani AAP. Effectiveness Test of Steamed Cake with Butterfly Pea Juice. Ziraa'Ah Maj Ilm Pertan. 2022;47(2):142.

23. Zainedi, A A, Indriyani, Surhaini. The Effect Butterfly Pea Flower Extract (*Clitoria ternatea* L.) Of Addition On The Characteristics Of Marshmallow. Itepa J Ilmu dan Teknol Pangan [Internet]. 2022;11(1):1–14. Available from: https://repository.unja.ac.id/33992/

24. Lamusu D. Organoleptic Test of Jalangkote with Purple Sweet Potato (*Ipomoea batatas* L) "As an Initiative for Food Diversification. J Pengolah Pangan. 2018;3(1):9–15.

25. Yam MF, Tew WY, Tan CS, Qiu Q, Zhou R, Wang X, et al. Investigation of synergistic interaction of sinensetin, eupatorin, and 3′-hydroxy-5,6,7,4′-tetramethoxyflavone in vasodilation efficacy. Hypertens Res. 2024;47(11):3193–9.