Acceptability and iron content mochi filled red beans and raisins

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ABSTRACT

Background: *In 2018, 32% of teenagers in Indonesia experienced anemia due to iron deficiency. Adolescence is one of the periods characterized by accelerated growth and development, leading to increased iron requirements in the body. Healthy and nutritious foods, including snacks, can be significant contributors to meeting the nutritional needs of iron-deficient teenagers. Red beans and raisins are among the food ingredients that can increase iron levels in the body; therefore, these food ingredients can be processed into the filling of a mochi that contains relatively high iron content.*

Objectives: *To determine the relationship between perceived body image and eating patterns among female SMAS Kesuma Bangsa Londut students.*

Methods: *This research is an experimental study. Acceptance testing was conducted organoleptically using a hedonic test method. The acceptance testing was conducted on 30 untrained panelists, namely female teenagers from SMAS Kesuma Bangsa Londut, and nutritional content analysis was performed at the Medan Industrial Research and Standardization Institute Laboratory. This research was conducted from January to March 2024.*

Results: *Organoleptic test results showed that the panelists liked the color, aroma, texture, and taste of the red bean and raisin-filled mochi. The iron content test results in 120 grams of the product showed 37.4 mg. The red bean and raisin-filled mochi given to the panelists was 30 grams, meaning it contained 9.35 mg of iron.*

Conclusions: *Red bean and raisin-filled mochi have good acceptance among teenage girls and also contain relatively high iron content.*

KEYWORD*: mocha; red beans; raisins; iron*

INTRODUCTION

Iron is a mineral essential for our body's growth and development. The body utilizes iron to produce hemoglobin, a protein found in red blood cells. Hemoglobin carries oxygen from the lungs to all parts of the body. Iron deficiency may lead to iron-deficiency anemia. Initially, this condition may show no symptoms, but over time, it can result in fatigue, shortness of breath, and issues with memory and concentration. Treatment for low iron and iron-deficiency anemia typically involves iron supplementation (1).

Adolescence is a period marked by accelerated growth and development, leading to increased iron requirements in the body (2). In adolescent girls, iron is also needed to replenish iron lost during menstruation. Anemia is one of the diseases that should be monitored, with iron deficiency being one of its causes (3). Based on the Basic Health Research data from 2007, 2013, and 2018, there has been an increasing trend in the prevalence of anemia among adolescents. In 2018, 32% of adolescents in Indonesia were affected by anemia due to iron deficiency. This implies that approximately 7.5 million Indonesian adolescents are at risk of growth and developmental delays, cognitive impairments, and susceptibility to infections (4).

Seeing these conditions, efforts to provide Blood Supplement Tablets (TTD) are important to give to young women in their growth process. Apart from minimizing the potential for anemia to have an impact on health and performance at school, giving blood supplement tablets is also to prepare the health of young women before they become mothers. Giving TTD to young women is to prevent mothers from giving birth to babies with short bodies (stunting) (3). Healthy and nutritious foods, including snacks, can be significant contributors to meeting the nutritional needs of iron-deficient adolescents (5).

Red beans (Phaseolus vulgaris) are a source of plant protein and a food item rich in non-heme iron, containing 10,3 mg of iron per 100 grams (6).In Indonesia, red bean production was 67,862 tons in 2018, decreased to 61,517 tons in 2019, and then increased to 66,210 tons in 2020 (7). In Indonesia, the processing of red beans is still relatively low. Red beans are consumed by the public by being processed into vegetables, ice cream toppings, and cake fillings (8).

Raisins are small, dried grapes. The small black grapes used to make raisins originally came from Greece (9). Currently, several grape varieties can produce small, dark blue, tasty, seedless raisins. Good-quality raisins should be thick, round, full-bodied, clean, uniformly sized, and dark blue (10). Raisins contain a type of iron called non-heme iron. The amount of non-heme iron absorbed during digestion is influenced by various natural substances found in food. This means that raisins, containing 0,8 mg of iron per small box, provide a high source of iron only when consuming 2 to 4,5 small boxes (11).

Raisins are considered a rich source of iron. 100 grams of raisins contain about 1,3 mg of iron, or 7% of the recommended daily intake for most women (12). Based on research conducted by Rodhiyah, (2021) the most preferred organoleptic assessment of MOPINK mochi formulations with the addition of red bean paste and guava was formulation MP2 (1:1) with an iron content of 72,15 mg/kg. The most preferred mochi formulation is MP2, and the highest iron content is in the control formulation. Organoleptic tests are needed to measure the acceptance of mochi filled with red beans and raisins by young women at SMAS Kesuma Bangsa as well as identifying areas of improvement in the development of mochi filled with red beans and raisins. This research will involve organoleptic tests to assess young women's preferences for mochi filled with red beans and raisins, as well as laboratory analysis to assess the iron content in it. The results of this research will provide useful data for the development of food products that are healthy and liked by young women.

Based on the results of research conducted by Afiska et al., (2021), the analysis of the nutritional needs of red bean pudding snacks shows that per 100 grams, there are 107,74 calories, while the calorie value for snacks is 210 calories. This is still insufficient for its energy needs as a snack, but in terms of its iron content, per 100 grams of snack contains 1,5 grams of iron, while the proximate analysis result is 1,33 in red bean pudding, meeting the requirements as a snack for adolescent girls with anemia.

Based on the analysis of variance conducted by Richard Randi, I Wayan Sudiarta dan I Nyoman Rudianta, (2022), it is seen that the treatment of adding CMC and storage duration, as well as the interaction between the two treatments, had no significant effect (p>0,05) on the water content in red bean milk. From the data analysis results, the highest water content can be obtained with the addition of 0,08% CMC, which is 91,76%. Meanwhile, the lowest water content can be obtained with the addition of 0,04% CMC, which is 91,32%, but statistically different insignificantly from other treatments. This means that the higher the addition of CMC, the tendency for a decrease in water content.

One interesting snack option is red bean and raisin-filled mochi. Mochi is a Japanese food made from steamed glutinous rice filled with various ingredients, such as red beans and raisins. Red beans and raisins are food items that can increase iron levels in the body. Red bean and raisin-filled mochi has the advantage of being an anemia-preventive snack due to its high iron content (16).

The aim of this research is to analyze the acceptability and iron content of red bean and raisin-filled mochi. By better understanding consumer preferences for this food, we can develop options that not only provide enjoyment but also make a positive contribution to the health of adolescent girls.

MATERIALS AND METHODS

R Research Location and Time

This study on the preparation of red bean and raisin-filled mochi was conducted at the Londut Plantation, Kualuh Hulu District, North Labuhanbatu Regency. The acceptance test of red bean and raisin-filled mochi was conducted at SMAS Kesuma Bangsa Londut, while the nutritional content test was performed at the Laboratory of the Medan Research and Standardization Institute on Jl. Sisingamangaraja No.24, Pasar Merah Baru, Medan Kota. This research was carried out from January to March 2024. This test has passed the health research ethics test of the Lubuk Pakam Medistra Health Institute with number No: 017.D/KEP-MLP/IV/2024.

Procedure

This research employed an experimental design. Experimental design is a traditional approach to conducting quantitative research with the main characteristic being intervention or treatment so that the causal relationship between the independent variable and the dependent variable is known (17). In making the mochi itself, the researchers repeated it 3 times before submitting it and testing it to the laboratory. The ingredients used in making mochi filled with red beans and raisins in this study were sticky rice flour, red beans, raisins, cooking oil, vanilla powder, sweetened condensed milk, tapioca flour, pandan leaves, pink food coloring, granulated sugar, salt and water.

The tools used to make mochi filled with red beans and raisins consist of a bowl, spoon, pan, skillet, spatula, stove, kitchen scale, baking sheet and knife. The tool used for organoleptic test research is a questionnaire distributed to young women. The iron test method uses Atomic Absorption Spectrophotometry (AAS). AAS is a method based on the principle of measuring the amount of electromagnetic radiation absorbed by atoms or minerals in the gas phase. When analyzing minerals in food ingredients or products, this method is usually used because it is simple, easy to use, can detect dangerous heavy metals, has a fast analysis time and has high sensitivity (18).

In making mochi filled with red beans and raisins there are several steps, soak 125 grams of red beans for 24 hours, then boil the red beans for 45 minutes until the red beans are tender, then drain the red beans in a container and immediately mash them. while it's warm so that the texture doesn't harden. Next, add 14,3 grams of vanilla powder and granulated sugar, then stir until mixed and evenly distributed. Once mixed and the texture is smooth, the next step is to make peanut balls and add 3 raisins to the peanut balls, then to make moci skin, the first step is to mix 100 grams of sticky rice flour plus 40 grams of sweetened condensed milk and 1 gram of salt and 13 grams of oil. fry and 1 gram of vanilla powder, 0,5 gram of food coloring and 50 ml of water, then stir until thickened, then transfer the mixture to a heat resistant container and steam the mixture for 35 minutes. For the coating flour mixture, roast 30 grams of tapioca flour then add

2 pandan leaves, roast over low heat until fragrant, then remove the steamed dough, then knead the dough until it takes an elongated shape and cut the moci dough into 30 pieces, then flatten the dough. moci then add the red beans that have been rounded earlier while adding a little tapioca flour all over the surface of the moci, and the red bean moci filled with raisins are ready to eat.

Analysis Method

Mochi filled with red beans and raisins has successfully passed the iron (Fe) content testing stage carried out in the laboratory by analysis by the Medan Industrial Standardization and Services Agency. After passing a rigorous testing process, this mochi has been officially accredited and has been given a certificate number No. 0359/BSKJI/BSP JI-Medan/MS-P/III/2024 as proof of safety and quality. The untrained panelists consist of 25 lay people who can be selected based on ethnicity, social level and education. These trained panelists are only allowed to assess simple organoleptic tools such as liking traits, but cannot use discrimination test data (19).

Researchers added the panelists to 30 untrained panelists, all of whom were students from SMAS Kesuma Bangsa Londut. The researcher added the panelists to 30 untrained panelists, all of whom were students from SMAS Kesuma Bangsa Londut. The characteristics of untrained panelists, namely young women, are able to assess color, aroma, texture and taste. The acceptance test was conducted organoleptically by the panelists, who evaluated the mochi filled with red beans and raisins based on four parameters: color, aroma, texture, and taste. Organoleptic testing methods include hedonic testing (ranking method), descriptive testing, and discriminative testing (triangle test, duo-trio, paired comparison, ranking, and scoring). The researchers used the hedonic testing method, which is a sensory organoleptic analysis method used to compare quality. The level of preference is expressed on a hedonic scale, such as extremely dislike, dislike, like, and extremely like (20).

RESULTS AND DISCUSSIONS

Based on its levels, the level of acceptance can be determined using the following **Table 1**.

Table 1. Hedonic Scale of Panelist Acceptance Level for Red Bean and Raisin-filled Mochi

Parameter	Hedonic Scale	Numeric Scale
Color	Very Dislike	1
	Dislike	2
	Like	3
	Very Like	4
Scent	Very Dislike	1
	Dislike	2
	Like	3
	Very Like	4
Texture	Very Dislike	1
	Dislike	2
	Like	3
	Very Like	4
Taste	Very Dislike	1
	Dislike	2
	Like	3
	Very Like	4

Acceptance of Color Parameter

The panelists' assessment based on the acceptance level of color in red bean and raisin-filled mochi can be seen in the table below:

Table 2. Panelists' Assessment Based on Color Acceptance Level of Red Bean and Raisin-filled Mochi

Hedonic Scale	Panelists	Percentages
Very Dislike	0	0%
Dislike	4	13.3%
Like	20	66.7%
Very Like	6	20%
Quantity	**30**	**100%**

In red bean and raisin-filled mochi products, color is the first sensory parameter assessed in an organoleptic test because it gives the primary impression to the panelists. Generally, the color of the resulting product is milky white, influenced by the raw materials used. To make panelists interested in red bean and raisin-filled mochi products, researchers added pink food coloring. As seen in Table 2, 20 panelists liked the color of red bean and raisin-filled mochi with a percentage of 66,7%, while 6 panelists very much liked the color, accounting for 20%, and 4 panelists

disliked the color, accounting for 13,3%. Panelists in the study showed a higher preference for bright and cheerful colors for the product.

This is consistent with previous research that color in food greatly influences attractiveness and taste preferences. Color itself is a difficult pattern to measure, resulting in different assessments when evaluating its quality. Differences in color assessments occur because each person has different vision and taste preferences as well (21).

Acceptance of Scent Parameter

The panelists' assessment based on the acceptance level of aroma in red bean and raisin-filled mochi can be seen in the table below:

Table 3. Panelists' Assessment Based on Aroma Acceptance Level of Red Bean and Raisin-filled Mochi

Hedonic Scale	Panelists	Percentages
Very Dislike	0	0%
Dislike	9	30%
Like	19	63.3%
Very Like	2	6.7%
Quantity	**30**	**100%**

Scent is one of the crucial factors in food because the perceived scent can stimulate appetite and have a positive impact on the product. Besides appearance, color, and taste, scent also plays a significant role. Often, many products fail to thrive due to unfavorable food scents, while some foods are well-accepted due to their pleasant scent, enhancing appetite even if the food itself is ordinary. Generally, the resulting product has the scent of glutinous rice flour, influenced by the raw materials used. To give red bean and raisin-filled mochi a distinct scent, researchers used roasted flour coating with pandan leaves. As seen in Table 3, 19 panelists liked the scent of red bean and raisin-filled mochi, accounting for 63,3%, while 2 panelists very much liked the scent, accounting for 6,7%, and 9 panelists disliked the scent, accounting for 30%. Panelists liked the scent of red bean and raisin-filled mochi because of the pandan scent, making this mochi different from the usual mochi.

This research aligns with previous studies that pandan leaves have a distinctive scent, and pandan leaves are often used to give food or drinks a natural scent. With the content of tannins, glycosides, and alkaloids, pandan leaves are beneficial for health (22).

Acceptance of Taste Parameter

The panelists' assessment based on the acceptance level of taste in red bean and raisin-filled mochi can be seen in the table below:

Table 4. Panelists' Assessment Based on Taste Acceptance Level of Red Bean and Raisin-filled Mochi

Hedonic Scale	Panelists	Percentages
Very Dislike	0	0%
Dislike	3	10%
Like	17	56.7%
Very Like	10	33.3%
Quantity	**30**	**100%**

Taste is the key factor in a food product. Teenagers are synonymous with sweet foods, making sweet foods easier to accept by teenagers. However, it may not be accepted by adults or parents, and it also needs to be appropriate for the area and situation, such as Javanese culture being synonymous with sweetness, while Batak culture is synonymous with spicy food. Taste is thus also an important factor in the acceptance of food, not only because of its appearance but also because taste needs to be carefully considered. The taste of this mochi is not too sweet, unlike typical mochi, which is intentionally done by the researchers to provide an interesting product variation for the panelists.

As seen in Table 4, 17 panelists liked the taste of red bean and raisin-filled mochi, accounting for 56,7%, while 10 panelists very much liked the taste, accounting for 33,3%, and 3 panelists disliked the taste, accounting for 10%.

Based on previous research, organoleptic test results by 30 students of the Makassar Health Polytechnic found that a concentration of 10% was the most preferred formula in terms of

color, aroma, texture, and taste, with an average score of 4,07. The 10% concentration is dark brown with black raisins, with the most prominent aroma being milk and honey, a crunchy texture that is not easily brittle, and a sweet taste from honey and sour taste from raisins. However, some panelists commented that the raisin taste was stronger and they didn't particularly like the raisin taste after consuming the 10% concentration snack bar (23).

Acceptance of Texture Parameter

The panelists' assessment based on the acceptance level of texture in red bean and raisin-filled mochi can be seen in the table below:

Table 5. Panelists' Assessment Based on Texture Acceptance Level of Red Bean and Raisin-filled Mochi

Hedonic Scale	Panelists	Percentages
Very Dislike	0	0%
Dislike	7	23.3%
Like	13	43.4%
Very Like	10	33.3%
Quantity	**30**	**100%**

Texture is the last assessment where an older person would often prefer soft-textured foods, while conversely, teenagers would prefer crunchy foods. A suitable texture will provide its own appeal when the food is consumed. The texture of this mochi is chewy due to the use of glutinous rice flour in its production.

As seen in Table 5, 13 panelists liked the texture of red bean and raisin-filled mochi, accounting for 43,4%, while 10 panelists very much liked the texture, accounting for 33,3%, and 7 panelists disliked the texture, accounting for 23,3%. Panelists liked the texture of red bean and raisin-filled mochi because of its chewy and easy-to-eat texture, while some panelists did not like the mochi texture because most of the teenage girls at Kesuma Bangsa Londut High School preferred a chewy texture.

Nutritional Content Analysis of Red Bean and Raisin-filled Mochi

The results of the nutritional content analysis of red bean and raisin-filled mochi can be seen in the table below:

Table 6. Nutritional Content of Red Bean and Raisin-filled Mochi

Sample Weight	Test Parameter	Unit	Test Result	Test Method
120 g	Iron (Fe)	mg/kg	37.4	AAS

Based on **Table 6**, the iron content test results in red bean and raisin-filled mochi show 37,4 mg for a sample weight of 120 grams. This indicates that the combination of red beans with raisins processed into mochi filling does not diminish the iron content therein. The sufficiency of iron in red bean and raisin-filled mochi products can be analyzed in the context of daily recommended intake. According to the Minister of Health Regulation of the Republic of Indonesia Number 28 of 2019 concerning Recommended Nutritional Adequacy Figures for the Indonesian Population, the recommended iron consumption for adolescent females aged 16-18 years is 15 mg. The mochi provided to the panelists weighs 30 grams, meaning it contains 9,35 mg of iron. This means that panelists still need 5,65 mg of iron to meet the recommended intake.

Red bean and raisin-filled mochi also contain non-heme iron, which is a plant-based source of iron. Although the absorption of non-heme iron is not as efficient as the absorption of heme iron found in meat, the combination of non-heme iron in red beans with non-heme iron from raisins can enhance iron absorption in the body.

This is consistent with previous research; red beans are one of the foods containing minerals that are beneficial in increasing hemoglobin levels. In 10 grams of red beans or 1 cup serving of red beans containing iron, copper, and zinc, can help increase hemoglobin levels. Red beans also contain folic acid, which functions in red blood cell formation (24). Raisins are dried grapes rich in iron. Every 100 grams of raisins contain 1,9 grams of iron (2)

CONCLUSIONS AND RECOMMENDATIONS

Red bean and raisin-filled mochi have good acceptance among adolescent girls and also contain a high amount of iron. Through organoleptic testing, it can be observed that the panelists liked the cheerful pink color, distinctive pandan aroma, slightly sweet and sour taste, and chewy texture of the red bean and raisin-

filled mochi. Red bean and raisin-filled mochi have a significant iron content, with 37,4 mg in 120 grams of the product . According to the Minister of Health Regulation of the Republic of Indonesia Number 28 of 2019 concerning Recommended Nutritional Adequacy Figures for the Indonesian Population, the recommended iron consumption for adolescent females aged 16-18 years is 15 mg. The researchers provided mochi for the panelists to consume, weighing 30 grams, which contained 9,35 mg of iron. This means there is still 5,65 mg of iron that has not been fulfilled.

It is hoped that future researchers will create mochi filled with red beans and raisins containing 15 mg of iron to meet the iron needs of adolescent girls. It is also hoped that future researchers will develop other products that are rich in iron and meet the recommended iron intake for adolescent girls. This can be achieved by creating creative and engaging promotions about the benefits of red bean and raisin-filled mochi using posters or educational content that can be widely shared on social media platforms such as TikTok and YouTube. Additionally, collaboration with the food industry to develop iron-rich food products preferred by teenagers, such as cereal products, snacks, or beverages rich in iron, could be beneficial.

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