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Exploring the potential of coffee cherry peel flour (*Coffea arabica*) and banana peel liquid (*Musa × paradisiaca*) as substitutes in rolled bolu cake

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ABSTRACT

Introduction: This research intends to investigate the potential of coffee cherry peel flour and banana peel liquid as cake-baking alternatives, taking into account both their chemical qualities and organoleptic reactions. **Methods:** This experimental study uses baking and steaming techniques to analyze coffee cherry peel flour and banana peel liquid. Chemical analysis of carbohydrates, protein, fiber, moisture, ash, and fat content is conducted, along with organoleptic analysis of color, fragrance, taste, and texture. The ANOVA method is used for data analysis. **Results:** According to the research findings, the greatest results are obtained when baking a cake using a mixture of 50% coffee cherry peel flour and 30% banana peel liquid. The cake has a chemical composition characterized by the presence of 28.9% carbohydrate, 4.02% protein, 6.23% fiber, 25.2% moisture content, 0.45% ash content, and 41.5% fat content. The organoleptic testing results indicate that this cake has received a favorable rating in terms of color (5.49 on the liking scale), scent (5.60 indicating very high liking), taste (5.44 indicating liking), and texture (5.31 indicating liking).**Conclusion:** The research results show that a 50% concentration of coffee cherry peel flour and a 30% banana peel liquid considerably change all organoleptic characteristics of the cake. The cake prepared using these specific proportions exhibits desirable attributes, including a well-received brown hue, a typical coffee fragrance, a discernible coffee flavor, and a tender and readily chewable consistency.

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INTRODUCTION

The part of the coffee fruit containing the coffee beans is called the "coffee cherry" or "cascara" when they are mature and covered by an outer coat like a cherry (Belchior, 2019). The production of coffee in Indonesia continues to be significantly influenced by coffee cherries. The quality of the coffee beans produced is strongly impacted by the proper harvesting and processing of coffee cherries. Coffee cherries must be harvested with care to prevent damage to the coffee beans within. Coffee cherries are often processed using either a wet or dry method, based on the location and the coffee producer's choice (Yuliandri, 2017).

The epidermis of coffee cherries is rich in antioxidants, particularly polyphenols, which promote the development of microorganisms in the intestines and inhibit the proliferation of cancer cells. Coffee cherry peel includes fiber and caffeine, as well as antioxidants. The peel of the coffee cherry includes carbohydrates, such as natural sugars from the coffee berry, which adds to the inherent sweetness of cascara. The peel of a coffee cherry includes potassium, vitamin A, and vitamin C (S. Agustin, 2020; AloDokter, 2021). The coffee cherries utilized in this research were procured from Tambaksari Village, Pasuruan, where the predominant variety is arabica coffee.

There is also the possibility of using coffee cherries in the food processing industry, particularly to develop new foods and beverages. Utilizing coffee cherries in food processing demonstrates the inventiveness and invention of food and beverage artisans in utilizing different sections of the coffee plant. Coffee cherries may be used to infuse a coffee flavor into food or beverages. Coffee cherries may be used as an ingredient in sweets or pastries. Rolled bolu cake is a sort of sponge cake that is shaped on a flat pan to resemble a sheet cake that can be rolled. Sponge cake rolls consist of flour, butter, sugar, eggs, milk, and emulsifiers. Wheat flour is a crucial element in baking sponge cake. Wheat flour's starch and gluten components may bind ingredients, absorb moisture, and help create the cake's

structure (Syarbini & Husin, 2013). When it comes to recipes, the replacement of coffee cherry peel flour for wheat flour needs careful attention since the two types of flour have distinct features and characteristics.

According to (Hariyono et al., 2021), the liquid that is extracted from banana peels may be utilized as an alternative to eggs in some recipes, particularly those that include pastries or cakes. Approximately 1/4 cup of pureed banana peel liquid may serve as a substitute for one egg. Due to the high pectin content of banana peel, banana peel liquid may be used as an egg replacement in some recipes (Megawati & Machsunah, 2016). Additionally, banana peel can be extracted from bananas. Pectin is a soluble fiber that may provide thickness and cohesion to dough or mixes, mimicking the role of eggs in food preparation. For this investigation, the liquid extracted from the banana peel was obtained from the "Pisang Nangka", which was found in Tambaksari Village, Pasuruan. The "Pisang Nangka", scientifically known as Musa × paradisiaca, is a regularly encountered commodity in the research site, often prepared in a basic manner. The juice from banana peel is used as an egg replacement in this recipe to provide a safe option for vegans or those with egg sensitivities. Eggs often play a number of vital functions in sponge cake recipes, including making the cake softer, helping to bond the batter, and contributing to the growth of the cake. This research aimed to explore alternative products that may substitute for wheat flour and eggs due to various causes such as dietary restrictions, allergies, or personal eating choices.

Coffee cherries, including their peel and liquid derived from banana peels, hold significant potential in food processing has noteworthy prospects for the food business and scientific inquiry. Studies suggest that antioxidants in coffee cherry peel can protect against chronic illnesses and improve digestive health. Banana peel pectin, found in the peel, can be used as an alternative to eggs, especially for those with dietary restrictions or allergies. This research broadens the range of ingredients and encourages creativity in food production, aligning with sustainability and health-conscious consumption trends (Ravindran & Jaiswal, 2016). Integrating these by-products into food formulations promotes the industry's transition to more sustainable methods and the creation of functional foods.

METHODS

Equipment and ingredients

The rolled bolu cake was made using a variety of components, including coffee cherry peel flour, granulated sugar, butter, sugar, eggs, banana peel liquid, milk, and an emulsifier. A local market in Surabaya was the source of these ingredients, which were obtained there. An oven, a blender, a burner, and a baking pan were among the analytical instruments, among others.

Research procedures

There were three phases involved in the process of making sponge cake rolls using coffee cherry peel flour and banana peel liquid for the recipe. First, the coffee cherry peel flour was prepared, then the banana peel liquid was prepared, and last but not least, the rolled bolu cake was prepared.

The preparation of flour made from coffee cherry peel

The cherry peel of the coffee cherries is chosen and then stored in a variety of containers. Thoroughly clean the peels of the coffee cherries that were chosen. As soon as there is no longer any water leaking from the coffee cherry peel, drain it and then allow it to stand until it is not too moist. Put the coffee cherry peel in the oven to dry. To grind the coffee cherry peels that have been oven-dried. The coffee cherry peel flour should be sifted. The flour made from oven-dried coffee cherry peel is now ready for usage (Andarwulan *et al.*, 2014).

Preparation of liquid made from banana peel

Remove the ends of the ripe banana peel, so that the peels may be blended more easily, and cut them into tiny pieces or slices. The banana peel should be blended or pureed with a small amount of water (to taste) until it reaches the consistency of a thick liquid. It is possible to utilize the liquid that is produced from the banana peel as a replacement for one of the eggs in the recipe.

Making rolled bolu cake substituted with coffee cherry peel flour and banana peel liquid

Take all of the necessary ingredients and weigh them out per the measurements that are provided in the recipe. Set the butter to melt. The dry ingredients should be mixed and then sifted to prevent lumps of flour and other dry components from forming. Until the mixture becomes firm, combine the banana peel liquid, eggs, and sugar. The dry ingredients should be added gradually while the mixture is being mixed using the folding method until everything is well blended. The melted butter should be added in small increments while swirling using the folding method until it is completely incorporated into the mixture. The batter should be poured into a mold that has been protected from oil with greaseproof paper that is designed particularly for baking. Cook by baking or steaming until done. First, take the bolu cake out of the mold, and then allow it to cool. Rolling out the bolu cake is now ready to be used.

Organoleptic test

During the hedonic organoleptic test, there were 594 participants that took part. Before the examination, the panelists were provided with information on the test method and instructions on how to complete the questionnaire (Wijandi, 2003). As shown in Table 1, the hedonic test was performed on bolu cake rolls.

Table 1. Hedonic test on bolu cake roll substituted with coffee cherry peel flour and banana peel liquid

Numeric scale	Color	Flavor	Taste	Texture
6	Very likely	Very likely	Very likely	Very likely
5	Likely	Likely	Likely	Likely
4	Somewhat Like	Somewhat Like	Somewhat Like	Somewhat Like
3	Somewhat dislike	Somewhat dislike	Somewhat dislike	Somewhat dislike
2	Unlikely	Unlikely	Unlikely	Unlikely
1	Very unlike	Very unlike	Very unlike	Very unlike

Data analysis

In this research, chemical analysis was used to determine the levels of carbohydrates, proteins, fibers, moisture content, ash content, and fat percentage, known as the proximate test. The Proximate Test is performed following the guidelines outlined in the SNI 01-2891-1992 standard. The Indonesian National Standardization Agency (BSN) has established a standard that details the methods for testing the fundamental nutritional elements of food items, such as carbohydrates, crude protein, dietary fiber, moisture, ash, and fat content. The proximate test is used to determine water content and ash content using thermogravimetric techniques. The ash content was determined using the same technique, while protein, fat, carbohydrates, and fiber content were measured using the Kjedhall method, sokhlet method, and reflux method. The AOAC guidelines were followed to ensure accurate results. The study aimed to provide a comprehensive understanding of the nutritional value of various food items. The process of standardization allows for the comparison and evaluation of different aspects within the food sector, leading to progress in the field of food science and technology (Ortiz *et al.*, 2019). To analyze all of the quantitative data that was gathered, an analysis of variance (ANOVA) was performed with a confidence level of 5%. These results were obtained by the use of the Statistical Product and Service Solution (SPSS) Program, version 22.0 (Dunya *et al.*, 2023).

RESULT AND DISCUSSION

Chemical analysis

Analyzing the chemical composition of meals or organic materials is an essential component of the nutritional composition analysis process. Because of this, one may get an understanding of the chemical components and nutritional content that are present in an ingredient. One of the subfields of food science is called food analysis, and it encompasses analytical procedures that are used to detect and determine the chemical components of foodstuffs, both while they are fresh and after they have been processed (Andarwulan *et al.*, 2014). Food analysis is basically a subfield of chemistry that investigates the process by which food components are disassembled into the many compounds that comprise them. The analysis is conducted with the intention of acquiring information on the composition of the components that are there (Sudarmadji *et al.*, 2010).

Table 2. Proximate test results of rolled bolu cake substituted with coffee cherry peel flour and banana peel liquid

Measurement	Method	Unit	Result
Carbohydrate	5.4/IK/2/2.19.1 (By difference INFOODS Tagnames CHOCDF)	%	28.9
Crude protein	SNI 01-2891-1992 point 7.1	%	4.02
Dietary fiber	5.4/IK/2/2.44 (Enzymatic Gravimetry)	%	6.23
Moisture content	SNI 01-2891-1992 point 5.1	%	25.2
Total ash	SNI 01-2891-1992 point 6.1	%	0.450
Total fat	SNI 01-2891-1992 point 8.2	%	41.5

Table 2 shows the result of the proximate test. The analysis using a proximate test is an objective measurement of product quality based on the chemical composition of the product (Beshaw *et al.*, 2022). A study was undertaken to ascertain the nutritional content of sponge cake rolls by substituting coffee cherry peel flour and utilizing banana peel liquid. The study findings revealed that bolu cake rolled made with coffee cherry peel flour and banana peel liquid had a carbohydrate content of 28.9%, protein of 4.02%, dietary fiber of 6.23%, moisture content of 25.2%, total ash of 0.450%, and total fat of 41.5%.

Carbohydrate

Carbohydrates, which are made up of the three primary elements carbon (C), oxygen (O), and hydrogen (H), include functional properties that are essential for a wide variety of food processing procedures. These functions include fillers, thickeners, emulsion stabilizers, water adhesives, taste, fragrance, and texture formers. Moreover, carbohydrates are used as natural sweeteners and as the basis for fermentation production. In terms of nutrition, carbohydrates are the most significant nutrient since they provide the carbon that is required by cells (Purwasih, 2021). According to the findings of the research based on Table 2, the sample has a carbohydrate content of 28.9% of the total weight of the sample, which suggests that about 28.9% of the sample is composed of carbohydrates. The carbohydrate figure in the study is 28.9%. The findings of this study may be valuable for studies pertaining to food and nutrition. For example, sugar, starch, and fiber are all examples of molecules that are included in the category of macronutrients known as carbs. The quantity of carbs present in a particular sample can vary depending on the kind of food or ingredient that is being evaluated.

It is usual practice to use wheat flour in the production of food, which results in a decrease in the nutritional density and fiber content of the meal. According to the findings of the research conducted by (Neoveta & Pangesthi, 2018), the composition of a roll cake consisted of 28.65% water, 6.88% fat, 53.85% carbohydrates, 9.56% protein, 1.05% fiber, 1.76% ash, and 26.9 mg calcium per 100 grams. The findings of this research were lower than the results of the study that came before it, which had a percentage of 28.9%. When compared to the information presented in (FatSecret, 2023b), which claims that the percentage of carbohydrates in sponge cake accounts for 77% of the total calories, this finding is likewise different. The quantity of coffee cherry peel flour that was added resulted in a reduction in the amount of carbohydrates that were included in the sponge cake that was prepared. The reduction is confirmed by the fact that the average carbohydrate content of coffee cherry peel flour is 61.7% (S. Agustin, 2020), which is lower than the carbohydrate content of wheat flour, which is 86% (FatSecret, 2023b).

Crude protein

The term "crude protein" is used in the realm of food, particularly in the field of nutritional analysis, to refer to a chemical analysis technique that is employed for the purpose of determining the total quantity of protein present in a food sample. The overall amount of protein that is present in a food is referred to as its crude protein. In the context of protein content analysis using the Kjeldahl technique, the phrase "crude protein content" is often used to speak about the findings. This level is in accordance with the National Standardization Agency (01-3840-1995), which recommends that the protein levels of sponge cake not exceed 9%. The results of this study in Table 2, showed that the protein content was 4.02, which is below the FAO rules, which state that the minimum food must contain 5 grams of protein per 100 grams. However, this level is below the FAO rules.

The amounts of protein in this research were not too high for a number of different reasons. In the first place, the original recipe for rolled bolu cake called for 60 grams of medium protein flour, which has a protein concentration of around ten to twelve percent (Gisslen, 2022). Second, coffee cherry peel flour, which has a lower protein level of 8-11%, was used in place of wheat flour in this recipe. The substitution was made by substituting wheat flour by 50%, or 30 grams (Amertet *et al.*, 2021). Additionally, the liquid extracted from banana peel was used in this investigation as an alternative to egg white. The findings of the examination of the banana peel indicate that it contains 8.98% crude protein (Hartadi *et al.*, 2019). Banana peels contain 8% of crude protein(Wadhwa & Bakshi, 2013). Protein level in food may be affected by a number of factors, including the diversity of raw materials utilized and the quality of the raw materials used in the production of food. In the event that the raw materials that are used have a low protein content, the product that is produced will likewise have a low protein level. During the production process of food, if substances that include protein are combined with other ingredients that have lower protein levels, the total amount of protein that is present in the final product decreases.

Dietary fiber

Dietary fiber represents foods that are not capable of being digested or broken down by the digestive system of a human being. Although dietary fibers do not provide energy in the form of calories like carbohydrates, fats, or proteins, they are essential for maintaining a healthy digestive system. Additionally, there are several other benefits associated with consuming dietary fibers.. In addition to the peels of cereals, vegetables, fruits, and legumes, other plant components that provide nutritional fiber include legumes. According to the (Badan Pengawas Obat dan Makanan, 2011), processed food items that are advertised as having a high fiber content should include a minimum of 6 grams of dietary fiber per one hundred grams of product. According to the findings of this investigation, the value of 6.23, based on Table 2, was found to be higher than the limit that was provided. The components that were employed in the production of this bolu cake are responsible for the rise in the amount of fiber that it contains. These ingredients include coffee cherry flour, which has a fiber content of 20.95% (S. Agustin, 2020), and the findings of the analysis of banana peel, which includes 13.70% crude fiber (Hartadi *et al.*, 2019).

Moisture content

The percentage of moisture that is present in a substance is referred to as the moisture content of the material. When it comes to the process of manufacturing cakes and preserving them, having the appropriate amount of moisture is quite crucial. A cake's texture, flavor, palatability, and the amount of time it can be kept may all be negatively impacted by the amount of moisture it contains. A cake that is too dry may become rough and unpleasant to eat, while a cake that is too moist can become mushy and run the danger of going bad in a short amount of time (MasterClass, 2023. The measurement of the moisture content of sponge cake is compared with that of SNI Sweet Bread 01-3840-1995, which has a maximum limit of 40% for the amount of moisture content that may be present. Sponge cake is included in the sweet bread group according to the Indonesian National Standard criteria. The amount of moisture that was present in this investigation in Table 2 was 25.2%; this result is still within the parameters that were established.

Total ash

The ash content of a food item, which is often expressed as a percentage according to the weight of the food item, may provide information about the amount of minerals that are present in the food item. When it comes to foodstuffs, the ash content may provide an indication of the number of minerals that are present. These minerals can originate from a variety of sources, including raw materials, additives, or fillers. An ash content of 0.450% was found in this investigation, stated on Table 2. There is a stronger positive correlation between the total and the mineral content of the ash. According to SNI 01-3840-1995, the normal amount of ash that should be included in sponge cake goods is 1. In this particular investigation, the findings demonstrated that the drop in ash content was followed by a decrease in the amount of water present. The denaturation of minerals and proteins rises with drying temperature. This is due to the fact that the greater the ash level, the higher the mineral concentration in the material (Yu *et al.*, 2006).

Total fat

The fat content in this study showed a figure of 41.5%, based on Table 2. The substitution of wheat flour with coffee cherry peel flour did not significantly change the fat content of the sponge cake, because the fat content in wheat flour is around 2% while the fat content in coffee cherry peel flour is 1% (Nugroho *et al.*, 2021). This result is lower than the fat content of sponge cake, which is 77% (FatSecret, 2023a). The decrease in fat content can be caused by the use of low-fat ingredients such as coffee cherry peel flour or by the selection of fat-substituting ingredients such as eggs replaced with banana peel liquid, which was used in this study. Fat in foodstuffs is usually degraded. The intensity of this degradation is strongly influenced by the temperature used and the processing time used; the higher the temperature used, the more severe the fat degradation (Zhuang *et al.*, 2022) (Arshad *et al.*, 2018).

Organoleptic

Table 3 Organic test result

Concentration	Colour	Flavor	Taste	Texture
Treatment: bake				
Coffee cherry peel flour 50%, banana peel liquid 25%	$4,77 \pm 0,67^{Aa}$	$4,88 \pm 0,64^{Aa}$	$4,44 \pm 0,84^{Ab}$	$4,48 \pm 0,90^{Ab}$
Coffee cherry peel flour 50%, banana peel liquid 30%	$5,49 \pm 0,72^{Aa}$	$5,60 \pm 0,67^{Aa}$	$5,55 \pm 0,67^{Aa}$	$5,31 \pm 0,90^{Aa}$
Coffee cherry peel flour 50%, banana peel liquid 40%	$4,99 \pm 0,88^{Aa}$	$4,98 \pm 0,71^{Aa}$	$4,77 \pm 0,74^{Ab}$	$4,64 \pm 0,79^{Ab}$
Coffee cherry peel flour 60%, banana peel liquid 25%	$4,57 \pm 0,88^{Ba}$	$4,66 \pm 0,75^{Ba}$	$4,35 \pm 0,91^{Bb}$	$4,37 \pm 0,88^{Bb}$
Coffee cherry peel flour 60%, banana peel liquid 30%	$4,74 \pm 0,85^{Ba}$	$4,66 \pm 0,79^{Ba}$	$4,68 \pm 0,82^{Ba}$	$4,49 \pm 0,84^{Ba}$
Coffee cherry peel flour 60%, banana peel liquid 40%	$4,59 \pm 0,89^{Ba}$	$4,67 \pm 0,82^{Ba}$	$4,70 \pm 0,79^{Bb}$	$4,35 \pm 0,81^{Bb}$
Coffee cherry peel flour 70%, banana peel liquid 25%	$4,54 \pm 0,88^{Ca}$	$4,40 \pm 0,99^{Ca}$	$4,43 \pm 0,90^{Cb}$	$4,26 \pm 0,91^{Cb}$
Coffee cherry peel flour 70%, banana peel liquid 30%	$4,46 \pm 0,92^{Ca}$	$4,43 \pm 0,84^{Ca}$	$4,41 \pm 0,82^{Ca}$	$4,43 \pm 0,80^{Ca}$
Coffee cherry peel flour 70%, banana peel liquid 40%	$4,49 \pm 0,86^{Ca}$	$4,51 \pm 0,95^{Ca}$	$4,12 \pm 1,02^{Cb}$	$4,21 \pm 0,90^{Cb}$
Treatment: steam				
Coffee cherry peel flour 50%, banana peel liquid 25%	$4,55 \pm 0,77^{Aa}$	$4,64 \pm 0,76^{Aa}$	$4,28 \pm 0,77^{Ab}$	$4,30 \pm 0,89^{Ab}$
Coffee cherry peel flour 50%, banana peel liquid 30%	$4,88 \pm 1,04^{Aa}$	$4,96 \pm 1,05^{Aa}$	$4,75 \pm 0,85^{Aa}$	$4,73 \pm 1,09^{Aa}$
Coffee cherry peel flour 50%, banana peel liquid 40%	$4,82 \pm 0,89^{Aa}$	$4,77 \pm 0,84^{Aa}$	$4,54 \pm 0,78^{Ab}$	$4,47 \pm 0,94^{Ab}$
Coffee cherry peel flour 60%, banana peel liquid 25%	$4,37 \pm 0,94^{Ba}$	$4,42 \pm 0,98^{Ba}$	$4,04 \pm 1,04^{Bb}$	$4,02 \pm 1,03^{Bb}$
Coffee cherry peel flour 60%, banana peel liquid 30%	$4,43 \pm 0,98^{Ba}$	$4,48 \pm 0,98^{Ba}$	$4,11 \pm 1,11^{Ba}$	$4,12 \pm 1,02^{Ba}$
Coffee cherry peel flour 60%, banana peel liquid 40%	$4,45 \pm 0,97^{Ba}$	$4,42 \pm 0,88^{Ba}$	$4,13 \pm 1,11^{Bb}$	$4,04 \pm 1,09^{Bb}$
Coffee cherry peel flour 70%, banana peel liquid 25%	$3,96 \pm 1,24^{Ca}$	$3,98 \pm 1,14^{Ca}$	$3,77 \pm 1,23^{Cb}$	$3,65 \pm 1,22^{Cb}$
Coffee cherry peel flour 70%, banana peel liquid 30%	$3,92 \pm 1,24^{Ca}$	$3,93 \pm 1,19^{Ca}$	$3,68 \pm 1,30^{Ca}$	$3,64 \pm 1,32^{Ca}$
Coffee cherry peel flour 70%, banana peel liquid 40%	$3,77 \pm 1,27^{Ca}$	$3,90 \pm 1,33^{Ca}$	$3,40 \pm 1,32^{Cb}$	$3,36 \pm 1,38^{Cb}$

Based on Table 3, the letters A, B, and C are represented by the subset numbers at the end of each number. These letters are written in capital letters to indicate the concentration of coffee cherry peel flour, whereas the letters a and b, which are written in lowercase letters, show the concentration of banana peel liquid that was utilized. The rank that is achieved is proportional to the size of the subgroup number. When it comes to the rank (subset) of the letter "A" or "a," the meaning is read as having the highest value result or the first rank. Similarly, when it comes to the rank of the letter "B" or "b," the meaning is that it has the second highest value result, and so on. According to Table 3, the product that is more desired is the bake of rolled bolu cake treatment rather than the steamed one because it has the highest rank number (subset) for all organoleptic test criteria. This is because the steamed treatment has a higher rank number (subset) than the oven bolu cake treatment. Following the bake treatment with each of the three concentrations for coffee cherry peel flour substitution of 50%, 60%, and 70%, as well as the three concentrations for banana peel liquid substitution of 25%, 30%, and 40%, it was discovered that the concentration of coffee cherry peel flour of 50% and banana peel liquid concentration of 30% had the highest number of subsets, or, to put it another way, this concentration was the one that the panelists preferred the most.

Color

The coffee cherry peel flour used in the production of this product gives it a brown color. Brown was the color that was discovered in each treatment and at each concentration of both coffee cherry peel flour and banana peel liquid, according to the findings of the organoleptic test on the color that was shown in Table 3. The color was found to be somewhat consistent throughout all of the treatments and concentrations. The Maillard reaction, which occurs when food is heated, causes it to become a dark brown color (Zahra *et al.*, 2013). This occurs because high temperatures are used to cook the food while it is being heated. This is also consistent with the viewpoint that was presented by(Hosen *et al.*, 2021), which said that the Maillard process alters the color and fragrance of meat. The process of discoloration, also known as browning, happens more quickly when the temperature is higher than 150 degrees Celsius (Sánchez & Antonio, 2005). Browning is caused by reactions that take place at a somewhat higher pace. The most important organoleptic component of the presentation phase is the color (Winarno, 1997). The reason behind this is that the sense of sight is responsible for the first impression. According to (Ledbetter & Palmquist, 2006), color has two significant meanings: it is vital for customer acceptability, and it is also important as a measurement of the development of brown pigments that emerge from non-enzymatic browning and caramelization processes. The potential value of modeling to anticipate color change during heat-based processing resides in its capacity to properly monitor the quality of the end product. This means that modeling has the potential to be useful. Producers are able to guarantee that the end product is in accordance with the desires of consumers while still keeping overall quality requirements if they thoroughly analyze and forecast the change in color via rigorous analysis (Bingol *et al.*, 2011).

Flavor

Despite the fact that only coffee cherry peel was employed in this investigation, the scent that was created was that of coffee. The scent that is formed from cascara coffee peels that are used to brew tea is comparable to the flavor that is often found in robusta coffee beans. This is because robusta coffee beans have a high concentration of both caffeine and chlorogenic acid in their core. Drinks that are created from cascara coffee peel waste have a scent that involves the combination of these ingredients in a manner that is comparable to that of robusta coffee beans (Sari *et al.*, 2021). The volatile molecules, proteins, and lipids that are included in food products and that evaporate during the heating process are responsible for the formation of flavor (Conina, 2015). This is in agreement with what was also communicated by (Negara *et al.*, 2016) (Ubaidillah & Hersulistyorini, 2010), which said that meals that include carbs and proteins would undergo non-enzymatic browning. Furthermore, if the material is heated (Maillard reaction), it will be able to generate either pleasant or unpleasant odors. In accordance to study carried out by (Fu *et al.*, 2020), the Maillard reaction has the potential to enhance the flavor and fragrance of goods made from a variety of components, including chicken, which is one of those ingredients. Based on the findings of (García-Lomillo *et al.*, 2016), it was shown that beef patties exhibited higher concentrations of pyrazine after the incorporation of many spices. These spices have the potential to favorably impact the sensory acceptability of fragrance. In every concentration of bolu cake, flavor values were found to be greater when the cake was treated in the oven as opposed to being steamed. The flavor is more prominent in the oven treatment because the roasting process causes the material to become dehydrated. This, in turn, leads to an increase in the protein value, as demonstrated by research conducted on tempeh (Wihandini *et al.*, 2012). The research was conducted using four different methods of cooking tempeh, and the results showed that fried and baked tempeh had a higher protein value than steamed and boiled tempeh. Due to study conducted by (Daforte & Sobari, 2018), the process of steaming brownies results in the formation of volatile chemicals by lipid oxidation. These compounds are produced from the fundamental components of brownies. Due to the fact that this lipid oxidation process is a significant source of essential flavor compounds, the length of time that steaming is applied has the ability to have an effect on the synthesis of volatile chemicals that contribute to scent.

Taste

The concentration of coffee cherry peel flour in this research resulted in a significant improvement in the taste of the rolled bolu cake. The coffee content that was carried in the coffee cherry peel flour contributed to the stronger flavor that was added to the rolled bolu cake. According to the findings of a research conducted by (F. Agustin & Putri, 2014), the effects of belimbing wuluh (Averrhoa bilimbi L.) jelly drink was comparable. The flavor of the jelly drink becomes more sour as the amount of belimbing wuluh extract that is added to it increases. During the roasting process, the bolu cake was cooked, which resulted in a more robust flavor being produced. Baking lowers the amount of water that is available in the dough, which allows theobromine chemicals that are contained in food items to stay inside the dough (Kadir *et al.*, 2016). Because of this, the flavor is more intense, particularly due to the presence of coffee present. As a result of the increased moisture content of the dough, bolu cakes that are steamed have a more subdued flavor. Because of this circumstance, the flavor of the theobromine component has a diminished intensity. Because of the changes in scent, texture, color, and taste that take place throughout the baking process, the baking method generates a better degree of palatability during the cooking process compared to other cooking methods such as steaming or boiling. This is because baking causes these changes to take place. These alterations are very well received by customers. It is also true that steamed food has a more flavorful flavor than boiled food. Compared to boiling meat, steamed meat loses a greater number of nutrients, including vitamins and other nutrients, in a shorter amount of time. This is because the only moment meat is cooked is when the water boils and releases moisture.

Texture

There is not significantly a difference between the texture that was created in this research and the control product, which does not utilize coffee cherry peel flour replacement and also banana peel liquid substitution. The control product has a texture that is characterized by a cavity that is characterized by fine and homogeneous pores. When a sponge cake is sliced by cutting it crosswise, the hollow should have the appearance of a well-formed tissue with little bubbles that are uniformly dispersed throughout. When a cake has a cavity that is nice, it means that the cake has expanded properly and has a structure that is both soft and crispy at the same time (Ekayani, 2011). The sponge cake need to be scrumptious and that it should not be too dry when it is bitten into (Arbowati *et al.*, 2021). This will make it simple to appreciate without having to chew it excessively. By increasing the quantity of coffee cherry peel flour, it is possible to decrease the amount of gluten protein that is present in the dough. As a result, the texture of the sponge cake that is high in fiber is more robust or more robust than the sponge cake that is created with wheat flour alone. Eggs are an essential component of the baking process because they contribute to the growth of the dough, which results in an increase in volume, the provision of color, the preservation of moisture, and the softening of the cake. Eggs are one of the most significant components that should be considered when establishing the overall quality of a sponge cake (Faizal & Syarif, 2021). In this research, it is possible to replace eggs with liquid made from banana peel. This is due to the fact that banana peel may be used as an egg replacement in some cake recipes. This is because banana peel has features that are comparable to those of eggs, including the ability to provide moisture, structure, and binding in the batter. Banana peels contain pectin, which may assist produce a soft texture and moisture to the cake. This is despite the fact that banana peels do not have the same amount of protein as eggs (Tuhuloula *et al.*, 2013).

CONCLUSION

As a replacement for wheat flour in the preparation of rolled bolu cakes, the use of coffee cherry peel flour has a direct impact on the cake's textural quality as well as its nutritional content. There is a considerable increase in the amount of fiber that is included in the cake as a result of the increased usage of coffee cherry peel flour. There is a possibility that this will result in the cake having a texture that is either more dry or more rigid. Incorporating coffee cherry peel flour into the dough has an effect on the amount of gluten protein that is present in the dough, which in turn has an effect on the elasticity and structure of the cake. The potential to give moisture, structure, and binding in the batter was proved by the use of liquid extracted from banana peels as an egg replacement in the preparation of bolu cake. However, the pectin content of banana peel liquid may assist generate a soft texture and partly replace the bolu function of eggs in the batter. This is despite the fact that banana peel liquid does not have the same amount of protein as eggs.

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