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Breadnut Seed Flour (*Artocarpus camansi*): Potential Utilization as Natural Stabilizers to Impact the Physicochemical Properties and Organoleptic Value of Ice Cream

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ABSTRACT

This study aimed to investigate the potential of breadnut seed flour (*Artocarpus camansi*) as a natural stabilizer in ice cream by evaluating its impact on physicochemical and organoleptic properties. A completely randomized design (CRD) was employed, with breadnut seed flour concentration as the single factor. Five treatment formulations were tested, consisting of varying ratios of skim milk to breadnut seed flour: 100:0 (P0, control), 87.5:12.5 (P1), 75:25 (P2), 67.5:32.5 (P3), and 50:50 (P4). The evaluated parameters included chemical properties (moisture, ash, and crude fiber content), physical properties (overrun and melting resistance), and organoleptic attributes (color, flavor, taste, and texture), assessed through both descriptive and affective methods. Data were analyzed using SAS software at a 5% significance level, with significant differences further examined using the Least Significant Difference (LSD) test. The results demonstrated that breadnut seed flour significantly influenced ($p < 0.05$) moisture, ash, crude fiber content, and descriptive evaluations of taste, flavor, texture, and color. Affective evaluations also indicated significant effects on flavor, texture, and color, though taste preference remained unaffected. The optimal formulation was the 12.5% breadnut flour treatment (P1), which exhibited favorable characteristics: 60.45% moisture, 1.96% ash, 0.86% crude fiber, 65.83% overrun, and 44.77 minutes of melting resistance. Organoleptically, this treatment produced ice cream with a creamy color, pleasant aroma, smooth texture, and high acceptability among panelists. These findings suggest that breadnut seed flour can effectively serve as a natural stabilizer in ice cream, with the 12.5% incorporation level providing the best balance of physicochemical and sensory properties.

Contribution to Sustainable Development Goals (SDGs):

SDG 2: Zero Hunger

SDG 8: Decent Work and Economic Growth

SDG 9: Industry, Innovation and Infrastructure

SDG 12: Responsible Consumption and Production

1. INTRODUCTION

1.1. Research Background

Ice cream is a popular food at all levels of society, not only in Indonesia but also in the world. The soft texture and sweet,

distinctive taste of ice cream are among its most popular features. The consumption of ice cream is particularly suitable in Indonesia due to its tropical climate, which often results in high temperatures. Consequently, ice cream emerges as a popular refresh option during hot weather. In addition to its soft taste and texture, ice cream is composed of numerous chemical ingredients, including vitamins, minerals, protein, carbohydrates, and fat.



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Ice cream is a frozen food that combines dairy products [1], such as cream or similar ingredients, with flavors and sweeteners. Ice cream is a semi-solid food product produced by freezing a blend of ice cream powder, milk, animal or vegetable fats, sugar, and optionally, additional food ingredients. In addition to its tendency to rapidly melt in the mouth, ice cream can provide substantial nutritional value for the body. Breadnut seeds were incorporated as a stabilizing agent to introduce a distinctive variation to the ice cream.

Breadnut seeds are utilized in the production of ice cream due to their high starch content, which contributes to the desirable characteristics of the final product. The starch in breadfruit seed flour has been demonstrated to function as a stabilizer in ice cream products. The stabilizer's function is to enhance the viscosity of the non-frozen phase mixture in the ice cream.

1.2. Literature Review

A stabilizer in food products is a substance added to maintain the food's texture, appearance, and consistency. It helps to prevent separation, crystallization, or changes in texture that could occur during processing, storage, or transportation [2]. Stabilizers are often used in processed foods to Improve Shelf Life, Enhance Texture, Maintain Consistency to ensure that the product doesn't separate (for example, in emulsions), and Prevent Crystallization in products like ice cream or candies; stabilizers prevent unwanted formation of crystals. Common stabilizers include gums (such as guar gum and xanthan gum), pectin, gelatins, and carrageenan. They're often derived from natural sources but can also be synthetically produced.

According to Ref. [3] and [4], the carbohydrate content of breadnut seeds of 26.11%, suggesting that breadnut seeds can be used as an alternative source of starch for food or industrial ingredients, namely as a stabilizer in ice cream. In addition to its role as a stabilizer, breadnut seed flour contributes to the unique flavor profile of the ice cream while also being a notable source of ash and crude fiber, 3.43 and 1.20%, respectively. The fiber in undigested foodstuffs possesses noteworthy nutritional and metabolic properties, underscoring the necessity of fiber intake for optimal bodily function, particularly in digestion. The potential for employing breadfruit seeds as an additional ingredient in the preparation of ice cream remains a possibility.

Ice cream is a food that is very popular with Indonesian people, especially during the summer months. In a previous study, Ref. [3] utilized jackfruit seed powder in the formulation of ice cream, with the optimal treatment comprising 75% milk and 25% jackfruit seed flour. A comparison of jackfruit and breadfruit seeds reveals that they possess nearly identical characteristics. A notable distinction is the percentage of starch in jackfruit seed flour, which accounts for 56.1% of the total composition. Furthermore, breadnuts and jackfruit [1]; [5] have been found to belong to the same genus, *Artocarpus*. A study of the starch content of breadnut seeds revealed a range of 30.15% to 39.09%, suggesting its potential application as a stabilizer in ice cream production. This characteristic is analogous to that observed in jackfruit seeds, which contain a starch content of 56.1%, thereby providing a benchmark for comparison.

1.3. Research Objective

This study aimed to ascertain the impact of breadnut seed flour (*Artocarpus camansi*) as a natural stabilizer on ice cream's physicochemical properties and organoleptic characteristics.

2. MATERIALS AND METHODS

2.1. Materials

The ingredients utilized in this study encompassed full-cream milk powder, skim milk powder, sugar, whipped cream, egg yolks, carboxymethyl cellulose (CMC), breadnut seeds powder, mineral water, ice cubes, table salt, distilled water, H₂SO₄ 0.255N (PA standard), and NaOH 0.313N (PA standard). The tools employed in this study encompassed a range of equipment, including Hitachi brand gas stoves, Maspion brand mixers, Philips brand blenders, water baths, laboratory standard thermometers (alcohol), analytical balances, refrigerators/freezers, analytical balances, furnaces, bulb flasks (refrigeration), and ovens.

2.2. Research Methods

2.2.1. Breadnut Seed Powder Processing

The breadnut seed powder was processed using a simple method, as outlined by [6], with modifications: The exterior layers of the breadnut seeds, known as the skin and epidermis, are meticulously removed through peeling. Afterwards, the seeds undergo a thorough cleansing to ensure their pristine condition. The specimen is sliced at a thickness of 0.2 centimetres and undergoes a drying process that spans 12 hours, commencing at 11:00 a.m. and concluding at 3:00 p.m. on the third day. The grinding and sieving process at a mesh size 80 should be continued until the desired product is obtained. The final product is characterized by its powdery consistency, commonly called breadnut seed powder.

2.2.2. Ice Cream Making Process

According to Ref [7], the ice cream-making process in this study involved the following modifications: Dry ingredients such as sugar and CMC were first dissolved in water with stirring. Full-cream skimmed, and breadnut seed flour were added in ratios of 100:0, 87.5:12.5, 75:25, 62.5:37.5, and 50:50, respectively. The mixture was heated to 45°C. A key modification involved preheating the breadnut seed flour separately until it formed a gel-like consistency before incorporation into the mix..

2.2.3. Pasteurization

The mixture of ingredients is subjected to pasteurization at a temperature of 80°C for 25 seconds. This process utilizes a water bath to eradicate any pathogenic bacteria within the ingredients.

2.2.4. Homogenization (modified)

The pasteurized ingredients are left to stand until the temperature drops to 50 oC, after which they homogenize using a blender and mixer with whipped cream and egg yolks at 35-40 oC for 5 minutes. These mixed ingredients are then called Ice Cream Mix (ICM). The modified process is a homogenization process, in which Ref conducted the research. [8] using a mixer, but in this study, using both a blender and mixer.

2.2.5. Cooling and Aging

The ice cream is subsequently refrigerated at a temperature of 4°C, which undergoes a maturation process lasting 20 to 24 hours.

2.2.6. Foaming

The ice cream is subjected to whipping with a mixer in an aluminum container. This is done until the ice cream achieves a fluffy consistency. The whipping process is conducted at approximately 15 degrees Celsius for 15 minutes. During this time, the container is surrounded by ice cubes and a small amount of salt.

2.2.7. Packaging and hardening

Ice cream is packaged into cups and stored in a freezer at -34°C. The ice cream is then subjected to hardening, forming a solid frozen dessert.

2.2.8. Method and Data Analysis

The experimental design employed in this research was a completely randomized design (CRD). The factors employed in this experiment included the incorporation of breadnut seed flour with the subsequent treatment: P0 corresponds to 0% breadnut seed flour by 12% by weight of ICM. P1 corresponds to 12.5% breadnut flour by 12% ICM weight. P2 corresponds to 25% breadnut flour by 12% ICM weight. P3 corresponds to 37.5% breadnut seed flour by 12% ICM weight. P4 corresponds to 50% breadnut flour by 12% ICM weight. Each treatment was repeated thrice to obtain 15 experimental units. The observational data were subjected to analysis of variance at the 5% level, employing the Statistical Analysis System (SAS) software. After identifying these discrepancies, a further test is conducted utilizing the Least Significant Difference Test (LSD) at a significant level of 5% [9]. The parameters examined in this study included the analysis of water content, ash content, crude fiber content, overrun, resistance, and organoleptic characteristics (i.e., color, texture, taste, and aroma).

2.3. Research Variables

The parameters tested include moisture content, fiber content, ash content, overrun, resistance and organoleptic value of ice cream (taste, aroma, color and texture).

3. RESULT AND DISCUSSION

3.1. Moisture content

Moisture is an essential component of foodstuffs, given its capacity to influence food ingredients' appearance, texture, and gustatory profile. As [10] noted, even desiccated foodstuffs such as dried fruit, flour, and grains contain a certain amount of moisture.

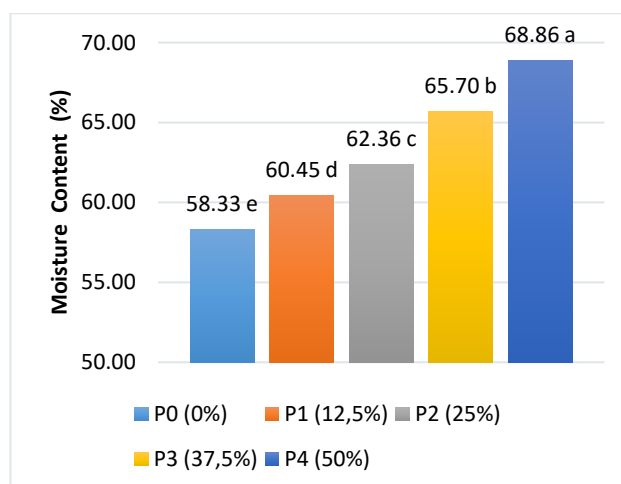


Fig. 1. Moisture Content of Ice Cream

As illustrated in Figure 1, the average moisture content of ice cream with the incorporation of breadnut flour ranged from 0% (P0) to 50% (P4), with specific values of 58.37%, 60.45%, 62.35%, 65.69%, and 68.86%, respectively. The findings reveal that the ice cream content in each treatment (P1, P2, P3, and P4) exceeds that of the control group (P0, the non-treated sample) based on the average moisture content of the ice cream. It has been demonstrated that the addition of breadnut flour to ice cream leads to an increase in moisture content. The lowest moisture content value in ice cream was observed when 0% breadnut flour was incorporated, while the highest moisture content was recorded when 50% breadnut flour was added. The moisture in ice cream was attributed to the incorporation of breadnut flour. It has been demonstrated that adding breadnut flour to ice cream is directly proportional to the moisture content of the final product. As the proportion of breadnut flour was reduced, the moisture content in the ice cream decreased. The incorporation of breadnut seed flour has been demonstrated to exert a significant influence on the moisture content of ice cream. This phenomenon arises from the initial processing of breadnut seed flour into a gel through the application of heat, which leads to the gelatinization of the seed flour and its subsequent transformation into a gelatinous state. The ratio of breadnut seed flour to moisture required for this transformation is approximately 1:5. It has been hypothesized that the transformation of breadnut flour into a gelatinous state may influence ice cream's moisture content. The primary components responsible for gel formation are moisture and breadnut flour's starch content.

The addition of moisture increases with the addition of breadnut flour in each treatment, causing the moisture content of the ice cream to increase as well. According to Ref. [11], starch that has undergone gelatinization will form a gel and is easier to bind moisture. So, the more breadnut flour you add to the ice cream, the higher the moisture content in the ice cream. It shows that adding breadnut flour has a significantly different effect on the moisture content of ice cream. The moisture content of ice cream increased with the addition of breadnut flour.

Moisture is the main component in the ice cream mixture because moisture functions as a solvent for the other ingredients in mixing the ice cream. According to Ref. [12], the standard moisture content in ice cream is 55-64%. The treatments that met the standards were the treatment with the addition of 0%, 12.5 and 25% breadnut flour, while the treatment with the addition of 37.5% and 50% did not meet the standards. It can be caused by

adding excessive moisture to the sample, namely the moisture content contained in the gelatinized starch.

Incorporating breadnut flour into each treatment increased moisture content, which increased the ice cream's moisture content. As posited by Ref. [11], starch that has undergone gelatinization will form a gel and is more readily capable of binding moisture. Consequently, the addition of breadnut flour to the ice cream results in an increase in its moisture content. The findings indicate that the incorporation of breadnut flour exerts a substantial influence on the moisture content of ice cream. The moisture content of ice cream increased with the incorporation of breadnut flour.

Moisture is the primary component in the ice cream mixture because it functions as a solvent for the other ingredients during the mixing process. According to [12], the standard moisture content in ice cream is 55-64%. The treatments that satisfied the established criteria were those incorporating 0%, 12.5%, and 25% breadnut flour, while those with 37.5% and 50% did not meet the established standards. The phenomenon under investigation has been shown to occur due to the addition of excessive moisture to the sample. This moisture is believed to be present in the gelatinized starch.

3.2. Ash Content

Ash content is a mixture of inorganic or mineral components found in a food ingredient. The composition of food ingredients is dominated by organic materials and moisture, accounting for 96% of the total composition. The ash content can indicate the minerals in a given food ingredient. As posited by Ref. [13] and [14], the organic materials in the combustion process will undergo combustion; conversely, the inorganic components will not.

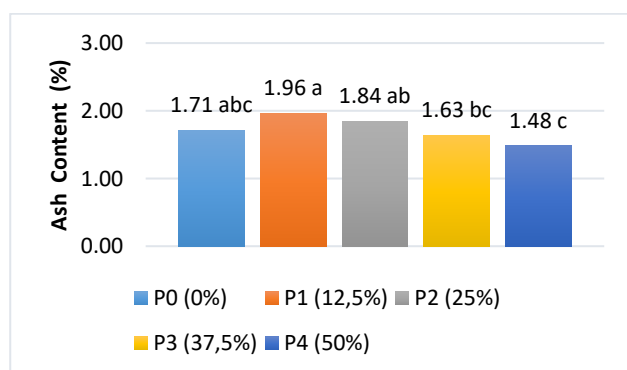


Fig. 2. Ash Content of Ice Cream

As demonstrated in Figure 2, the mean ash content of ice cream increased from 12.5% to 25% in the absence of breadnut flour, then decreased from 25% to 37.5% in the presence of breadnut flour. The rate of change is 50% per unit of time. As demonstrated in Figure 2, the incorporation of 12.5% (P1) and 25% (P2) breadnut seed flour resulted in a higher ash content compared to the control group (P0), which comprised 0% breadnut flour or no treatment. In contrast, the treatments involving 37.5% (P3) and 50% (P4) breadnut seed flour exhibited a lower ash content than the P0 group.

The incorporation of breadnut flour led to a substantial decrease in the ash content of ice cream. The mean ash content of ice cream with the addition of 0% (P0), 12.5% (P1), 25% (P2), 37.5% (P3), and 50% (P4) breadnut flour was 1.00%, 1.71%,

1.96%, 1.84%, and 1.48%, respectively. As the proportion of breadnut flour increased, the ash content in the ice cream decreased. Conversely, as the proportion of breadnut flour incorporated into the mixture reduces, the ash content in the ice cream increases. The lowest ash content value in ice cream was observed by adding 50% breadnut seed flour, while the highest ash content was recorded with 12.5% breadnut seed flour. The addition of breadnut flour influenced the moisture content of ice cream.

The ash content of ice cream is indicative of its mineral content. The mineral content of breadnut seed flour was notably high, comprising potassium, calcium, phosphorus, iron, sodium, and other elements [4]. Consequently, the mineral content rises as the proportion of breadnut seed flour increases in a given mixture. However, the findings of this study demonstrate that an increase in the incorporation of breadnut flour results in a decrease in the ash content of the ice cream. This phenomenon can be attributed to the inverse proportionality between ash and moisture content. Conversely, increased moisture content within the ice cream is associated with decreased ash content. The relationship between moisture and ash content in ice cream can be seen in the correlation curve, namely ± 0.5359 , which shows that the correlation between the two is relatively high. This assertion aligns with the findings of [15], which demonstrate a direct correlation between moisture content and ash content in materials, with higher moisture content correlating with lower ash content and vice versa.

3.3. Crude Fiber Content

It is imperative to note that coarse fiber differs from fine (food) fiber. Crude fiber is defined as plant fiber that does not dissolve in moisture, while fine fiber, also known as dietary fiber, is any fiber that remains in the colon after the digestive process. This includes soluble dietary and insoluble dietary fiber, or unsoluble nutritional fiber [11].

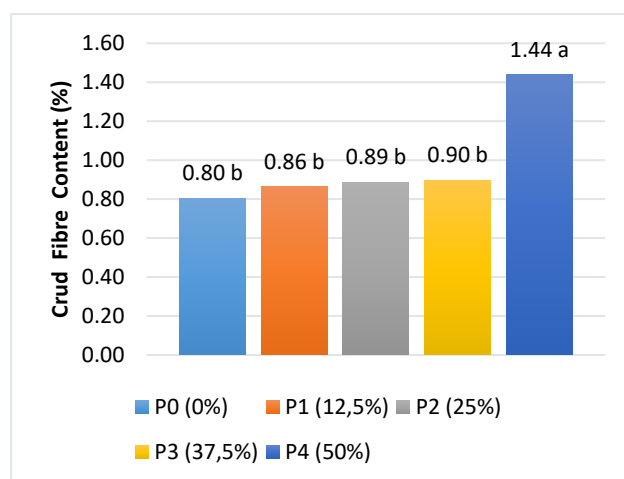


Fig. 3. Crude Fiber Content of Ice Cream

As illustrated in Figure 3, the investigation revealed a notable increase in ice cream's average crude fiber content enhanced with breadnut seed flour, ranging from 0% to 50% breadnut seed flour addition. The mean crude fiber content of ice cream with the addition of 0% (P0), 12.5% (P1), 25% (P2), 37.5% (P3), and 50% (P4) breadnut flour was 0.80%, 0.86%, 0.88%, 0.89%, and 1.43%, respectively. As illustrated in Figure 3, the incorporation of 12.5% (P1), 25% (P2), 37.5% (P3), and 50% breadnut seed

flour resulted in a decrease in crude fiber content compared to the control, which utilized 0% breadnut seed flour. Adding breadnut flour to the ice cream mixture is directly proportional to the crude fiber content of the final product. Conversely, the inverse relationship exists between the addition of breadnut flour and the crude fiber content of the ice cream. The lowest crude fiber content value in ice cream was observed when 0% breadnut flour was incorporated, while the highest content was recorded when 50% breadnut flour was added. The presence of breadnut flour in the ice cream sample was the primary factor contributing to its elevated fiber content.

The incorporation of crude fiber into ice cream is associated with a linear increase in its content, ranging from the minimal addition to the maximum permitted level. The findings indicate that the incorporation of breadnut flour substantially impacts the crude fiber content of ice cream, resulting in a notable increase. The crude fiber content of ice cream increases with each addition of breadnut flour because breadnut flour contains approximately 8.197% fiber.

3.4. Overrun

Overrun is the increasing volume caused by the ice cream mixture's trapped air. Not forming an overrun results in the ice cream forming a hard lump, whereas ice cream with a high overrun will melt quickly [16].

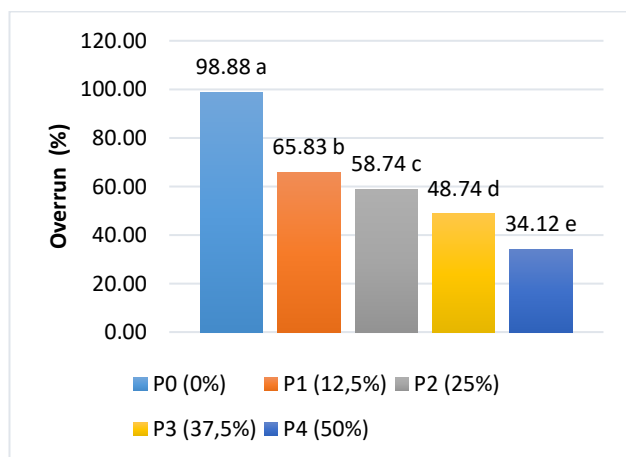


Fig. 4. Overrun of Ice Cream

Based on Figure 4, it's known that the addition of breadnut flour significantly reduces the overrun value of ice cream. It shows that the average overrun test for ice cream with adding breadnut flour decreased from the treatment with adding 0% to 50% breadnut seed flour. The average overrun of ice cream with the addition of breadnut flour 0% (P0), 12.5% (P1), 25% (P2), 37.5% (P3) and 50% (P4) was 98.87 %, 65.83%, 58.74%, 48.73% and 34.12% respectively. Based on Figure 8, it's known that the treatment with the addition of 12.5% (P1), 25% (P2), 37.5% (P3), and 50% (P4) kluiwh seed flour had a higher overrun compared to the addition of 0% breadnut seed flour (P0). The higher the breadnut flour added, the lower the overrun on the ice cream. Conversely, the lower the addition of breadnut flour, the higher the overrun on the ice cream. The lowest overrun value for ice cream was when 50% breadnut flour was added, while the highest was when 0% breadnut flour was added. It's due to the overrun in ice cream, which was affected by the added breadnut flour.

The decrease in overrun value in ice cream could be caused by the starch content in breadnut flour being less effective in maintaining overrun in ice cream, resulting in decreased overrun in ice cream. The starch contained in breadnut flour does not function well in preserving ice cream overrun, possibly because the starch is bound with other compounds, thereby reducing the effectiveness of the starch's function in preserving ice cream overrun. Another thing can be due to excessive use of starch or stabilizers that will reduce the effectiveness of starch as a stabilizer. Ref. [17] stated that the use of starch in ice cream is 0.1% -0.2%. And it is suspected that the starch used in this research exceeds the starch requirements that must be used.

Using pure extracted starch may provide a good stabilizing function for starch in ice cream making. Using a thick enough thickener will cause the overrun of ice cream [11]. However, overrun ice cream added with breadnut flour meets the ice cream quality requirements according to [18], namely for an industrial scale 70-80% and a household scale of around 35-50%. Overruns that are too low cause ice cream to become a product that is too hard and soft, while overruns that are too high cause ice cream to be softer, melt quickly, and have a bland taste [1]. The relationship between overrun and texture can be seen in the correlation curve, namely ± 0.9747 , which states that the two have a high correlation.

Overruns can occur due to shaking during the freezing process. Due to shaking, air can enter the ice cream mixture, thereby increasing the volume of the ice cream mixture [1]. The time spent shaking the ice cream also affects the overrun of the ice cream. The addition of 50% breadnut flour has the highest viscosity, so the overrun is lower than other treatments.

3.5. Resistance (Meltability)

Ice cream's resistance or melting time is the time it takes for ice cream to melt completely, expressed in minutes [19]. Based on Figure 4, it's known that the addition of breadnut seed flour significantly increases the resistance value of ice cream and it can be seen that the average resistance test (melting power) of ice cream with the addition of breadnut seed flour has increased from the treatment with the addition of 0% to 50% breadnut seed flour. The effect of adding breadnut flour on ice cream resistance can be seen in Figure 5.

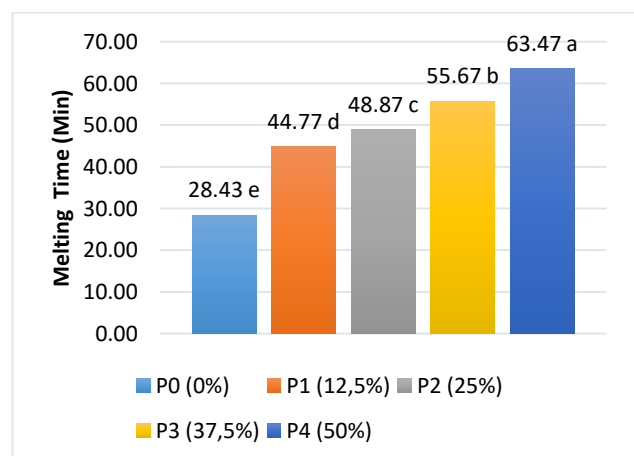


Fig. 5. Meltability of Ice Cream

Based on Figure 5, it's known that the average resistance of ice cream in the treatment with the addition of 0%, 12.5%, 25%,

37.5% and 50% breadnut flour was 28 minutes 43 seconds, 44 minutes 77 seconds, 48 minutes 87 seconds, 55 minutes 67 seconds and 63 minutes 47 seconds respectively. Based on Figure 9, it's known that the treatment with the addition of 12.5% (P1), 25% (P2), 37.5% (P3) and 50% kiwi seed flour had lower resistance compared to the addition of 0% breadnut seed flour (P0). The higher the concentration of added breadnut flour, the higher the resistance value, and vice versa. It shows that breadnut flour influences ice cream resistance.

According to Ref. [11] and [20], starch that has been gelatinized to form a gel causes the viscosity of ice cream to increase. The higher the viscosity of the ice cream, the more resistant it will be. The viscosity and texture of ice cream are not only influenced by the size of the ice crystals, where the size of the ice crystals was by the amount of air introduced during freezing. Ice cream that has low overrun has ice crystals that are larger and have a rougher texture. According to Ref. [18], air or high overrun levels reduce ice cream's hardness, making it softer. Ice cream with a small ice crystal size will slow down the melting time of the ice cream.

As mentioned by [11], the higher the overrun, the faster the ice cream will melt, and vice versa, the lower the overrun, the slower the ice cream will melt. The relationship between resistance and overrun can be seen in the correlation curve, namely ± 0.9739 , indicating that the relationship between the two is very high. Likewise, the resistance and texture of ice cream have a correlation curve of ± 0.9418 , which shows that the relationship between resistance and texture of ice cream is very high. All samples meet the ice cream quality requirements of [18] with 15-25 minutes resistance test criteria.

3.6. Organoleptic Value

The organoleptic test assessment involved 20 panelists who classified as untrained. Scoring test with a value of 1-10 (the lowest value of 1, and the highest value of 10). The average organoleptic value of ice cream in each treatment is presented in Figure 6.

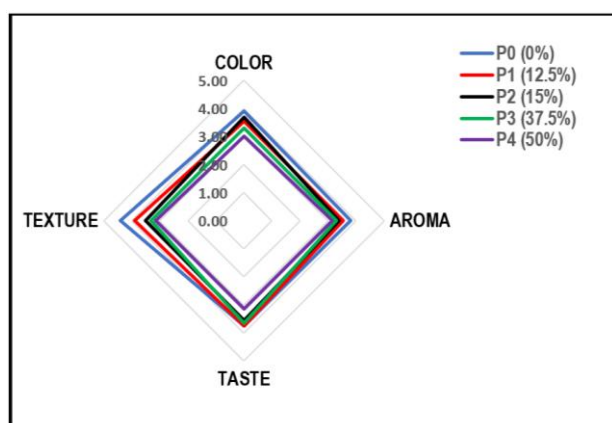


Fig. 6. Organoleptic Value of Ice Cream

3.6.1. Color

Color is the most attractive factor in determining whether a food product determines product quality, freshness, or maturity [11]. Color is the most important quality attribute, even though a product has high nutritional value, tastes good, and has a good texture, if the color is not attractive, it will cause the product to be less desirable.

Based on Figure 6, of adding breadnut flour on the color of ice cream significantly reduces the level of panelists' liking (affective method) but significantly increases the level of panelists' acceptance (descriptive methods) of the color of ice cream. It's known that the results of the descriptive method with the addition of breadnut flour P0, P1, P2, P3 and P4 were 3.05, 3.35, 3.7, 3.45, and 3.95 respectively, with the color criteria in P0 and P1 being slightly cream colored, while for treatments P2, P3 and P4 were cream colored. The addition of 0% breadnut flour (P0) was lower than the addition of 12.5% (P1), 25% (P2), 37.5% (P3), and 50% (P5) breadnut seed flour. The lowest value of the color descriptive method was in the treatment with the addition of 0% breadnut seed flour with a mean value of 3.05 and the criteria were slightly cream colored, while the highest value of the color descriptive method was the addition of 50% breadnut seed flour with a mean of 3.95 and the criteria were cream colored.

The results of the affective method with the addition of breadnut flour P0, P1, P2, P3 and P4 were 3.9, 3.55, 3.7, 3.3, and 3 respectively, with the level of color preference at P0, P1 and P2 was like, while for treatments P3 and P4 were a bit like. The addition of 0% breadnut seed flour (P0) was higher than the addition of 12.5% (P1), 25% (P2), 37.5% (P3) and 50% (P5) breadnut seed flour. The color practical method value was lowest in the treatment, adding 50% breadnut seed flour with a mean value of 3 and a liking level somewhat like it. In comparison, the highest value of the color-effective method was the addition of 0% breadnut seed flour with a mean of 3.9 and a liking level for ice cream it.

The addition of breadnut flour affects the color of the ice cream. The more breadnut flour added, the creamier the color of the ice cream. Meanwhile, ice cream without adding breadnut flour was yellowish similar to the color of milk. The level of panelists' liking for the color of ice cream is inversely proportional to the panelists' acceptance [21].

3.6.2. Aroma

The aroma of food has a strong attraction and can stimulate the sense of smell to arouse appetite. The aroma of food is due to by the formation of volatile compounds. Two or more odors can mix to reinforce or mask each other. There is a slight aroma of ice cream because ice cream is a frozen food so the substances in the ice cream do not evaporate [11], [22].

Based on Figure 6, it's known that the aroma of ice cream significantly reduces the panelists' level of liking (affective method) and significant increases the panelists' level of acceptance (descriptive methods). It's known that the results of the explanatory method with the addition of breadnut flour P0, P1, P2, P3 and P4 were 1.85, 3, 3.1, 3.2, and 3.6 respectively, with the aroma criteria at P0, namely not having a breadnut aroma, P1, P2 and P3 having a slight breadnut aroma, while treatment P4 has a breadnut aroma. The addition of 0% breadnut flour (P0) was lower than the addition of 12.5% (P1), 25% (P2), 37.5% (P3), and 50% (P5) breadnut seed flour. The aroma descriptive method value was lowest in the treatment with the addition of 0% breadnut seed flour with a mean value of 1.85 and the criteria for no breadnut aroma, while the value of the aroma descriptive method was highest for the addition of 50% breadnut seed flour with a mean value of 3.6 and the criteria for a breadnut aroma. It can be seen that the higher the addition of breadnut seed flour, the

more flavorful the breadnut seed flour will be. Breadnut flour is known to have a distinctive aroma.

The results of the affective method with the addition of breadnut flour P0, P1, P2, P3, and P4 were 3.8, 3.55, 3.4, 3.3, and 3.15 respectively, with the level of color preference at P0 and P1 being liked while for treatments P2, P3, and P4 somewhat liked. The addition of 0% breadnut seed flour (P0) was higher than the addition of 12.5% (P1), 25% (P2), 37.5% (P3), and 50% (P5) breadnut seed flour. The affective aroma method value was lowest in the treatment with the addition of 50% breadnut seed flour with a mean value of 3.15 and a liking level of somewhat liking, while the affective aroma method value was highest with the addition of 0% breadnut seed flour with a mean of 3.8 and a liking level for ice cream liking. It can be seen that the higher the addition of breadnut flour, the level of panellists' liking for the aroma of ice cream decreases to slightly liking it. It could be caused by the panellists not liking the aroma of breadnut flour [20].

3.6.3. Texture

The quality of ice cream is judged not only by taste but also by texture. A soft and firm texture is the main focus when the ice cream is in the mouth. The formation of large ice crystals and a rougher texture occurs because the milk fat content in the ice cream is too low. Using CMC as a stabilizer can improve the texture of ice cream because it can bind moisture and reduce the formation of ice crystals [11], [22].

Figure 6 shows that adding breadnut flour significantly reduces the level of panellists' liking (affective method) and the level of panellists' acceptance (descriptive method). It's known that the results of the affective with the addition of breadnut flour P0, P1, P2, P3 and P4 were 4.4, 3.9, 3.5, 3.3, and 2.75, respectively, with the texture criteria at P0, P1 and P2 being soft, while treatments P3 and P4 have a slightly soft texture. The addition of 0% breadnut seed flour (P0) was higher than the addition of 12.5% (P1), 25% (P2), 37.5% (P3), and 50% (P5) breadnut seed flour. The lowest texture descriptive method value was in adding 50% breadnut seed flour with a mean value of 2.75 and slightly soft criteria, while the color descriptive method value was highest when adding 0% breadnut seed flour with a mean of 3.95 and soft.

The results of the affective method with the addition of breadnut flour P0, P1, P2, P3, and P4 were 3.9, 3.7, 3.35, 3.1, and 2.8 respectively, with the level of texture preference at E0 and E1 being like it, while for treatments P2, P3 and P4 it is a bit like it. The addition of 0% breadnut seed flour (P0) was higher than the addition of 12.5% (P1), 25% (P2), 37.5% (P3) and 50% (P5) breadnut seed flour. The effective texture method value was lowest in the treatment, adding 50% breadnut seed flour with a mean value of 2.8 and a liking level somewhat like it. In comparison, the color practical method value was highest with adding 0% breadnut seed flour, with an average of 3.9 and a liking level for ice cream like it.

The more breadnut flour added, the less favorable the ice cream texture will be, somewhat softer. It's because the breadnut seeds have a texture that is less soft or not smooth; this could be due to the sieving process being less than smooth. It could also be because the viscosity of ice cream is high, so the ice cream does not melt quickly in the mouth, giving the impression that it is not soft [11].

3.6.4. Taste

Taste is one of the valuable factors in determining the taste of food. Product acceptability by consumers if it has the desired taste. Therefore, taste is a sensory attribute that defines the acceptance of panelists or consumers [11] and [20]. The effect of adding breadnut flour on the taste of ice cream based on the affective method can be seen in Figure 6.

Based on Figure 6, adding breadnut flour significantly increased the panelists' acceptance (descriptive method) but did not differ substantially from the panelists' preferences (effective methods). It's known that the results with the treatment of adding breadnut seed flour P0, P1, P2, P3, and P4 were 1.65, 2.95, 3.1, 3.35, and 4, respectively, with the taste criteria at P0 being no breadnut taste, treatments P1, P2 and P3 having a slight breadnut taste and treatment P4 having a breadnut taste. The addition of 0% breadnut flour (P0) was lower than the addition of 12.5% (P1), 25% (P2), 37.5% (P3), and 50% (P5) breadnut seed flour. The lowest taste descriptive method value was in the treatment with the addition of 0% breadnut seed flour with a mean value of 1.65 and the criteria for no breadnut taste, while the highest taste descriptive method value was with the addition of 50% breadnut seed flour with a mean of 4 and a breadnut taste.

The results of the affective method with the addition of breadnut flour P0, P1, P2, P3 and P4 were 3.75, 3.6, 3.55, 3.65, and 4, respectively, with the liking for all treatments being like. The addition of 0% breadnut seed flour (P0) was higher than the addition of 12.5% (P1), 25% (P2), 37.5% (P3), and 50% (P5) breadnut seed flour.

The taste accepted by the panelists [21], [22] was without the addition of breadnut flour with the criteria of no taste of breadnut flour, and the least acceptable was the addition of 50% breadnut flour with the requirements of ice cream tasting of bread. It shows that panelists can accept the taste of ice cream without breadnut flour compared to the breadnut flour of 12.5%, 25%, 37.5% and 50%. It shows that the more breadnut flour used, the higher the taste of breadnuts you will feel, and vice versa.

4. CONCLUSION

Based on the results of the research and discussion, a conclusion can be stated, namely: The addition of 12.5% breadnut flour is the best result with the characteristics of a moisture content of 60.45%, ash content of 1.96%, crude fiber content of 0.86%, overrun 65.83%, resistance 44.77 minutes, and the panelists' organoleptic criteria were acceptable with a slightly cream color, a slight breadnut aroma with a soft texture and a slight breadnut taste and a level of liking by the panelists.

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