TEKNOBUGA Vol. 13 No.1 (2025)

p-ISSN 2085 4056
e-ISSN 2528 7087

JURNAL TEKNOLOGI BUSANA DAN BOGA

https://journal.unnes.ac.id/journals/teknobuga/index

The Effect of Mulberry Fruit Juice Substitution on Nata Sensory Quality

Mauly Izzati Nabila, Sari Mustika*, Anni Faridah, and Rahmi Holinesti

Family Welfare Education, Universitas Negeri Padang, Padang, Indonesia

*Corresponding author: sari.mustika@fpp.unp.ac.id

ABSTRACT - Mulberry plants are generally used for their leaves as silkworm feed, while their fruits are rarely used. In fact, mulberry fruit has the potential as a functional food because of its antioxidant content and high economic value. One form of processing is making nata to add variety. This study aims to determine the effect of mulberry juice substitution at concentrations of 0% (X0), 25% (X1), 50% (X2), and 75% (X3) on the sensory quality of nata including color, aroma, texture, and taste. The method used was a pure experiment with a completely randomized design (CRD), involving 50 panelists. Data were analyzed using ANOVA and Duncan's test. The results showed that 50% mulberry juice substitution (X2) significantly increased the nata color score by 2.99, and produced a slightly chewy texture with a score of 2.28 which was still preferred by panelists. Aroma and taste did not show significant differences. Based on the overall results, treatment X2 (50%) was the best treatment in producing nata with the most preferred sensory quality.

Keywords: Mulberry fruit, nata, quality.

INTRODUCTION

Nata de coco is the result of a fermentation process involving *Acetobacter xylinum* in a coconut water medium supplemented with carbon and nitrogen sources under controlled conditions. Under these circumstances, the bacteria produce enzymes that synthesize long-chain sugars or cellulose fibers. From the vast biomass that develops in the coconut water, millions of cellulose strands are formed, eventually producing a solid, white to translucent mass known as nata (Nugroho & Aji, 2015).

Nata is a food product originating from the Philippines. This product is obtained through a fermentation process, shaped like jelly, and has a chewy texture (Wahyuni, 2019). Nata is produced by a species of acetic acid-producing bacteria, Acetobacter xylinum. These bacteria form a thick layer on the surface of the fermentation medium, known as nata. In the market, nata is available in various forms, such as nata in syrup, ice cream mixes, fruit cocktails, cakes, and other snacks (Wahyuni, 2019). Nata is very useful if processed into various foods or refreshing drinks because it contains fiber (dietary fiber). Like natural cellulose, nata plays an important role in the digestive process in the small intestine and water absorption in the large intestine, thus supporting digestive health. Apart from containing fiber, nata is also rich in protein derived from *Acetobacter xylinum*, which is found between cellulose fiber networks (Ezi Angraini et al., 2020).

Nata can be made not only from coconut water, but also from various other ingredients that are rich in sugar, protein, and minerals, such as fruit juice, soy juice, or sugar water. Therefore, the name of nata can vary according to the ingredients used, such as nata de soya (from soy juice), nata de mango (from mango juice), nata de pina (from

pineapple juice), nata de corn (from corn juice), and so on (Oktoviana & Njoeroemana, 2021). If the substrate used is coconut water, this product is known as nata de coco (Apriyanto, 2019).

This processed nata de coco product is widely available on the market with various forms of packaging. The process of making nata de coco is relatively easy to do, so that many small businesses to household scale are engaged in this field. However, to produce nata de coco that is of good quality physically and hygienically so that it is suitable for consumption, it is necessary to understand and apply good and correct production methods (Erminawati and Sidik. W, 2019).

The Indonesian people's fondness for consuming nata de coco is due to the characteristics of this product as one of the processed coconut water products that is rich in fiber, low in calories, suitable for diet food, good for the digestive system, and cholesterol-free. These factors make nata de coco increasingly popular among the Indonesian people (Wardah et al., 2022).

In general, marketed nata products have the same characteristics, namely white in color and without variations in taste (Suciningtyas, M. et al., 2015). Therefore, to add variety to the main ingredients of nata products and to improve the functionality of nata, it is necessary to replace or add other ingredients as an alternative. One of the ingredients that can be used as a substitute is mulberry juice.

Mulberry fruit, known by the Latin name Morus alba, is a plant that is often used as fodder for silkworms on the leaves (Windana et al., 2021). Mulberry (*Morus alba L.*) fruit has a high yield in one fruiting season in many countries, especially in Asia, and a long history of use as an edible fruit and traditional medicine. A great diversity of nutritive compounds such as fatty acids, amino acids, vitamins, minerals, and bioactive compounds, including anthocyanins, rutin, quercetin, chlorogenic acid, and polysaccharides have been found in mulberry fruit depending on the cultivars and maturity stages. Furthermore, the extracts and active components of mulberry fruit have demonstrated numerous biological activities, including antioxidant, neuroprotective, antiatherosclerosis, immunomodulative, antitumor, antihyperglycemic, and hypolipidemic activities in in vitro and in vivo studies, and they have received increasing interest from researchers (Q Yuan and L Zhao, 2017).

In Indonesia, mulberry plants have been widely cultivated and have the potential to support the improvement of the community's economy since 2014 (Yuniati. Y, 2023). Overall, the area of cultivation of this plant in Indonesia reaches 45,085.5 ha. (Cahyadi et al., 2018). The utilization of mulberry fruit is less desirable because mulberry is only used for its leaves to feed silkworms. In fact, mulberry fruit can be used as a functional food that is rich in antioxidants and has high economic value (Astaningrum, 2023).

The anthocyanin content in mulberries has benefits as a natural food coloring while providing physiological functions such as anticancer, protection against cardiovascular disease, antioxidants, and antihypertension (Basuki. S et al., 2024). In addition, mulberries have great potential as a source of natural antioxidants that act as anticancer (Burhan et al., 2019).

To increase the utilization of mulberry plants, which have so far only been used for leaves as silkworm feed, one alternative that can be done is to process the fruit into nata products. Mulberry fruit is used in the form of juice produced through processing. The substitution of mulberry fruit juice in making nata is expected to increase public interest in this product, as well as serve as a functional food that provides health benefits and increases the economic value of processed mulberry fruit products. In this study, 25% (X1), 50% (X2), and 75% (X3) of the amount of coconut water used was substituted with mulberry juice to analyze the quality of nata produced with the addition of mulberry juice.

Thus, the author's interest in conducting this research is based on efforts to increase the utilization of mulberry fruit, which has so far been used more for its leaves as silkworm feed. This research develops fermented-based processed products, namely nata, as a form of product diversification. The novelty of this research lies in the use of mulberry juice as a substitute material in nata fermentation media, which aims to improve the sensory quality and functional value of nata products. Until now, studies on the utilization of mulberry juice in making nata are still very limited, so the results of this study are expected to be a new reference in the development of fermentation-based functional foods.

METHOD

This study used a pure experimental method (true experiment) with a complete randomized design (CRD) design. The variable tested was the effect of mulberry juice substitution at concentrations of 0% (X0), 25% (X1), 50% (X2), and 75% (X3), with each treatment repeated three times. Assessment was carried out on the sensory quality of nata

products which included aspects of color, aroma, texture, and taste. For the assessment, two types of tests were used, namely the ranking test, in which panelists were asked to rank the samples from 1 to 4, with rank 1 indicating the lowest intensity and rank 4 indicating the highest intensity, and the hedonic test to assess the level of panelists' liking for the product.

The fundamental difference between ranking and hedonic tests lies in the purpose and approach of the assessment. The ranking test aims to assess intensity objectively by asking panelists to rank several samples from the lowest with a ranking of 1 to the highest ranking of 4 based on certain criteria, such as color from non-purple to purple, aroma from non-fragrant to fragrant, texture from non-chewy to chewy and taste from bland to bland. In this case, the ranking is not based on preference, but on the panelist's perception of quality or sensory. Nurwin et al. (2019) stated that the ranking test is effective in distinguishing the intensity of quality between treatments statistically, although it does not measure preference.

Meanwhile, the hedonic test in this study was used to measure the level of panelists' preference or acceptance of the product's organoleptics, such as color, aroma, texture, and taste. The assessment was carried out subjectively using a preference scale, in this study the preference scale was 1 to 4, where dislike was ranked 1 to like was ranked 4. This test reflects consumer perceptions of product quality and is very relevant in evaluating market preferences. According to (Setiawan et al., 2022), the hedonic test involves untrained panelists who provide assessments based on personal impressions of the product being tested.

This research was conducted at the Tata Boga Workshop, Department of Family Welfare Science, Faculty of Tourism and Hospitality, Padang State University, from April 10 to May 8, 2025. A total of 50 panelists who were students of the Family Welfare Education Study Program at Padang State University were involved in this study. The data obtained were analyzed using Analysis of Variance (ANOVA), and if the calculated F value was greater than the F table, the analysis was continued with the Duncan Test.

To ensure the quality of the data obtained, the testing process was carried out using the blinded tasting method and random sample presentation. Panelists were not informed about the composition or treatment of each sample tested, so that the assessment was carried out without the influence of initial information. In addition, the order of sample presentation was made different for each panelist to avoid the order effect in assessing. The application of this procedure aims to maintain the objectivity of the assessment and increase the validity of the sensory test results. According to (Setiawan et al., 2022), randomization and blind testing are important techniques in organoleptic evaluation to reduce panelist perceptions of the product.

The following is the process of processing nata with the addition of mulberry juice, the recipe is taken from the research journal Maizarni et al. (2023), regarding nata making. For more details can be seen in **TABLE 1**.

TABLE 1. Ingredients for making mulberry fruit juice nata.

Component	Composition of Research Materials			
	X0 (0%:100%)	X1 (25%:75%)	X2 (50%:50%)	X3 (75%:25%)
Coconut water	1000 ml	750 ml	500 ml	250 ml
Granulated sugar	10 gr	10 gr	10 gr	10 gr
Food grade urea	2,5 gr	2,5 gr	2,5 gr	2,5 gr
Glacial acetic acid	10 ml	10 ml	10 ml	10 ml
Starter (Acetobacter Xylinium)	150 ml	150 ml	150 ml	150 ml
Mulberry fruit juice	-	250 ml	500 ml	750 ml

Processing Tools

The equipment used in the process of making nata with the addition of mulberry juice includes a blender, a stemmed pot, a tray, a bowl, a stove, a digital scale, a measuring cup, a cloth sieve, newsprint, and a 150 ml plastic cup as a serving container. The procedure for processing nata with mulberry juice substitution can be seen in **FIGURE 1**.

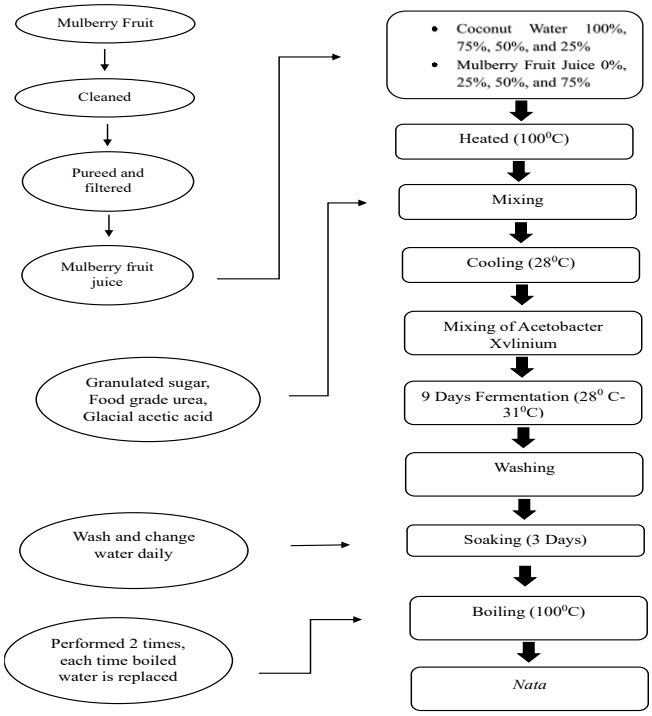


FIGURE 1. Flowchart of nata processing with mulberry fruit juice substitution.

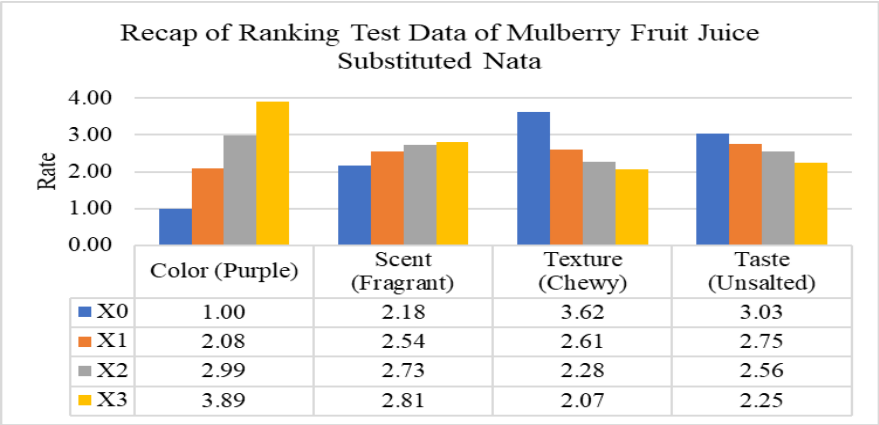
RESULTS AND DISCUSSION

The following are the results of tabulating the final data of nata research with the addition of mulberry juice using the ranking test and hedonic test which includes aspects of color, aroma, texture, and taste.

Rank Test

Ranking test is conducted to assess the intensity of nata quality based on aspects of color, aroma, texture, and taste objectively by panelists. Panelists are asked to sort samples based on the sensory or quality of each product, without considering personal preference levels.

After the researcher conducted the research three times, the research data was obtained. The measured qualities are color (purple), aroma (fragrant), texture (chewy), and taste (tasteless). The following is the result of the final data tabulation of mulberry juice substitution research on nata quality can be seen in **FIGURE 2**.



	Color (Purple)	Scent (Fragrant)	Texture (Chewy)	Taste (Unsalted)
X0	1.00	2.18	3.62	3.03
X1	2.08	2.54	2.61	2.75
X2	2.99	2.73	2.28	2.56
X3	3.89	2.81	2.07	2.25

FIGURE 2. Ranking test chart of nata with mulberry fruit juice substitution.

Based on **FIGURE 2**, it can be seen that the results of Analysis of Variance (ANOVA) through ranking tests on nata with mulberry juice substitution of 0% (X0) 25% (X1), 50% (X2), and 75% (X3) are as follows:

a. Nata Color Ranking Test with the Addition of Mulberry Fruit Juice as Much as 0%, 25%, 50%, and 75%

Color is one of the easiest visual indicators used to assess the quality of a food product. In addition, color can also be a clue to the characteristics of the product being observed (Hidayat et al., 2018). The presence of color in food also affects consumer attractiveness and appetite (Setiawan et al., 2022).

Based on the organoleptic test results on color quality, it shows that the average score obtained from each treatment is X0 of 1.00 (not purple), X1 of 2.08 (less purple), X2 of 2.99 (moderately purple), and X3 of 3.89 (purple). Treatment X3 recorded the highest average value, which was 3.89. From the results of statistical analysis using ANOVA, it was found that the Fcount value was greater than Ftable (13.29 > 2.67). This indicates that the addition of mulberry juice has a significant effect on the color quality of nata. Therefore, the analysis was continued with the Duncan test to determine the differences between treatments in more detail.

TABLE 2. Duncan test results of nata color quality with the addition of mulberry fruit juice.

Sample	Average	Symbol
X0	**1.00**	**a**
X1	2.08	b
X2	2.99	bc
X3	3.89	c

Based on **TABLE 2**, the Duncan test results show that there is a significant difference in purple color quality between treatments X0 and X1, X0 and X2, and X0 and X3. Meanwhile, there was no significant difference between X1 and X2 or between X2 and X3, but X1 and X3 showed a significant difference. Color is a visual indicator that is most easily used to assess the quality of food products, and can also provide an overview of the characteristics of the product being observed (Hidayat et al., 2018). Mulberry fruit contains high amounts of anthocyanin compounds, which are natural pigments from the flavonoid group that give colors ranging from orange, red, purple, blue, to black in plants (Utomo, 2013). Substituting a higher amount of mulberry juice tends to produce a more purple nata color.

b. Aroma Ranking Test of Nata with the Addition of Mulberry Fruit Juice as Much as 0%, 25%, 50%, and 75%

Aroma is also called remote tasting using the sense of smell. Humans can recognize the deliciousness of food that has not been seen only by smelling the smell or aroma of the food from a distance (Nurwin et al., 2019). Based on the results of the organoleptic test on the aroma aspect, the average value for each treatment is X0 of 2.18 (less fragrant), X1 of 2.54 (quite fragrant), X2 of 2.73 (quite fragrant), and X3 of 2.81 (quite fragrant), with the highest value obtained in treatment X3. However, the results of statistical analysis using ANOVA showed that the Fcount value of 0.56 was smaller than the Ftable at the 5% level of 2.67. Therefore, it can be concluded that the addition of mulberry juice does not have a significant effect on the aroma (fragrant) of the nata produced.

This is due to the low intensity of volatile compounds in mulberry fruit that contribute to aroma. Aromatic compounds such as esters, alcohols and aldehydes that give mulberry fruit its characteristic aroma are volatile and can be degraded during the fermentation process (Wang et al., 2008).

c. Nata Texture Ranking Test with the Addition of Mulberry Fruit Juice as Much as 0%, 25%, 50%, and 75%

According to (Nur Midayanto & Setyo Yuwono, 2014), the texture of a food can be seen in terms of thickness, brittleness, dryness, softness, chewiness of the food. Each food has its own texture properties depending on the physical state, size, and ingredients used (Sinaga, 2022). The texture of good nata de coco is generally chewy. One of the things that affects the texture of nata de coco is fiber (Arruan et al., 2022). The expected texture of mulberry juice substitution nata is chewy.

The results of organoleptic tests on texture quality, the average value obtained from each treatment is based on the results of organoleptic tests on texture quality, the average value obtained from each treatment is X0 worth 3.62 (chewy), X1 worth 2.61 (moderately chewy), X2 worth 2.28 (less chewy) and X3 worth 2.07 (less chewy). The highest average value is found in X0 which is 3.62. Based on the results of ANOVA statistics, it is known that Fcount> Ftable (3.25> 2.67). Thus it can be stated that there is a significant effect of the addition of mulberry juice on texture quality. Therefore, further Duncan test was conducted to see the different treatments.

TABLE 3. Duncan test results of nata texture quality with mulberry fruit juice subsitution.

Sample	Average	Symbol
X0	**3.62**	**a**
X1	2.61	ab
X2	2.28	b
X3	2.07	b

Based on the table above, it can be seen that the Duncan test results for the quality of the chewy texture in the treatment results X0 and X1 are not significantly different, X0 and X2 are significantly different, X0 and X3 are significantly different, X1 and X2 are not significantly different, X2 and X3 are not significantly different. The factor that affects the difference in texture in this study is the amount of mulberry juice substitution in nata. The more mulberry juice that is subsumed, the softer the texture of the resulting nata will be. This is due to the influence of the water content in fresh mulberry fruit reaching 80.18% (Utomo, 2013), resulting in a softer nata texture.

d. Nata Taste Ranking Test with the Addition of Mulberry Fruit Juice as Much as 0%, 25%, 50%, and 75%

Taste is one of the important things that must be considered in a processed product. Taste is a stimulus produced from the material eaten, mainly felt by the sense of taste, the taste of food is influenced by the use of basic ingredients (Yohana et all., 2017). The expected taste of mulberry juice substitution nata in this study is tasteless.

Based on the results of the organoleptic test on taste quality, the average value obtained from each treatment is based on the results of the organoleptic test on taste quality, the average value obtained from each treatment is X0 worth 3.03 (quite tasteless), X1 worth 2.75 (quite tasteless), X2 worth 2.56 (quite tasteless) and X3 worth 2.25 (less tasteless). The highest average value is found in X0 which is 3.03. The data from the ANOVA statistical results state that the Fcount is 0.72, this value is smaller than the Ftable at the 5% level, which is 2.67, thus there is no significant effect of the addition of mulberry juice on the taste quality (tasteless) of mulberry juice substitution nata.

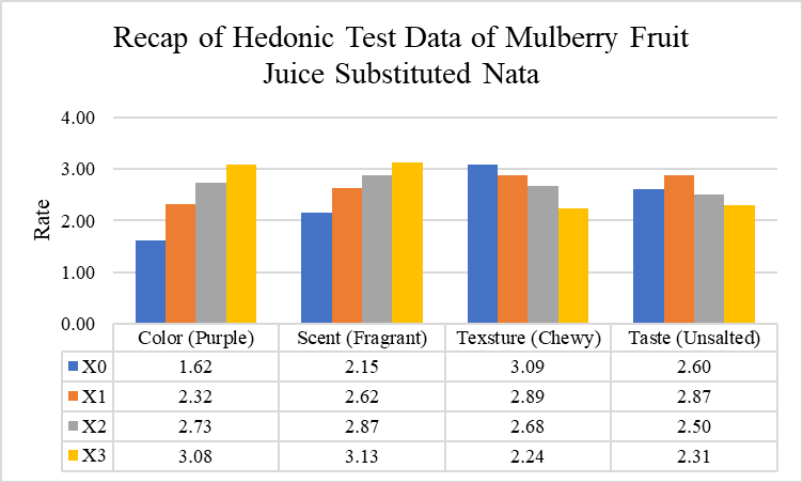
The decrease in the level of tastiness in nata substituted with mulberry juice can be attributed to the natural properties of mulberry fruit which has a sweet-sour taste and contains organic acids and anthocyanins (Basuki et al., 2024). These compounds provide a natural sourness that, although mild, still affects the perception of tastelessness in the nata product, especially at higher juice concentrations.

The test results showed that increasing the concentration of mulberry juice from 0% to 75% had a significant effect on the color and texture of nata. Treatment X2 (50%) got the best ranking for the strongest purple color and the most chewy texture, while treatment X0 (0%) tended to get the lowest ranking for color attributes because it did not contain anthocyanin pigments from mulberries. Meanwhile, in terms of aroma and taste, there was no significant difference in ranking between treatments, indicating that the addition of mulberry juice did not significantly affect the intensity of the two products.

Hedonic Test

The hedonic test is used to determine the level of panelists' preference for nata products based on color, aroma, texture, and taste. Unlike the ranking test, this assessment is subjective and describes consumer perceptions of product quality preferences with personal preferences.

The following are the results of the final data tabulation of the research on the substitution of mulberry juice for the hedonic quality of nata, which can be seen in **FIGURE 3**.



	Color (Purple)	Scent (Fragrant)	Texsture (Chewy)	Taste (Unsalted)
X0	1.62	2.15	3.09	2.60
X1	2.32	2.62	2.89	2.87
X2	2.73	2.87	2.68	2.50
X3	3.08	3.13	2.24	2.31

FIGURE 3. Hedonic test chart of nata with mulberry fruit juice substitution.

Based on **FIGURE 3**, it can be seen that the results of Analysis of Variance (ANOVA) through hedonic tests on nata with mulberry juice substitution of 0% (X0) 25% (X1), 50% (X2), and 75% (X3) are as follows:

a. Hedonic Test of Nata Color with Mulberry Fruit Juice Subsitution of 0%, 25%, 50%, and 75%

The results of the hedonic test on the color aspect of nata that is subsumed by mulberry juice show quite interesting results. Treatment X3 (75%) obtained the highest average score of 3.08 and was included in the “like” category. In contrast, treatment X0 (0%) has the lowest average score of 1.62, which is included in the “less like” category. The X1 (25%) treatment scored 2.32 which was also in the “less like” category, while the X2 (50%) treatment obtained an average score of 2.73 which was categorized as “quite like”. These results indicate that the higher the concentration of mulberry juice used, the greater the level of panelist preference for the color of the resulting nata product.

The results of this study indicate that the substitution of mulberry juice in larger amounts succeeded in increasing the color intensity of the nata, which had a positive effect on the visual acceptance of panelists. As stated by (Basuki et al., 2024), anthocyanins not only function as natural colorants, but also provide additional aesthetic and functional value to food products due to their antioxidant content. This research supports the increase in visual appeal of nata in this study, especially in treatment X3.

Based on the ANOVA results, it is known that Fcount < Ftable (3.15 > 2.67). This indicates that there is a significant effect on the quality of nata color for the four treatments. Therefore, further Duncan test was conducted to see different treatments.

TABLE 4. Results of Duncan hedonic test for nata color with mulberry fruit juice substitution.

Sample	Average	Symbol
X0	**1.62**	**a**
X1	2.32	ab
X2	2.73	b
X3	3.08	b

Based on **TABLE 4** above, it can be seen that the results of the Duncan test for color hedonic quality in the treatment results X0 and X1 are not significantly different, X0 and X2 are significantly different, X0 and X3 are significantly different, X1 and X2 are not significantly different, X1 and X3 are not significantly different, X2 and X3 are not significantly different.

b. Hedonic Test of Nata Aroma with Mulberry Fruit Juice Subsitution of 0%, 25%, 50%, and 75%

The results of the hedonic test on the aroma of nata with added mulberry juice showed that treatment X3 (75%) obtained the highest average value, namely 3.13, which is included in the "quite like" category. This shows that panelists prefer the aroma of nata containing higher levels of mulberry juice compared to other treatments. Treatment X0 (0%) obtained an average value of 2.15, which is included in the "less like" category, while treatments X1 (25%) and X2 (50%) obtained an average value of 2.62 and 2.87, respectively, which are both included in the "quite like" category.

Based on the results of ANOVA analysis, the value of Fhitung < Ftabel (1.14 < 2.67) was obtained, indicating that there was no significant effect on the quality of nata aroma in the four treatments tested. The increase in aroma in the treatment with a higher concentration of mulberry juice can be explained by the natural aroma characteristics of mulberry fruit which has a fragrant and fresh scent. Mulberry fruit is known to contain natural volatile compounds, such as anthocyanins and flavonoids, which in addition to providing color, also play a role in creating a distinctive fresh aroma in fruits (Basuki et al., 2024). This shows that the variation in aroma assessment among panelists is quite large, and the higher the concentration of mulberry juice, the greater the preference for the fragrant aroma produced.

c. Hedonic Test of Nata Texture with 0%, 25%, 50%, and 75% Mulberry Fruit Juice Subsitution

The results of the hedonic test on the texture of nata substituted with mulberry juice showed that treatment X0 (0%) obtained the highest average value of 3.09, which was included in the "quite like" category. Treatments X1 (25%) and X2 (50%) also received the "moderately liked" category, with values of 2.89 and 2.68 respectively. In contrast, the X3 (75%) treatment received a score of 2.24, which falls into the "less like" category. Based on this data, it can be concluded that the addition of mulberry juice in larger amounts tends to reduce the panelists' level of liking for the texture of the nata.

The factor affecting the level of texture liking is caused by the higher the concentration of mulberry juice used, the panelists' level of liking for the texture of the nata tends to decrease. This is due to the high water content in mulberry juice, which according to Utomo (2013) and USDA (2016), reaches around 80-87%. This high water content has the potential to dilute the fermentation medium and reduce cellulose formation by Acetobacter xylinum.

However, the addition of mulberry juice is not an absolute thing, but these results show that the addition of mulberry juice is still acceptable up to 50% treatment (X2) with a level of liking for texture that is in the "quite like" category and still produces nata with texture quality that is acceptable to panelists. Based on the ANOVA results, it can be concluded that Fcount < Ftable (0.85 < 2.67). This indicates that there is no significant effect on the hedonic quality of texture on nata for the four treatments.

d. Hedonic Test of Nata Taste with Mulberry Fruit Juice Subsitution of 0%, 25%, 50%, and 75%

Based on the results of the hedonic test on the taste of nata with mulberry juice substitution, it shows that treatment X1 (25%) has the highest average value of 2.87 and is included in the "quite like" category. This indicates that panelists liked the taste of nata in treatment X1 the most compared to other treatments. The X0 (0%) and X2 (15%) treatments were also still in the "moderately liked" category with an average value of 2.60 and 2.50, while X3 (75%) was lower with an average value of 2.31 which fell into the "less liked" category.

The ANOVA results stated Fcount < Ftable (0.24 < 2.67). This indicates that there is no significant effect on the quality of flavor in nata for the four treatments. Based on these data, it can be concluded that the substitution of mulberry juice has an influence on the level of panelists' liking for the taste of nata, with the highest level of acceptance at the addition of 25% (X1). The decrease in the level of panelists' liking in the X3 treatment was most

likely influenced by the high content of organic acids in mulberry juice, such as ascorbic acid and anthocyanins, which provide a natural sour taste (Basuki et al., 2024).The higher the concentration of mulberry juice added, the stronger the sour taste that appears, thus reducing the perception of the expected fresh taste in the nata. However, this study showed that 25% concentration of mulberry juice was the most acceptable taste according to the panelists, with the category “quite like”.

The hedonic test results showed that treatment X2 (50%) received the highest score from panelists for all aspects, especially color and texture. This shows that the fairly strong purple color intensity and chewy texture at a concentration of 50% are preferred by panelists compared to other treatments. Although aroma and taste did not show any real differences objectively, the hedonic scores for both attributes also tended to be high in treatment X2, indicating that panelists preferred products that had a balance of quality and attractive appearance.

Comparison of Ranking Test and Hedonic Test Results

To provide a clearer picture of the differences in sensory ranking tests and panelists' preference levels, **TABLE 5** is presented, which compares the results of the ranking tests (sensory assessment) and hedonic tests (preference assessment) for each treatment.

TABLE 5. Comparison of ranking test values and hedonic test of mulberry juice substituted nata.

Treatment	Color (Ranking)	Color (Hedonic)	Aroma (Ranking)	Aroma (Hedonic)	Texture (Ranking)	Texture (Hedonic)	Taste (Ranking)	Taste (Hedonic)
X0 (0%)	1.00	1.62	2.18	2.15	3.62	3.09	3.03	2.60
X1 (25%)	2.08	2.32	2.54	2.62	2.61	2.89	2.75	2.87
X2 (50%)	2.99	2.73	2.73	2.87	2.28	2.68	2.56	2.50
X3 (75%)	3.89	3.08	2.81	3.13	2.07	2.24	2.25	2.31

From the table above, it can be seen that treatment X2 (50%) generally gets a good score in both ranking and hedonic assessments. For example, color X2 has a high ranking (2.99) and a high hedonic value (2.73), which indicates that the color is quite purple and is liked by the panelists.

In terms of aroma and taste, although the ranking values between treatments do not differ much, the hedonic values of treatments X2 and X3 tend to be higher, which means they are preferred in terms of aroma and taste. However, in terms of texture, even though X0 received the highest ranking (3.62) indicating that it was chewy, its hedonic value was actually lower (3.09) compared to X1 (2.89), which shows that a texture that is too chewy is not necessarily the most preferred.

This comparison shows that the best result in the ranking test is not necessarily the most preferred in the hedonic test. Therefore, both need to be analyzed together to determine the most optimal treatment. In this case, treatment X2 (50%) was assessed as the best treatment because it provided a balance between sensory quality and subjective panelist preference.

CONCLUSION

Based on the results of the study, it can be concluded that the effect of mulberry juice substitution on the sensory of nata analyzed through the ranking test and hedonic test using the Analysis of Variance (ANOVA) method, there is a significant difference in the effect of mulberry juice substitution in each treatment as much as 25%, 50%, and 75% on the sensory of color (purple), texture (chewy) and there is no significant effect on the sensory of aroma (fragrant), and taste (tasteless).

As a recommendation for further research, it is suggested to explore the addition of other ingredients such as texture enhancers, as well as testing the stability of nata during storage. In addition, further research can also consider

chemical or microbiological quality tests to obtain a more comprehensive picture of the quality and safety of mulberry juice-based nata products.

REFERENCES

Apriyanto, M. (2019). Coconut Commodities Training And Association Processes. *Jppm Lpip Ump*, *3*(2), 179–183.

Arruan, M. B., Koapaha, T., & Lamaega, J. C. E. (2022). Pengaruh Pencampuran Ekstrak Daun Kelor (Moringa Oleifera) Terhadap Sifat Fisikokimia Dan Organoleptik Nata De Coco. *Jurnal Agroteknologi Terapan*, *3*(2), 213–219.

Astaningrum, M. S., (2023). Variasi Gula Pada Penetapan Formulasi Sirup Buah Murbei (Morus Alba L) (Doctoral dissertation, Politeknik Negeri Jember).

Basuki, S., Johan, J., Goestjahjanti, F. S., Winanti, W., Hasna, S., Kamar, K., Himmy'azz, I. Ku., Cahya Kumoro, D. F., Nurasiah, N., & Trisolvena, M. N. (2024). Edukasi Budidaya Tanaman Murbei sebagai Produk Olahan Keripik Daun Murbei di Padepokan Arben Kalikoa Cirebon. *Jurnal Pengabdian Masyarakat Progresif Humanis Brainstorming*, *7*(1), 146–153. https://doi.org/10.30591/japhb.v7i1.6009

Burhan, A., Aisyah, A. N., Awaluddin, A., Zulham, Z., Taebe, B., & Gafur, A. (2019). Uji Aktivitas Antioksidan Dan Antikanker Ekstrak Batang Murbei (Morus Alba L.) Terhadap Sel Kanker Widr Secara in Vitro. *Kartika : Jurnal Ilmiah Farmasi*, *7*(1), 17. https://doi.org/10.26874/kjif.v7i1.173

Erminawati, & Sidik, W. (2019). Usaha Meningkatkan Kualitas Dan Nilai Ekonomi Nata De Coco Bagi Masyarakat Desa Petanahan Melalui Penyuluhan Pembuatan Yang Baik Dan Benar Serta Minuman Ready To Drink Berbasis Nata De Coco. Ethos : Jurnal Penelitian Dan Pengabdian Kepada Masyarakat, 7(1), 137–142.

Ezi Angraini, Elida, Anni Faridah, & Sari Mustika. (2020). Pkm Pembinaan Pengolahan Nata De Citrullus Dan Olahan Lainnya Dari Semangka Afkir Bagi Petani Semangka Di Nagari Kapelgam Kec. Bayang, Kab. Pesisir Selatan. *Journal of Community Service*, *2*(2), 109–114. https://doi.org/10.56670/jcs.v2i2.40

Hua Wang, Li Zhang & Yuqiao Ren (2008). VOLATILE COMPOSITION OF MULBERRY FRUIT AND SPARKLING WINE . Acta Hortic. 769, 473-478 https://doi.org/10.17660/ActaHortic.2008.769.68

Maizarni, Guswira. R., Ulhaq. A,. (2023). *Modification of Nata De Coco Manufacturing Using Food-Grade Urea as a Practical Material in the Postharvest Processing Laboratory.* Politeknik Pertanian Negeri Payakumbuh.

Midayanto. (2019). *Ilmu Pangan: Karakteristik dan Mutu Produk Makanan*. Yogyakarta: Deepublish.

Nugroho, D. A., & Aji, P. (2015). Characterization of Nata de Coco Produced by Fermentation of Immobilized Acetobacter xylinum. *Agriculture and Agricultural Science Procedia*, *3*, 278–282. https://doi.org/10.1016/j.aaspro.2015.01.053

Nur Midayanto, D., & Setyo Yuwono, S. (2014). Determination of Quality Attribute of Tofu Texture to be Recommended as an Additional Requirement in Indonesian National Standard. *Jurnal Pangan Dan Agroindustr*, *2*(4), 259–267.

Nurwin, F.A., E.N. Dewi, dan Romadhon. 2019. Pengaruh penambahan tepung karagenan pada karakteristik bakso kerang darah (Anadara granosa). Jurnal Ilmu dan Teknologi Perikanan 1: 39-46.

Oktoviana, V., & Njoeroemana, Y. (2021). *1989-6306-1-Pb (1)*. *4*, 78–83.

Setiawan, E. C., Puspitasari, D. A., Rakhmani, S. K., Alfani, M. N. R., Imam, A. W. N., & Widyanto, R. M. (2022). Kandungan Gizi dan Uji Organoleptik Beras Analog Kedelai Edamame dan Rumput Laut. *Indonesian Journal of Human Nutrition*, *9*(1), 1–15. https://doi.org/10.21776/ub.ijhn.2022.009.01.1

Suciningtyas, M. (2015). Pengembangan Produk Rehydrated Nata de Coco. Skripsi. Fakultas Teknologi Pertanian. Universitas Gadjah Mada, Yogyakarta.

USDA. 2016. *National Nutrient Database for Standard Reference Basic Report 09190, Mulberries, raw.*

Wahyuni, S. (2019). Pengaruh Pemberian Air Jeruk Lemon Terhadap Kualitas Produk Nata de Coco. *Best Journal (Biology Education, Sains and Technology)*, *2*(2), 42–47. https://doi.org/10.30743/best.v2i2.1817

Wardah, S., Suharto, S., & Lestari, R. (2022). Analisis Pengendalian Kualitas Proses Produksi Produk Nata De Coco Dengan Metode Statistic Quality Control (Sqc). *JISI: Jurnal Integrasi Sistem Industri*, *9*(2), 165. https://doi.org/10.24853/jisi.9.2.165-175

Windana, F., Handaratri, A., & Asri Zaen, M. T. (2021). Implementasi Metode K-Nearest Neighbor Untuk Pengenalan Buah Murbei Dengan Korelasi Kandungan Antosianin. *Jurnal Informatika Dan Rekayasa Elektronik*, *4*(1), 78–86. https://doi.org/10.36595/jire.v4i1.320

Yohana, F. S. 2017. “Kualitas Organoleptik dan Daya Leleh Es Krim dengan Penambahan Persentase Berbeda Buah Nanas (Ananas Sativus) Berbeda. Skripsi. Makasar: Universitas Hasanuddin.
Yuan, Q. and Zhao, L. (2017). “The Mulberry (Morus alba L.) Fruit-a review of characteristic components and health benefits,” J. Agric. Food Chem., 65(48), 10383-10394.
Yuniati, Y. (2023). Studi Pustaka: Ekstraksi dan Potensi Utilisasi Ekstrak Komponen Bioaktif Tanaman Murbei di Indonesia. Bioscientist: Jurnal Ilmiah Biologi, 11(2), 1775–1786.