

Herbal Jelly Candy Mengkudu and Red Ginger Extract, Physicochemical and Organoleptic Properties Reviews

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ABSTRACT

Noni is a fruit that contains important nutrients such as vitamins A, C, niacin, and thiamine. Red ginger contains important compounds such as zingiberon, zingiberin, and zingibetol. Noni and red ginger can be used as jelly candy products. Jelly candy is a soft-textured confectionery that people love and is processed with the addition of hydrocolloid ingredients. This study aims to determine the effect of the combination of noni juice and red ginger on jelly candy's physicochemical and organoleptic properties. The design used was a one-factor Complete Random Design (RAL) with a comparison of noni juice and red ginger, namely P1 95:5, P2 90:10, P3 85:15, P4 80:20, P5 75:25. The results showed that the combination of noni juice and red ginger juice in jelly candy products did not have a real effect on the level of chewiness of the product. The combination of noni juice and red ginger juice in jelly candy has a very real effect on the product's moisture content and ash content, where the moisture content will increase as the concentration of noni juice increases and the concentration of red ginger juice decreases. In contrast, the ash content will increase as the red ginger juice concentration increases and the noni juice concentration decreases. The combination of noni juice and red ginger juice in jelly candy did not have a real effect on the level of color and aroma preference, but had a real effect on the level of taste and chewiness, where P4 was the most preferred by the panelists.

Keywords: Noni, Red Ginger, Herbal Jelly Candy

1. INTRODUCTION

Noni or pace is often considered a wild or yard plant, even though noni has various important compounds. Almost all parts of the noni plant have phytochemical content that can be used for medicine, especially the fruit, which is good for body health. Phytochemical compounds in noni fruit, namely ascorbic acid, caproic acid, caprylic acid, damnakantal, alkaloids, acubin, lasperuloside, alizarin, anthraquinone substances, and scopoletin substances (Sinaga et al., 2022). Noni fruit contains anti-inflammatory compounds, such as capric acid, caprylic acid, and scopoletin. These compounds can inhibit the production of pro-inflammatory cytokines, such as TNF- and IL-6, which play a role in chronic inflammation. In addition, noni also contains antioxidants, such as vitamin C and beta-carotene, which can help protect cells from damage caused by free radicals, which can trigger inflammation (Syifa, 2024). Noni fruit is rich in

nutrients, but the use of this fruit is still rarely done because noni fruit has a distinctive, unpleasant taste and aroma that many people do not like.

Unlike mengkudu, ginger is one of the medicinal plants whose distinctive aroma and taste are widely liked by people. Ginger is one of the natural ingredients well-known among the general public as a producer of taste and flavor. The essential oils in it make ginger able to create its taste and aroma (Futri, 2021). Ginger contains substances needed by the body, such as zingiberone, zingiberin, zingibetol, barneol, camphor, folandren, sineol, gingerin, besides that it also contains vitamins (A, B1, and C), carbohydrates (20-60%), resin, organic acids (malic and oxalic), and essential oils (0.5-5.6%) (Bactiar et al., 2017). Three varieties of ginger are commonly found in Indonesia, namely red ginger (*Z. officinale* var. *Rubrum*), elephant ginger (*Z. officinale* var. *officinarum*), and emprit ginger (*Z. officinale* var. *amarum*). Red ginger contains more oleoresin and essential oils than other varieties of ginger, so red ginger is more often used in medicine (Wicaksono, 2015). Red ginger can prevent and treat digestive disorders, relieve muscle and joint pain, coughs, headaches, erectile dysfunction, Alzheimer's, cancer, and heart disease (Aryanta, 2019).

Noni fruit and red ginger, which have various nutritional values and compounds, are usually processed into herbal medicine, capsules, tablets, syrups, juice drinks, and powdered drinks, but many people still do not like them. An innovation is needed in using noni fruit and red ginger to become an alternative functional food that the community can accept. The rich nutrition in noni fruit is why researchers are interested in researching the use of noni fruit juice combined with red ginger juice into jelly candy products, where people of various ages widely like jelly candy. Combining ingredients with red ginger juice in this study is expected to improve the quality of jelly candy products, both in terms of organoleptic and physicochemical properties, without damaging the properties contained in both ingredients.

2. RESEARCH METHOD

This research was conducted at the Integrated Food Laboratory of the Agroindustry Study Program, Faculty of Vocational Studies, University of 17 August 1945 Surabaya for 2 months, from March to May 2024.

Research Tools and Materials

The tools used in making jelly candy include: blender, analytical scales, measuring cups, sieves, pans, stoves, stirrers, silicone molds, basins, and refrigerators. Tools for analysis include:

ovens, porcelain cups, Erlenmeyer flasks, electric furnaces, and Objective Precision Scientific Penetrometer type penetrometers. The materials used in making jelly candy include: noni fruit obtained from Bae Village, Kudus Regency, red ginger obtained from the Kudus Bitingan market, granulated sugar brand "Gulaku", unbranded gelatin obtained from the "CMC" shop in Kudus, agar brand "Swallow Globe" plain variant (without flavor), and water.

Research Design and Procedure

This research is an experiment using a Completely Randomized Design (CRD) with one factor: a combination of noni juice and red ginger juice. The experiment consisted of five treatment combinations with three repetitions, so 15 experimental units were obtained.

Table 1. Jelly Candy Making Formula

Treatment	Noni Fruit Juice (ml)	Red Ginger Juice (ml)	Granulated sugar (g)	Gelatin (g)	Jelly (g)
P1	95	5	60	10	1,5
P2	90	10	60	10	1,5
P3	85	15	60	10	1,5
P4	80	20	60	10	1,5
P5	75	25	60	10	1,5

Note:

- P1 = noni fruit juice 95ml : red ginger juice 5ml
P2 = noni fruit juice 90ml : red ginger juice 10ml
P3 = noni fruit juice 85ml : red ginger juice 15ml
P4 = noni fruit juice 80ml : red ginger juice 20ml
P5 = noni fruit juice 75ml : red ginger juice 25ml

Noni Juice Making Process

The process of making noni juice in this study refers to the research modified after preliminary research (Islamiah et al., 2019). Noni fruit is prepared and selected to have an overripe level of ripeness, then the noni fruit is washed thoroughly using running water. The noni fruit is peeled, and the seeds are separated until the flesh remains. Furthermore, the noni fruit is weighed and crushed using a blender. The smooth noni fruit is then filtered to obtain noni juice.

Red Ginger Juice Making Process

The process of making red ginger juice in this study refers to research conducted by Putri (2021) which was modified after preliminary research. Red ginger is prepared and selected fresh

and not rotten. Furthermore, the red ginger is washed thoroughly using running water. The red ginger is then cut into small pieces to facilitate the crushing process, and then the red ginger is weighed and crushed using a blender. The smooth red ginger is then filtered to obtain red ginger juice.

Jelly Candy Making Process

The process of making red ginger juice in this study refers to research by Kamalasari, (2019) which was modified after preliminary research was conducted. The process of making jelly candy begins with preparing the primary raw materials, namely mengkudu juice and red ginger juice, then the two juices are mixed and granulated sugar is added; gelatin; agar, then cooked using medium heat until boiling (\pm 8 minutes), after boiling it is poured into a mold that has previously been greased with oil, then stored in the refrigerator for 24 hours, after 24 hours the jelly candy is released from its mold.

Data Collection and Processing

The data collection technique used in this study was obtained from observations during the study. The jelly candy testing data produced included physical (elasticity), chemical (water content and ash content), and Organoleptic (hedonic) testing. Hedonic testing is testing the level of panelists' preference for color, aroma, taste, and elasticity of jelly candy with a hedonic scale of 1-5; 1 (very much dislike), 2 (dislike), 3 (somewhat like), 4 (like), and 5 (very much like).

The data obtained will be analyzed statistically using the ANOVA test at a significance level of 5%; if there is a real effect between treatments, it will be continued with the BNT test. Organoleptic data in ordinal form is transformed into interval form with MSI (Method of Successive Interval) in Microsoft Excel before the ANOVA test is carried out.

3. RESULTS AND DISCUSSION

The results of the test of herbal jelly candy with mengkudu extract combined with red ginger extract are as follows:

Physical Test (Chewy)

The chewiness of jelly candy is one of the product's main characteristics. Chewy jelly candy is caused by mixing gelatin, agar, and granulated sugar in the manufacturing process. The physical test that was carried out produced an average value of the chewiness of jelly candy with mengkudu extract combined with red ginger extract ranging from 79.3667-96.0333mm/100g/10sec, presented in Table 2.

Table 1. Average Level of Jelly Candy Chewiness

Treatment	Treatment Level of Chewyness (mm/100g/10sec)
P1 (nino fruit juice 95ml and red ginger juice 5ml)	79,3667 _a
P2 (nino fruit juice 90ml and red ginger juice 10ml)	91,4000 _a
P3 (nino fruit juice 85ml and red ginger juice 15ml)	96,0333 _a
P4 (nino fruit juice 80ml and red ginger juice 20ml)	79,6667 _a
P5 (nino fruit juice 75ml and red ginger juice 25ml)	92,1000 _a

Note: Numbers followed by the same letter are not significantly different ($P > 0,05$)

Based on the analysis of variance, it is known that the P value (0.099) is greater than 0.05, meaning that there is no significant effect on the elasticity of the jelly candy product of noni juice combined with red ginger juice between treatments. This is because the composition of the thickening agent used in making jelly candy in this study is the same: gelatin and agar. Jelly candy is a soft-textured confectionery that is processed by adding hydrocolloid materials such as agar, gum, pectin, starch, carrageenan, gelatin, and others, which are used to form a texture to produce a chewy product (Badan Standarisasi Nasional, 2008).

The exact composition of granulated sugar in each treatment also causes no significant difference in the level of jelly candy elasticity. Sugar followed by cooking and stirring, can bind water, causing the material to become gel-like or thick. The ability to bind water is caused by the hygroscopic molecules contained in sugar (Ridhani & Aini, 2021). The combination of mengkudu juice and red ginger juice does not affect the physical test of jelly candy because both ingredients contain a little pectin, a thickener. Pectin is a substance that can form a gel when there is acid and sugar (Perina et al., 2017).

Chemical Test

The chemical tests conducted in this study were water content and ash content analysis, described as follows:

Water Content

Water content is one of the important parameters that determines product quality because it determines a food product's freshness and shelf life (Kamalasari, 2019). The purpose of testing the water content in this study was to determine the quality and durability of the mengkudu jelly candy combined with red ginger juice. The water content test in this study obtained average results, as seen in Table 3.

Table 3. Average Water Content of Jelly Candy



Treatment	Water content (%)
P1 (nino fruit juice 95ml and red ginger juice 5ml)	17,3170 _a
P2 (nino fruit juice 90ml and red ginger juice 10ml)	15,6407 _b
P3 (nino fruit juice 85ml and red ginger juice 15ml)	13,4933 _c
P4 (nino fruit juice 80ml and red ginger juice 20ml)	12,6473 _c
P5 (nino fruit juice 75ml and red ginger juice 25ml)	9,9493 _d

Note: Numbers followed by the same letter are not significantly different ($P>0,05$)

The average distribution of water content of noni juice jelly candy combined with red ginger juice ranged from 9.9493% -17.317%, meaning that the water content results in this study showed a figure below the maximum figure determined by SNI 3547.2-2008, where the water content in jelly candy has a maximum figure of 20.0%.

The results of the further BNT test showed that the combination of noni juice and red ginger juice in jelly candy products had a significantly different effect between treatments, except for P3 to P4, where there was a decrease in water content for each decrease in noni juice concentration and an increase in red ginger juice concentration. This is due to the significant difference in water content in noni fruit and red ginger. The water content in noni fruit is around 89.01% (Landari et al., 2023), while fresh red ginger has approximately 80% (Wiraputra, 2024).

Ash Content

Ash is a mixture of inorganic components or minerals contained in a food ingredient, which, although small, is very much needed. The purpose of testing the ash content is to determine whether or not the management is good, the type of material used, determine the nutritional value parameters of a product, and estimate the content and authenticity of the materials used (Fikriyah & Nasution, 2021). The ash content test in this study obtained average results, which can be seen in Table 4.

Table 4. Average Ash Content of Jelly Candy

Treatment	Ash Content (%)
P1 (nino fruit juice 95ml and red ginger juice 5ml)	0,1323 _a
P2 (nino fruit juice 90ml and red ginger juice 10ml)	0,2710 _b
P3 (nino fruit juice 85ml and red ginger juice 15ml)	0,2687 _b
P4 (nino fruit juice 80ml and red ginger juice 20ml)	0,3607 _c

P5 (nino fruit juice 75ml and red ginger juice 25ml)	0,3857 _c
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Note: Numbers followed by the same letter are not significantly different ($P > 0,05$)

The average distribution of ash content testing of noni juice jelly candy combined with red ginger juice ranged from 0.1323% -0.3857%, meaning that the ash content results in this study showed a figure below the maximum figure determined by SNI 3547.2-2008, where the ash content in jelly candy has a maximum figure of 3%.

Based on the results of the BNT further test, it showed that the combination of noni juice and red ginger juice in jelly candy products had a significantly different effect between treatments except for treatment P2 against P3 and treatment P4 against P5, where there was an increase in ash content for each increase in red ginger juice concentration and a decrease in the concentration of noni juice. This is because the ash content in noni and red ginger is significantly different. The ash content contained in red ginger juice is higher than that of noni fruit juice. The ash content in noni fruit is 6.01% (Sitorus et al, 2021), while the ash content in red ginger is 12.62% (Cahyanto, 2021).

Organoleptic Test

The organoleptic test in this study used a hedonic scale, namely the level of preference with parameters of color, aroma, taste, and elasticity.

Color

Color is one of the important characteristics of a food product, and it can influence consumer interest (Kamalasari, 2019). Color is the first indicator to assess a product; an attractive color will usually provide consumers a better level of preference (Salim et al., 2017). The tests that have been carried out obtained the average color preference value results, which can be seen in Table 5.

Table 5. Average Jelly Candy Color Preferences

Treatment	Color
P1 (nino fruit juice 95ml and red ginger juice 5ml)	4,39970 _a
P2 (nino fruit juice 90ml and red ginger juice 10ml)	4,22693 _a
P3 (nino fruit juice 85ml and red ginger juice 15ml)	4,02677 _a
P4 (nino fruit juice 80ml and red ginger juice 20ml)	4,49900 _a
P5 (nino fruit juice 75ml and red ginger juice 25ml)	4,39987 _a

Note: Numbers followed by the same letter are not significantly different ($P > 0,05$)

The average distribution of the assessment of 5 treatments, color preferences ranged from 4.02677 to 4.49900, meaning that the level of aroma preference for noni juice jelly candy

combined with red ginger juice is very high.

Based on the analysis of variance of jelly candy color preferences, the P value (0.227) is greater than 0.05, meaning there is no real effect on the level of color preference for noni juice jelly products combined with red ginger juice between treatments. There is no effect on the level of color preference in each treatment of noni juice jelly candy combined with red ginger juice because the colors of the two ingredients are almost the same, namely brownish noni juice and red ginger juice, which is red-brown. Ripe noni juice is yellow-brown, and red ginger juice is red-brown (Islamiah et al., 2019).

The same sugar composition in each treatment is also the reason why the color of the jelly candy product is not significantly different. The sugar and fruit juice components in food ingredients that undergo a heating process will experience a non-enzymatic browning process, namely caramelization and Maillard reactions (Ridhani, 2021). It can be interpreted that the color of the jelly candy product produced is due to the influence of the interaction between sugar, noni juice, and red ginger juice during the cooking process.

Aroma

Aroma is one of the important characteristics of a food product, as the aroma can provide a distinctive feature of the basic ingredients used in making the product, which will affect consumer interest (Kamalasari, 2019). Aroma is the second indicator in assessing a product, because aroma can quickly provide consumer acceptance assessment results (Islamiah et al., 2019). The tests that have been carried out obtained the results of the average value of aroma preferences, which can be seen in Table 6.

Table 6. Average Preference for Jelly Candy Aroma

Treatment	Aroma
P1 (nino fruit juice 95ml and red ginger juice 5ml)	3,02673 _a
P2 (nino fruit juice 90ml and red ginger juice 10ml)	3,15880 _a
P3 (nino fruit juice 85ml and red ginger juice 15ml)	3,49893 _a
P4 (nino fruit juice 80ml and red ginger juice 20ml)	3,22703 _a
P5 (nino fruit juice 75ml and red ginger juice 25ml)	3,61460 _a

Note: Numbers followed by the same letter are not significantly different ($P > 0,05$)

The average distribution of the assessment of the five treatments, the aroma preference ranged from 3.02673 to 3.61460, meaning that the level of aroma preference in the mengkudu jelly candy combined with red ginger juice was from quite liking to almost liking.

Based on the results of the analysis of variance, the level of aroma preference for jelly candy showed that the P value (0.079) was greater than 0.05, meaning that there was no significant difference in the level of preference for the aroma indicator of the noni jelly candy product combined with red ginger juice between treatments. The combination of red ginger juice in this study did not significantly affect the level of aroma preference for jelly candy products between treatments. This is due to the strong, unpleasant aroma typical of noni fruit. The pungent aroma of mengkudu fruit is due to many short-chain fatty acid. These fatty acids are a combination of capric acid, caproic acid, and caprylic acid, active antibiotics (Sukeksi et al., 2018).

Taste

Taste is the most important indicator that can determine consumer acceptance of a product (Irawan et al., 2017). Consumers usually pay close attention to food products in terms of taste. Taste will determine the food product's suitability. The taste produced from food products comes from the food itself and added substances. The tests that have been carried out have resulted in the average value of taste preferences which can be seen in Table 7.

Table 7. Average Jelly Candy Flavor Preferences

Treatment	Taste
P1 (nino fruit juice 95ml and red ginger juice 5ml)	3,22673 _a
P2 (nino fruit juice 90ml and red ginger juice 10ml)	3,40003 _a
P3 (nino fruit juice 85ml and red ginger juice 15ml)	4,22717 _b
P4 (nino fruit juice 80ml and red ginger juice 20ml)	4,54533 _b
P5 (nino fruit juice 75ml and red ginger juice 25ml)	4,15873 _b

Note: Numbers followed by the same letter are not significantly different ($P > 0,05$)

The average distribution of the assessment of the five treatments, the taste preference ranged from 3.22673-4.54533, meaning that the level of taste preference for the noni juice jelly candy combined with red ginger juice was quite like to like. The results of the further BNT test of the taste preference of the noni juice jelly candy combined with red ginger juice showed that there was a significant difference between treatments except for treatments P1 against P2, P3 against P4 and P5, and P4 against P5, where there was an increase in the preference value for each increase in the concentration of red ginger juice and a decrease in the concentration of noni juice. Treatment P1 has the lowest preference value with the lowest red ginger extract composition, and P4 has the highest preference value with a relatively high red ginger extract composition. However, the preference level in P5 with the highest red ginger composition is lower than that of P4. This is

because P5 has a taste that is too spicy, so a bitter taste arises in the resulting jelly candy.

Ginger contains mengandung *gingerol*, *zingeone*, *shogaol*, dan *resin*, which cause a spicy and bitter taste (Irawan et al., 2017). Red ginger contains quite high levels of gingerol and shogaol compounds with an average level of gingerol (23-25%) and shogaol (18-25%) (Sholikhati et al., 2023). Thus, the higher the composition of red ginger extract, the spicier and bitter the jelly candy tastes, causing a decrease in the panelists' preference scores.

Chewiness

The chewiness of jelly candy is one of the product's main characteristics. Chewy jelly candy is caused by mixing thickening agents such as gelatin and agar in the cooking process (Kamalasari, 2019). Testing the level of preference for the chewiness indicator must determine the panelists' interest in the product. The tests that were carried out obtained the average value of chewiness preference, which can be seen in Table 8.

Table 8. Average Preference for Jelly Candy Chewiness

Perlakuan	Chewiness
P1 (nino fruit juice 95ml and red ginger juice 5ml)	3,49900 _a
P2 (nino fruit juice 90ml and red ginger juice 10ml)	3,61487 _a
P3 (nino fruit juice 85ml and red ginger juice 15ml)	3,75473 _a
P4 (nino fruit juice 80ml and red ginger juice 20ml)	4,40013 _b
P5 (nino fruit juice 75ml and red ginger juice 25ml)	3,75493 _a

Note: Numbers followed by the same letter are not significantly different ($P > 0,05$)

The average distribution of the assessment of the five treatments, the preference for chewiness ranged from 3.49900 to 4.40013, meaning that the level of preference for chewiness in noni juice jelly candy combined with red ginger juice was at the level of slightly liking to liking.

The results of the further BNT test of noni juice jelly candy combined with red ginger juice showed that P4 was significantly different from all treatments, where there was an increase in preference value for each increase in red ginger juice concentration and a decrease in the concentration of noni juice. Treatment P1 had the lowest preference value with the lowest red ginger juice composition, and P4 had the highest preference value with a relatively high red ginger juice composition. However, the preference level in P5 with the highest red ginger composition decreased the panelists' preference for the chewiness of the jelly candy. This is due to the difference in elasticity of jelly candy caused by pH, where pH affects the jelly candy texture (Nur et al., 2024). Meanwhile, a lower pH causes jelly candy to become chewier, but a pH that is too

low will cause jelly candy to produce a gel with a hard texture (Hidayati et al., 2022). Noni fruit has an acidic pH ranging from 3.6 to 4.3 (Harahap, 2019), while red ginger has a pH ranging from 5.6 to 5.9 (Anonymous, 2020). This shows that the higher the concentration of noni juice and the lower the concentration of red ginger juice, the more complex the jelly candy's elasticity tends to be. This condition reduces the panelists' preference value for the elasticity of jelly candy. Conversely, the lower the concentration of noni juice and the higher the concentration of red ginger causes an increase in the panelists' preference value for the elasticity of jelly candy.

4. CONCLUSION

The combination of noni juice and red ginger juice in jelly candy products does not have a significant effect ($p > 0.05$) on the level of elasticity (mm/100g/10sec) of the product. The combination of noni juice and red ginger juice in jelly candy products has a very significant effect ($p < 0.05$) on water content and ash content of the product, where the water content will increase with the increasing concentration of noni juice and decreasing concentration of red ginger juice, while the ash content will increase with the increasing concentration of red ginger juice and decreasing concentration of noni juice. The combination of noni juice and red ginger juice in jelly candy products does not significantly affect ($p > 0.05$) the preference level for color and aroma indicators. However, it has a significant effect ($p < 0.05$) on the preference level for taste and elasticity indicators, where P4 with a composition of 80ml noni juice combined with 20ml red ginger juice, is most preferred by panelists in assessing taste and elasticity.

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