

# Fermented Jelly Candy, Aspects of Lime Mixing Percentage On Its Consistency And Sensory Properties

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## ABSTRACT

This study aims to determine the effect of the combination of fermented noni and lime on consistency and sensory properties. The design used was a completely randomised design (CRD) with one factor, namely the ratio of fermented noni and lime, which were P1 50:50, P2 60:40, P3 70:30, P4 80:20, and P5 90:10. The study was conducted at the Integrated Agroindustry Laboratory, Faculty of Vocational Studies, Untag Surabaya. Data collection consisted of organoleptic test data from 30 panelists and analysis results, namely physical consistency analysis in the form of texture testing using a penetrometer. The analysis results indicate that the optimal formulation for fermented noni jelly candy, serving as a reference for producers to manufacture consumer-preferred fermented noni jelly candy ( ), is a 50:50 ratio of fermented noni to lime.

**Keywords:** Jelly candy, Fermented noni, Lime, Organoleptic test

## 1. INTRODUCTION

Fermented noni juice produced by UD. Manjur Makmur, Lumajang, successfully obtained a distribution permit from the Indonesian Food and Drug Administration (BPOM) in 2022. This beverage is marketed in the Lumajang area, East Java, and even overseas. This fermented beverage contains nutrients such as potassium, zinc, minerals, and vitamin C. Orders at UD. Manjur Makmur use a Make To Order system. This fermented noni fruit beverage has a shelf life of 1 year in liquid form. Therefore, we have innovated to encapsulate the fermented noni fruit beverage to extend its shelf life. One technique for processing food products to extend their shelf life is to reduce their water content, in this case, by turning them into jelly candies (Rosida, 2020).

Mengkudu fruit can be beneficial for boosting immunity, restoring body cells, lowering blood pressure, relieving headaches, stabilising blood sugar, and as an anti-cancer, anti-inflammatory, antibacterial, antioxidant, and anti-allergic agent (Handoko *et al.*, 2003). However, the use of mengkudu fruit itself is still rare because it has a distinctive taste and aroma that many people dislike.

Candy is a type of snack that is loved by people of all ages. Candy can be divided into two types: hard candy and soft candy. The difference between the two types of sweets lies in their texture, where hard sweets have a solid and hard texture, while soft sweets have a soft and elastic

texture with a certain chewiness. According to the (SNI, 2008)), jelly sweets are classified as soft confectionery. Soft jelly confectionery, also known as jelly candy, is a soft confectionery processed with the addition of hydrocolloid ingredients such as agar, gum, pectin, starch, carrageenan, gelatin, and others, which are used to form the texture, resulting in a chewy product that must be moulded and aged before packaging (SNI, 2008). Ageing is the process of storing products under certain conditions and for a certain period of time to produce the desired product characteristics (Mahardika et al., 2014). Jelly sweets are sweets made from water or fruit juice and gel-forming ingredients, giving them a clear and transparent appearance and an elastic texture with a certain chewiness (Bactiar et al., 2017). Jelly sweets are semi-moist foods with a water content of around 10-40% (Pragawati, 2018).

Lime (*Citrus aurantifolia*) is a type of plant that grows widely and is cultivated in Indonesia. Lime is useful for treating coughs, phlegm, and influenza. Lime contains beneficial chemical compounds, such as citric acid, amino acids, essential oils, glycosides, citric acid, fats, calcium, phosphorus, iron, vitamin C, and vitamin B1. Lime is not only beneficial for health but also provides a sour taste and acts as a refresher (Yulia et al., 2022).

The objective of this study is to obtain the appropriate formulation for Fermented Noni Jelly Candy so that it can be utilised by the relevant SMEs or the general public to produce it as a functional food candy.

The scope of this study is limited to fermented noni products produced by UD. Manjur Makmur Lumajang, which may have different production characteristics from other fermented noni products.

### Previous Research Related to Noni Juice

Research by (Sogandi & Nilasari, 2019) revealed that ethyl acetate extract from noni fruit has the potential to inhibit the formation of dental caries through a mechanism of action that is thought to create holes in the cell membrane of *Streptococcus mutans* bacteria, which cause dental caries. In addition, it is known that the dominant bioactive compound in noni fruit extract is a quinolone compound.

Research by (Rarahayu, 2020) explains that 268 grams of noni fruit, peeled and cut into pieces, yielded 63 grams of flesh. After being blended until smooth and filtered through an 80-mesh sieve, this produced 30 grams of noni juice. This means that the productivity of noni fruit in producing juice is 11%.

Research by (Wahyudi et al., 2022), shows that noni fruit (*Morinda Citrifolia L.*) is an effective antihypertensive plant containing several compounds, namely prexeronin (*endothelial vasoactive*), scopoletin (*causes vasodilation*) and xeronine (*diuretic effect*).

Meanwhile, research by (Cahyani & Widodo, 2024) states that fermented noni fruit encapsulation can be an alternative to consuming noni fruit in a more palatable way without tasting the bitterness and astringency of noni. Noni encapsulation has a longer shelf life compared to fermentation in liquid form.

The excellent health benefits of noni fruit for humans must be balanced with product performance to be organoleptically appealing. Therefore, new ideas are needed to produce products that are liked by consumers but still have significant health benefits. One idea that emerged was the encapsulation of fermented noni juice, but consumers still did not like it because its form resembled medicine, meaning that encapsulated products were associated with medicine, not food, let alone functional food.

The next idea is to change the physical form of fermented noni juice into a popular snack, namely jelly candy. However, formulation adjustments are needed compared to making regular jelly candy, especially to eliminate the pungent smell and bitter taste of fermented noni juice. The effort is to add lime juice. In this study, several combinations of different amounts of lime were tested to determine the right amount so that the product is truly liked by consumers.

## 2. RESEARCH METHOD

### Research Tools and Materials

The equipment used in the production of jelly candy included: a blender, analytical scales, measuring cups, sieves, pots, stoves, stirrers, baking trays, silicone moulds, basins, and refrigerators. The equipment used for analysis included: an oven, porcelain dishes, Erlenmeyer flasks, electric furnaces, and Objective Precision Scientific Penetrometers.

The materials used in making jelly candy include: fermented mengkudu obtained from a small and medium-sized enterprise (SME) under the guidance of Untag Surabaya, namely CV. Manjur Makmur Lumajang; lime obtained from the Semolowaru market in Surabaya; "Gulaku" brand granulated sugar; unbranded gelatin obtained from the "88" bakery supply store in Surabaya; "Swallow Globe" brand plain (unflavoured) agar; and water. Materials for analysis include: n-Hexane (solvent).

## Research Design and Procedure

This research was an experiment using a completely randomised design (CRD) with one factor, namely the combination of fermented noni and lime, consisting of 5 (five) treatment combinations with 3 (three) replicates each, resulting in 15 (fifteen) experimental units.

Table1 . Jelly Candy Formulation

Treatment	Fermented Noni (ml)	Lime Juice (ml)	Granulated Sugar (g)	Gelatin (g)	Agar (g)
P1	50	50	60	10	1.5
P2	60	40	60	10	1.5
P3	70	30	60	10	1.5
P4	80	20	60	10	1.5
P5	90	10	60	10	1.5

Description:

- P1 = fermented noni 50 ml : lime juice 50 ml
- P2 = fermented noni 60 ml : lime juice 40 ml
- P3 = fermented noni 70 ml : lime juice 30 ml
- P4 = fermented noni 80 ml : lime juice 20 ml
- P5 = fermented noni 90 ml : lime juice 10 ml

## Research Implementation Stages

The implementation stages of this research were carried out according to the steps below:

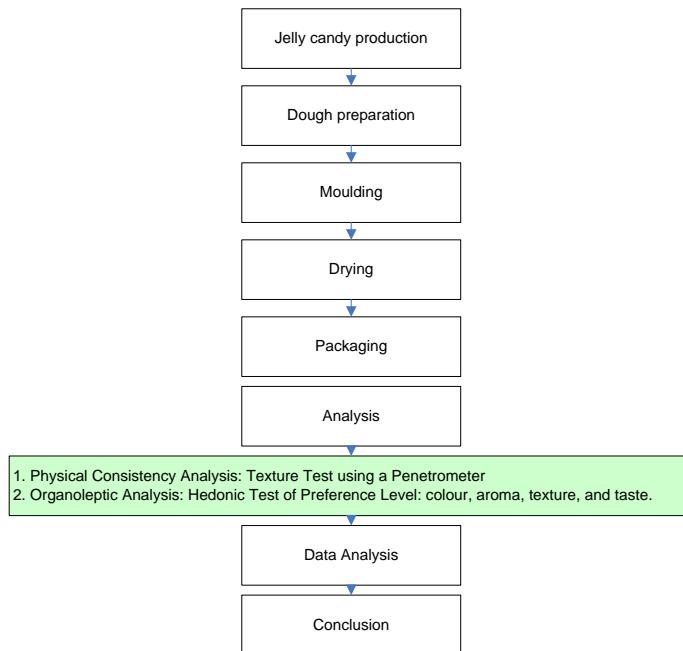


Figure 1. Research framework stages

## RESULTS AND DISCUSSION

### Physical Test (Chewiness) of Jelly Sweets

The chewiness of jelly sweets is one of the main characteristics of the product. Chewy jelly sweets are caused by the mixing of gelatin and granulated sugar in the manufacturing process. Physical testing using a penetrometer conducted on fermented noni jelly candy with added lime showed an average elasticity level of 108.3-124.19 mm/100g/10sec, as presented in Table 2. Meanwhile, the results of the variance analysis are presented in Table 3.

Table 2. Average Firmness Values of Fermented Noni Jelly Candy

Treatment	Average Firmness
P1	108.2667
P2	119.2667
P3	124.2667
P4	123.6667
P5	124.1993

Table 3. Analysis of variance of the elasticity level of fermented noni jelly candy

Source of variation	Df	Sum of squares	Mean Square	F	Sig.
Treatment	4	16,892.133	4,223.033	14,141	0.000
Error	70	20,904.533	298,636		
Total	74	37,796.667			

Based on the results of the variance analysis, a p-value of 0.000 was obtained, indicating that the formulation with lime has a very significant effect on the softness of fermented noni jelly candy. Further investigation was conducted using the BNT test, which showed that the more noni added to the formulation, the softer the texture of the jelly candy became. This is because the more noni added, the higher the water content of the jelly candy dough, resulting in a weaker gel structure and a softer final texture of the jelly candy. According to (Grace & Nurali, 2021), panelists preferred a chewy jelly candy texture that was not too soft.

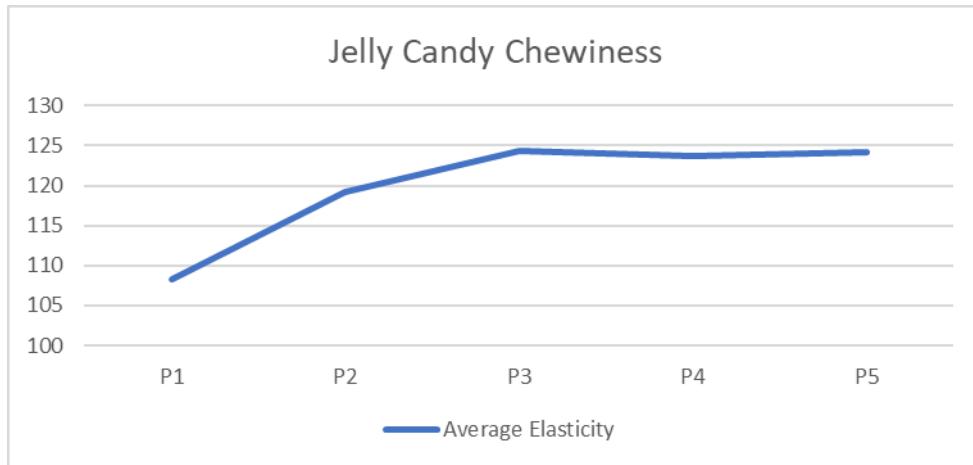


Figure 2. Chewiness based on Physical Testing

### Organoleptic Test

Organoleptic testing is conducted to determine the quality and level of preference or acceptability of a product so that it can be accepted by panelists (consumers). Organoleptic testing in this study used a hedonic scale, namely the level of preference with parameters of colour, aroma, taste and texture (chewiness).

#### Colour

Colour is an important factor in food products, as it can influence consumer appeal and interest (Marlina et al., 2023). Colour is often the initial assessment of a product; an attractive colour tends to increase consumer interest and preference (Yuliasanti et al., 2025). The average panelist preference for the colour of fermented noni jelly candy is presented in Table 4.

Table 4. Average Panelist Preference Scores for the Colour of Fermented Noni Jelly Candy

Treatment	Average colour	Standard Deviation
P1	4.2270	0.94
P2	4.3996	0.89
P3	3.3117	0.94
P4	3.3998	0.93
P5	2.6146	0.97

Based on the results of the variance analysis, it is known that the p-value = 0.852, indicating that the formulation has a significant effect on the colour of fermented noni jelly candy. Further investigation was conducted using the Least Significant Difference (LSD) test, which was not performed because the addition of moringa leaf extract had a significant effect on the colour of fermented noni jelly candy. Fermented noni pulp is dark green in colour, while lime is slightly



green. The addition of noni up to 90% had a different effect on the colour of the jelly candy, so the panelists gave different ratings for all treatments.

### Aroma

Aroma is an important aspect of food products because it reflects the characteristics of the main ingredients used, thereby influencing consumer interest (Marlina et al., 2023). Aroma acts as a secondary indicator in product evaluation because it can quickly provide an overview of consumer acceptance (Islamiah et al, 2019). The average panelist preference scores for the aroma of fermented noni jelly candy are presented in Table 5, while the results of the analysis of variance are presented in Table 6.

Table 5. Average Panelist Preference Scores for Jelly Candy Aroma

Treatment	Average aroma
P1	3.6147
P2	3.6147
P3	3.3997
P4	3.4990
P5	3.2269

Table 6. Analysis of variance of panelists' preference for jelly candy aroma

Source of variation	Sum of squares	DF	Mean square	F	Sig.
Treatment	.000	4	.000	.000	1,000
Error	123,776	145	.854		
Total	123,776	149	.854		

Based on the results of the variance analysis, it is known that the p-value = 1.000, indicating that the formulation does not have a significant effect on the aroma of jelly candies.

### Taste

Taste is a major factor that greatly determines the level of consumer acceptance of a product (Irawan et al., 2017). In general, consumers highly consider taste when evaluating food products, as taste is the main determinant of the product's suitability (Marlina et al., 2023). The results of the panelists' preference test for the taste of jelly candy can be seen in Table 7, while the results of the analysis of variance are presented in Table 8.



Table 7. Average Panelist Preference Scores for Jelly Candy Flavour

Treatment	Average Taste	Standard Deviation
P1	3.9396	.94303
P2	3.6144	.94555
P3	3.2270	.92722
P4	3.2269	.96273
P5	3.2270	.96139

Table 8. Analysis of variance of panelists' preference for jelly candy flavour

Source of variation	DF	Sum of squares	Mean square	F	Sig.
Treatment	4	14.936	3,734	4,154	,003
Error	145	130,332	,899		
Total	149	145,268			

Based on the results of the variance analysis, it is known that the p-value = 0.003, which indicates that the formulation has a significant effect on the taste of fermented noni jelly candy. The highest level of preference for the P1 jelly candy formula by the panelists may be due to the small amount of noni (50%) contained in the jelly candy formula, so that the aroma and bitter taste of noni can still be covered by the lime flavour. Conversely, the lowest level of preference for jelly candy formulations P3, P4 and P5 by the panelists may be due to the fact that the more noni there is, the stronger the taste of noni, which is less preferred.

### Texture

According to (Pratiwi et al., 2016), texture is a sensation of pressure that can be felt using the fingers when pressed or the mouth when bitten and chewed. The results of the panelists' preference test for the taste of jelly candy can be seen in Table 9, while the results of the analysis of variance are presented in Table 10.

Table 9. Average Panelist Preference Scores for Jelly Candy Texture

Treatment	Average texture	Standard Deviation
P1	3.3998	.96421
P2	3.3120	.95707
P3	3.2269	.90230
P4	3.2270	.95086
P5	2.6146	.94708



Table 10. Analysis of variance of panelists' preference for jelly candy texture

Source of variation	Sum of squares	DF	Mean square	F	Sig.
Treatment	11.426	4	2,856	3,202	.015
Error	129,367	145	.892		
Total	140,793	149			

Table 11. Average Results of Organoleptic Tests

Treatment	Colour	Aroma	Taste	Texture	Average
P1	4.2270	3.6147	3.9396	3.3998	3.7953
P2	4.3996	3.6147	3.6144	3.3120	3.7352
P3	3.3117	3.3997	3.2270	3.2269	3.2913
P4	3.3993	3.4990	3.2269	3.2270	3.3381
P5	2.6146	3.2269	3.2270	2.6146	2.9208

Results of Organoleptic Testing of Fermented Mengkudu Jelly Candy

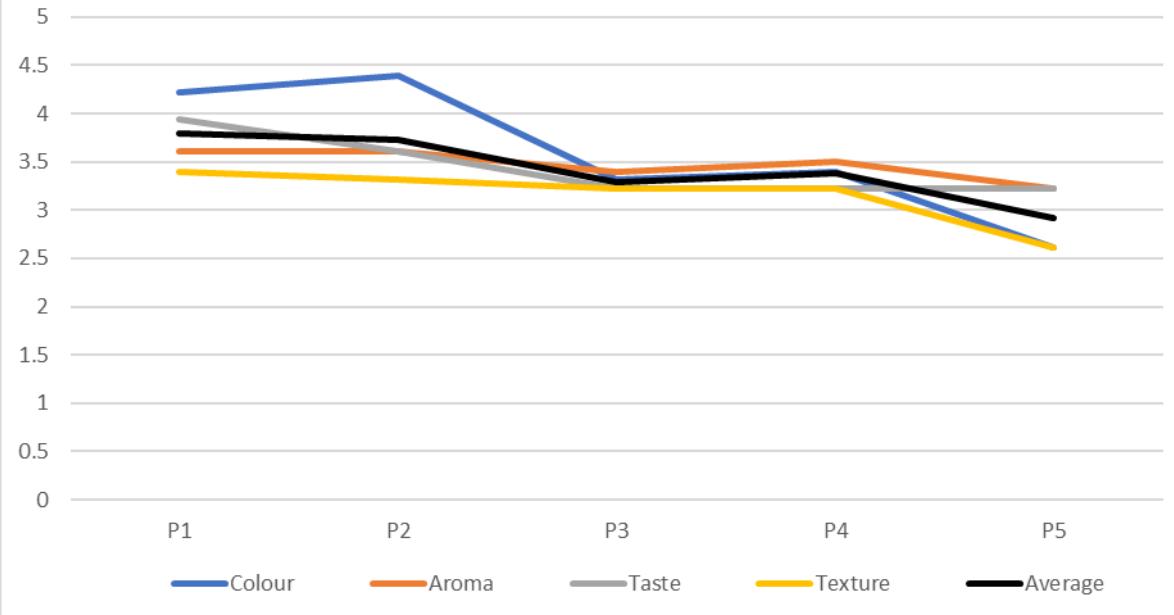


Figure 2. Organoleptic Test Results

Based on the results of the variance analysis, it is known that the p-value = 0.015, indicating that the formulation has a significant effect on the texture of fermented noni jelly candy. When the above texture test is compared with the physical texture test using a penetrometer, treatment P1 (fermented noni: lime 50:50 formulation) is the treatment with the hardest texture. This indicates that the panelists prefer jelly candies with a non-soft texture. According to (Sachlan,

Putri. Mandey, 2019), the texture of jelly candy is not only related to taste and gel strength, but also to the water content of the jelly candy. The slightly soft texture of jelly candy is thought to be due to its high water content, which was less preferred by the panelists. Based on the average data for each organoleptic test treatment, it can be concluded that treatment P1 (a 50:50 ratio of noni and lime) was the most preferred by the panelists.

## CONCLUSION

At the end of this research process, conclusions can be drawn about the effect of the combination of fermented noni jelly candy formulations. Based on the results of physical, chemical, and organoleptic tests, it can be concluded that:

1. Consumers tend to consider the jelly candy produced to be organoleptically acceptable in terms of colour, aroma, texture and taste. Only the aroma test showed no significant difference between treatments.
2. There is a tendency that the less fermented noni fruit added, the more organoleptically acceptable the product is. Therefore, treatment P1, which is a 50:50 formulation of fermented noni and lime, is the treatment most preferred by the panelists.

## Recommendations

Further research is needed with the addition of other herbal products that have a stronger aroma than lime to eliminate the musty smell of fermented noni. Research is also needed on the addition of additives or food additives in the form of flavour enhancers that can also eliminate the undesirable taste of fermented noni.

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