Use of Lime as an Acidity Regulator and Soybean Extract as a Nitrogen Source in Nata Decoco

Titik Suryani[1, *], Arsihti Dwi Putri Indratyaseta[2],
[1,2]Prodi Pend Biologi, FKIP, Universitas Muhammadiyah Surakarta,'
[2] Alumni Prodi Pend Biologi, FKIP, Universitas Muhammadiyah Surakarta,
Email : ts169@ums.ac.id

Abstract

Nata is a fermented food resulting from the growth of Acetobacter xylinum which contains cellulose. Coconut water as a substrate and lime juice as an acidity regulator and soybean extract as a nitrogen source of the fermentation process to produce nata. The aim of this research was to determine the fiber content and organoleptic quality of nata de coco with variations in the concentration of lime juice and soybean extract. This research method used completely randomized design (CRD) with a factorial pattern with 2 factors. The first factor : concentrations of lime juice 1% and 2%, The second factor : concentrations of soybean extract 10%, 15% and 20% with 3 repetitions. The results showed that the highest fiber content of nata de coco was the N1K3 treatment (1% lime juice and 30% soybean extract) at 3.71%. The organoleptic quality of nata was dense texture, yellowish white color, quite sour, the most preferred, thickness of 1.6 cm as well as yield of 78.4%.

Keywords: *Nata, coconut water, lime, soybeans, fiber, organoleptic quality*

Abstrak

Nata merupakan salah satu pangan hasil fermentasi dari pertumbuhan *Acetobacter xylinum yang* mengandung selulosa. Air kelapa sebagai substrat dan sari jeruk nipis sebagai pengatur keasaman serta ekstrak kedelai sebagai sumber nitrogen dalam proses fermentasi untuk menghasilkan nata. Tujuan penelitian ini untuk mengetahui kadar serat dan kualitas organoleptik nata de coco dengan variasi kosentrasi sari jeruk nipis dan ekstrak kedelai. Metode penelitian ini menggunakan Rancangan Acak Lengkap (RAL) pola faktorial dengan 2 faktor. Faktor1: konsentrasi sari jeruk nipis (1% dan 2%) dan factor 2 : ekstrak kedelai (10%, 15%, dan 20%) dengan 3 kali ulangan. Hasil penelitian menunjukkan bahwa kadar serat nata de coco tertinggi pada perlakuan N1K3 (sari jeruk nipis 1% dan ekstrak kedelai 30%) sebesar 3,71 % dan kualitas organoleptik nata tekstur padat, warna putih kekuningan, cukup asam,paling disukai, dan ketebalan 1,6 cm serta rendemen sebesar 78,4%.

Kata kunci*: Nata, air kelapa, jeruk nipis, kedelai, serat, kualitas organoleptik*

INTRODUCTION

Nata is a fermented food product resulting from the growth of Acetobacter xylinum like agar, has a chewy texture, is white in color, and contains cellulose. Nata is formed from the growth of Acetobacter xylinum on the surface of a liquid medium that is acidic and contains sugar. The prospect of nata continues to increase and market demand for nata de coco is quite high, both domestically and nationally. According to research by the LIPI Biology Research and Development Center, the nutritional content of nata per 100 g of nata contains 80% water, 20 g carbohydrates, 146 calories, 20 g fat, 12 mg calcium, 2 mg phosphorus and 0.5 mg ferrum (iron). Nata is very good to consume because it contains fiber which is very good for human digestion. The fiber in nata is produced by the starter Acetobacter xylinum (Kumalaningsih, 2014). Acetobacter xylinum is a bacteria that is used to form nata in liquid media which functions as a starter. The research results of Ihsan H and Titik S (2020) showed that the crude fiber content of nata de cherry was highest and the best quality of nata in the treatment of 1% lime extract and 25% green bean extract was 4.08 and the texture was supple, yellowish white in color, and the aroma was good. acidic, very favorable acceptability, thickness 1.13 cm, and yield 58%.The research results of Arifin and Titik S (2020) showed that the highest nata de kersen fiber content in the treatment of 13% starfruit extract and 15% cowpea extract was 5.15% with a thickness of 1.45, a yield of 56.4% and the best quality of nata. starfruit extract 11% and cowpea 15%, chewy texture, cloudy white, not sour and most liked by panelists.Apart from that, the success and quality of nata is influenced by several factors including the carbon source, pH

regulator in the fermentation process and the nitrogen source.

Carbon sources are very important for the growth of Acetobacter xylinum bacteria, obtained by breaking down carbohydrates which are converted into cellulose by Acetobacter xylinum. An alternative ingredient that can be used as a carbon source can be coconut water. Good quality, fresh coconut water has a sweet, fragrant taste and an acidity level of around 6-7. The nutritional content that is quite complete in coconut water is an excellent medium for microbial growth. According to research by Ningsih (2021), the use of fermentation media in the form of coconut water can produce nata with a chewier texture and a distinctive aroma of fragrant coconut water.

Apart from a carbon source as a medium for nata formation, the growth of Acetobacter xylinum requires a nitrogen source and pH regulator. In general, nata is produced with inorganic materials, namely a nitrogen source, namely urea/ZA and using vinegar as an acidity (pH) regulator. However, if inorganic ingredients are consumed continuously, it will have an impact on health, so there is a need for innovation in making nata with organic ingredients. In this research, nata was made using organic ingredients as an alternative to inorganic ingredients, namely soybeans as a substitute for urea/ZA and lime as a substitute for vinegar.

Acetobacter xylinum bacteria are able to form nata through an aerobic fermentation process in an acidic medium that has a pH of 3-6 with sufficient nutritional content. An acidic atmosphere in the bacterial growth medium can be obtained by adding acetic acid or glacial vinegar. However, the addition of vinegar will cause an unpleasant aroma, so it requires further action after harvesting nata, namely repeated soaking and boiling so as not to cause an unpleasant sour aroma, so the solution can be using lime juice (Citrus aurantifolia L. .) as a regulator of acidity in the media. (Nurhayati, 2006). Based on research results from Iryandi (2014), the addition of lime juice to nata de soya affects the thickness and duration of fermentation. The concentration of lime juice used in nata media is 1%, 2.5% and 5%.

Lime (Citrus aurantifolia L.) has the highest citric acid content compared to other types of citrus, namely 7% (Khotimah, 2002). Lime juice (Citrus aurantifolia L.) has a sour taste and distinctive aroma, so it is hoped that the resulting nata will have a fresh and distinctive aroma with more practical post-harvest handling. Apart from that, by giving lime juice you can achieve an optimal acidity level with a pH of 4.3 (Wijayanti, 2012).

The nitrogen source that is often used in making nata is an inorganic nitrogen source. However, the use of inorganic nitrogen sources can have an impact on health, so you can use alternative organic materials to replace nitrogen sources for making nata, one of which is soybeans (Glycine max) (Alfiana, 2021). The protein content of soybeans (Glycine max) is 35%, even superior varieties have protein levels that can reach 40-43% higher than other types of beans (Sinaga, 2013). Syarhani's (2008) research results show that nitrogen sources from soybeans have an effect on starter and nata production.

The combination of nutritional sources contained in lime juice (Citrus aurantifolia L.) and soybeans (Glycine max) can supply the nutritional needs needed for the growth of Acetobacter xylinum. This is in accordance with the research results of Anggraeni (2015), the thickness of the nata will be thicker with the administration of a lower concentration of lime juice and the administration of a higher concentration of green bean sprout extract. Meanwhile, the water content of nata is small because it adjusts to the thickness of the nata produced.

The aim of this research was to determine the fiber content and organoleptic qualities of nata de coco with lime juice as an acidity regulator and soybean extract as a nitrogen source.

METHOD

This research was carried out at the Industrial Microbiology Laboratory, FKIP Biology, UMS. This research was an experimental method with a completely randomized design (CRD), 2 factors. The first factor: lime juice concentration (N): 1% (N1) and 2% (N2) of the medium volume. Second

factor: concentration of soybean extract (K): 10% (K1), 15% (K2), and 20% (K3) of the medium volume, 3 repetitions of each treatment. The tools and materials used in this research were measuring cups, 500ml glass beakers, thermometers, autoclaves, test tubes, LAF, glass stirrers, digital scales, calipers, coconut water, palm sugar, limes, Axetobacter xylium starter, soybeans (Glycine max),

The research implementation procedure begins with the preparation stage of equipment (sterilization) and materials, then the stage of making nata media, lime juice, nutrition from soybean extract. The next stage of implementation is by adding starter and soybean extract to the nata media, adjusting the degree of acidity (pH) with lime juice in the nata fermentation process. Next, harvesting, soaking and boiling were carried out, then fiber content testing was carried out using the gravimetric method and organoleptic tests as well as community acceptability involving 20 panelists, the thickness and yield of nata were measured. To find out the results of the nata research, the data was analyzed using descriptive quantitative and descriptive qualitative . Quantitative descriptive is to test fiber content, while qualitative descriptive is to test organoleptic quality. Analysis of quantitative data testing using a two-way analysis of variance test (Two Way ANOVA) and qualitative analysis using Excel.

RESULTS AND DISCUSSION (RESULTS AND DISCUSSION)

Nata Quality (Fiber Content, Thickness, and Yield)

Table 3.1. Results Average Fiber Content, Thickness, Nata Yield

Treatment	Fiber Content (%)	Thickness (cm)	Rendement (%)
N1K1	2.62	1	64.4
N2K1	2.29 *	0.95*	62*
N1K2	2.93	1,2	65.2
N2K2	3.21	1.4	73.8
N1K3	3.71 **	1.6**	78.4**
N2K3	3.18	1.4	69.6

Information:
** :highest fiber content,
**:Highest yield
* :lowest fiber content
*:Lowest yield
** :highest thickness
* :lowest thickness
N1K1: Lime juice 1% + soybean extract 10%
N2K1: lime juice 2% + soybean extract 10%
N1K2: lime juice 1% + soybean extract 15%
N2K2: Lime juice 2% + soybean extract 15%
N1K3: lime juice 1% + soybean extract 20%
N2K3: lime juice 2% + soybean extract 20%

Nata Fiber Content

The results of the highest fiber content for nata decoco in the N1K3 treatment (1% lime juice and 20% soybean extract) were 3.71%, while the lowest fiber content for nata in the N2K1 treatment (2% lime juice and 10% soybean extract) was 2. 29%. The high fiber percentage is influenced by the activity of Acetobacter xylinum in the metabolism of glucose into cellulose. The optimal activity of Acetobacter xylinum is influenced by the optimal acidity level (pH) in the media with the addition of 1% lime juice concentration.

By adding a little lime juice, the acidity level of the nata media can be more optimal, whereas adding a lot of lime juice causes the media to be too acidic, resulting in the activity of Acetobacter xylinum being less than optimal (Iryandi, 2014). A nutritional source from soybean extract as a source of nitrogen which is quite abundant in nata media is very much needed so that it produces high fiber if the nutritional needs of Acetobacter xylinum are met (Wahyuni, 2019).

The fiber content in all treatments was still in accordance with the fiber content in nata quality requirements (SNI 01-4317-1996), namely a maximum of 4.5%. In control nata (commercial nata) the fiber content is also below 4.5%, so nata has the same fiber content range as control nata (commercial nata) even though it

is made using organic ingredients. This shows that nata with the addition of lime juice and soybean extract meets the fiber content standards for consumption.

Nata fiber content that is less than optimal as in the N2K1 treatment (2% lime juice and 10% soybean extract) can be influenced by media that is too acidic due to the addition of a fairly high concentration of orange juice and too little amount of soybean extract nutrients, causing Acetobacter xylinum to not can form cellulose optimally. This is in accordance with the research results of Marlinda (2019) which stated that the growth of Acetobacter xylinum was hampered because cell metabolism lacked the nutrients needed to form the nata cellulose layer so that the activity of Acetobacter xylinum was hampered.

The addition of lime juice showed that the data was normally distributed and homogeneous (Sig > 0.05), while the addition of soybean extract showed that the data was not normally distributed and not homogeneous (Sig < 0.05). The results of further testing of lime juice concentration using the Kruskal Wallis method showed Asymp Sig. 0.965 > 0.05 so it can be stated that H0 is accepted, which means there is no significant influence of lime juice concentration on nata fiber content. However, giving soybean extract to nata fiber content showed Asymp results. Sig. 0.025 < 0.05 so it can be stated that H0 is rejected, which means there is a significant effect of giving soybean extract on nata fiber content. Further test results using the Two Way Anova method to analyze the interaction between variations in the concentration of lime juice and soybean extract on nata fiber content showed Fhit 12,141 and Ftab 4.49 so Fhit > Ftab, this means that H0 was rejected so there was an interaction between the concentration of orange juice lime and soybean extract on nata fiber content. The results of statistical tests show that variations in the concentration of lime juice have no effect on the fiber content of nata, while soybean extract has an effect on the fiber content of nata.

Nata thickness

The highest nata thickness test results were in the N1K3 treatment (1% lime juice and 20% soybean extract) at 1.6 cm. Meanwhile, the lowest nata thickness in the N2K1 treatment (2% lime juice and 10% soybean extract) was 0.95 cm. The availability of sufficient nutrients can support the activity of Acetobacter xylinum in forming a cellulose layer. As long as nutrients are available, the cellulo layer formed will become thicker. The smaller the concentration of lime juice added, the higher the thickness of the nata, and vice versa, if the concentration of lime juice is greater, the thickness of the nata is less than optimal. This is in accordance with the research results of Aini (2019) which states that adding a large concentration of lime juice to the fermentation media makes the media more acidic. The thickness of nata is higher if the concentration of soybean extract is added more and more, this is in accordance with the results of research by Hamad (2013) which states that the more nitrogen sources added in nata decoco fermentation will increase the activity of Acetobacter xylinum in producing cellulose.

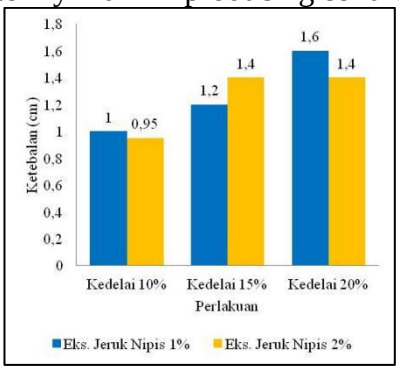

Figure 3.1 Nata Thickness Results

Nata's rendition

The highest nata yield in the N1K3 treatment (1% lime juice and 20% soybean extract) was 78.4%. Meanwhile, the lowest nata yield was in the N2K1 treatment (2% lime juice and 10% soybean extract) at 62%. The difference in nata yield is influenced by the acidity level (pH) of the media from the addition of lime juice and soybean extract as a nitrogen source. Adequate nutrition greatly influences Acetobacter xylinum to produce a cellulose layer. The thicker the cellulose layer, the greater the yield. This is in accordance with Pratiwi (2015) who states that the yield is directly proportional to the thickness and weight of the nata, this means that the higher the thickness of the nata, the higher the yield.

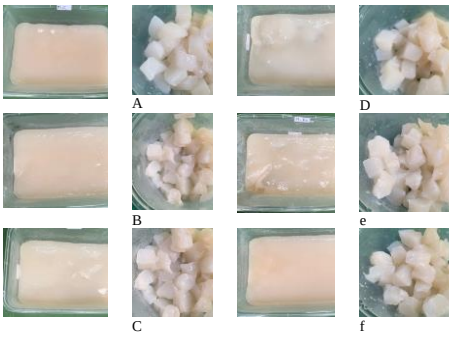

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Figure 3.3 Nata decoco results

Description: 1) N1K1: 1% lime juice + 10% soybean extract, 2) N2K1: 2% lime juice + 10% soybean extract, 3) N1K2: 1% lime juice + 15% soybean extract 4) N2K2: 2% lime juice + 15% soybean extract 5) N1K3: 1% lime juice + 20% soybean extract 6) N2K3: 2% lime juice + 20% soybean extract

Nata Organoleptic Quality and Acceptability)

Table 3.2 Results of Organoleptic Quality and Acceptability of Nata

Treatment	Aspect			
	Texture	Color	Aroma	Acceptability
N1K1	Springy	Yellowish White	Simply Sour	Like
N2K1	Chewy enough	Yellowish White	Simply Sour	Like
N1K2	Springy	Yellowish White	Simply Sour	Like
N2K2	Springy	Yellowish White	Simply Sour	Like
N1K3	Springy	Yellowish White	Simply Sour	Really like
N2K3	Springy	Yellowish White	Simply Sour	Like

Description: 1) N1K1: 1% lime juice + 10% soybean extract, 2) N2K1: 2% lime juice + 10% soybean extract, 3) N1K2: 1% lime juice + 15% soybean extract, 4) N2K2 : lime juice 2% + soybean extract 15%, 5) N1K3 : lime juice 1% + soybean extract 20%, 6) N2K3 : lime juice 2% + soybean extract 20%.

The texture in the N1K3 treatment (1% lime juice and 20% soybean extract) was the chewiest because the crude fiber content was the highest compared to the other treatments. According to Marvianie (2014) total cellulose fiber content is related to fiber content because fiber has a dense and interconnected structure. The ratio between fiber and elasticity is directly proportional, the more nata fiber content, the chewier the texture (Alfiana, 2021). The color of the nata before processing is brownish white, then the color of the nata becomes yellowish white after boiling. The color of the nata in all treatments was yellowish white, while the control nata was white/transparent white. The color of nata is greatly influenced by the type of substrate and source of nutrients, this is because soybean extract is cloudy yellow. Adding sprout filtrate to the media during the boiling process causes the color of the media to change to yellowish white.

The aroma of nata in all treatments was quite sour, while the control nata had a non-sour aroma. According to Putriana (2013), in nata fermentation, saccharomyces breaks down sugar into ethanol by Acetobacter xylinum and Gluconobacter oxidizing it into acetic acid and water so that the pH of the medium becomes more acidic, namely 3 and the aroma also becomes sour. This is also because the nata undergoes processing that is not the same as the control nata so that the resulting aroma is quite sour and different from the control nata. Another factor that influences the aroma of nata in all treatments is that it is quite sour because boiling is not long enough so that the sour aroma of nata is still there. The acceptability of nata in all treatments showed liking except in the N1K3 treatment (1% lime juice and 20% soybean extract). The acceptability was very favorable, the same as the control nata. The panelists' acceptance was influenced by the texture, aroma and color of the nata. The majority of panelists liked nata so that this processed nata product could be used as an alternative to nata de coco with organic ingredients.

CONCLUSION

The best fiber content of nata decoco in the N1K3 treatment (1% lime juice and 20% soybean extract) was 3.71%, thickness 1.6 cm, and yield 78.4%, as well as organoleptic properties of nata with a chewy texture, yellowish white color, The aroma is quite sour, and the reception is very pleasant.

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