Emirates Journal of Food and Agriculture. 2023. 35(12): 1-5
doi: 10.9755/ejfa.2023.3196
http://www.ejfa.me/

RESEARCH ARTICLE

Nata de durio: the utilization of durian seeds as a glucose source in the production of bacterial cellulose gel

Tri Sutriani Syam[1], Syahrijuita Kadir[2], Ika Yustisia[2]

[1]Master Program of Biomedical Science, Graduate School Hasanuddin University, Makassar, South Sulawesi, Indonesia, [2]Department of Biochemistry, Faculty of Medicine, Hasanuddin University, Makassar, Indonesia Jl. Pioneers of Independence No.KM.10, Tamalanrea Indah, Kec. Tamalanrea, Makassar City, South Sulawesi, 90245, Indonesia

ABSTRACT

Durian seeds are a waste product from durian fruit. Durian seeds are often used by people as the main ingredient in making bread and cakes. However, the use of durian seeds as the main ingredient in making nata has never been done. Nata is extracellular cellulose obtained from the activity of the bacteria Acetobacter xylinum. The nata that is often found is nata de coco made from coconut water as the main ingredient. This research aims to look at the formation of nata de durio from durian seeds. The results showed that different dry weights of durian seeds did not affect the thickness of the Nata De Durio formed. The thickness of Nata De Durio on days 7 and 14 was highest at a dry weight of 250 grams of durian seeds with an average of 0.4 and 0.5 cm and the lowest was at a dry weight of 100 grams of durian seeds with an average of 0. 3 and 04 cm. **Conclusion:** The difference in dry weight of durian seeds does not affect the thickness of Nata De Durio. However, the dry weight of 250 gram durian seeds has a better Nata De Durio thickness compared to the dry weight of 100 grams and 200 grams of durian seeds.

Keywords: Durian seeds; Thickness; Nata De Durio

INTRODUCTION

Durian (Durio zibethinus Murr.) is a commercial tropical fruit that is very popular with the public. Durian fruit production every time it enters the season always increases in line with market demand for this healthy and nutrient-rich fruit (Ho and Bhat, 2015). Of the entire fruit, only the flesh can be consumed directly by the public, while the durian skin and seeds will become waste. It is reported that one durian fruit produces 70% waste in the form of seeds, and 20-25% in the form of skin or shell, all of which are inedible (Natania and Wijaya, 2022).

Durian seeds actually contain nutritional elements that are very beneficial for the body, which not many people know about. Several previous studies have analyzed the content of durian seeds. The nutritional content in durian seed flour is 85.4 grams of carbohydrates, 1.14 grams of fat, 98 mg of calcium, and 13 mg of phosphorus (Verawati, 2017, Verawati and Yanto, 2019). The relatively high carbohydrate content in durian seeds can be used as a basic ingredient for making nata, considering that the general requirement for making nata is that the basic ingredient used has a fairly high carbohydrate (glucose) content. Without glucose, nata cannot be formed (Irhamniah, 2018).

Nata is a layer of extracellular polysaccharides (cellulose) in the form of fine threads or a thin layer in gel form, has a chewy texture, and is milky white or clear in color.which is produced by the work of the bacteria Acetobacter xylinum (Safitri et al., 2017). The nata component is bacterial cellulose because Acetobacter xylinum metabolizes the sugar in the medium and adds it to the cellulose which has unique properties as a nanofiber (Toda, 2016). The nata that is often found is nata de coco made from coconut water as the main ingredient which was first discovered in the Philippines. The quality in making nata is caused by several factors such as carbon source, nitrogen source and fermentation pH. The carbon source is obtained from the carbohydrate content in durian seeds and the addition of sugar, the nitrogen source is obtained from inorganic or organic materials, for example sprout extract as a source of

***Corresponding author:**
Syahrijuita Kadir, Department of Biochemistry, Faculty of Medicine, Hasanuddin University, Makassar, Indonesia Jl. Pioneers of Independence No.KM.10, Tamalanrea Indah, Kec. Tamalanrea, Makassar City, South Sulawesi, 90245, Indonesia. **E-mail:** syahrijuitakadir@yahoo.com

Received: 10 July 2023; **Accepted:** 17 November 2023

nutrition for the growth of Acetobacter xylinum (Suzanni et al., 2020). The quality of nata is also influenced by the pH of the substrate, because Acetobacter xylinum bacteria are able to grow optimally at a pH of 4.3 (Sutanto and Rahayuni, 2013).

The main use of Acetobacter xylinum is to produce nata in all fields of biotechnology. In this research, researchers used pineapple extract to naturally obtain Acetobacter xylinum bacteria which will be used as a starter in making nata de durio. Fermented pineapple extract can naturally produce Acetobacter xylinum which will work to form nata from the cellulose produced (Majesty et al., 2015).

Making nata is one way to utilize durian waste into useful products. Research regarding the use of waste durian seeds, especially the Sawerigading variety, which is a local variety in Palopo City, South Sulawesi, into nata de durio has never been carried out before, therefore this research was carried out with the aim of seeing the effect of the concentration of durian seeds used in making nata de durio on The nata formation process can be seen from the thickness of the nata de durio that is formed.

RESEARCH METHODS

Making pineapple extract starter

A starter is a microbial population in physiological numbers and conditions that is ready to be inoculated into the fermentation medium.Making a starter from pineapple extract begins with peeling and cutting one young pineapple, then washing it until clean and mashing it using a blender. Next, the pineapple is squeezed and the pulp is taken. Pineapple pulp is then added with sugar and water in a ratio of 2:1:1. Then stir the mixture until smooth, then put it in a tightly closed bottle and leave it for 14 days at room temperature until a white layer forms on the mixture. The water from the mixture contains Acetobacter xylinum bacteria which will be used as a starter (Ferdiansyah et al., 2018).

Durian seed varieties

This research used durian seeds taken from the Sawerigading durian variety. This variety is a type of local durian that is widely developed in Palopo City, South Sulawesi.

Making nata de durio

Durian seedsThe ones used are large in size so that when you peel them there are a lot of seeds. The durian seeds that have been sorted are then washed repeatedly until clean, then boiled for 5 minutes, after which they are peeled. Durian seeds that have been peeled, sliced thinly using a slicer. The durian seed slices are then soaked in salt for 5-10 minutes, then dried directly in the sun. The drying process is carried out until the durian seed slices are dry. After drying, the durian seed slices are put into a blender with different dry weight variations, namely 100 grams, 200 grams and 250 grams. and add 600 ml of distilled water, then blend until smooth then filter to separate the solution from the dregs. The solution was cooked and 60 grams of sugar was added, 12 mL of bean sprouts solution and 30 mL of acetic acid were added while boiling, allowed to continue boiling while stirring for ± 3 minutes, then the pH was measured. The solution is put into jam bottles of 200 ml each, then covered with sterile paper and the lid is tightened with rubber or string, wait until it cools. After cooling, then add 250 ml of pineapple extract starter. Next, the container was closed again with plastic warp, covered with paper and incubated at room temperature. This container must not be disturbed or shaken. The effect of fermentation on the formation of nata de coco was seen on days 7 and 14 (Masri et al., 2020).

Nata thickness measurement

Observations of the thickness of nata de durio were carried out on days 7 and 14 using a measuring ruler.

Data analysis

Data obtained during the research were analyzed using Analysis of Variance (ANOVA). Differences were significant between groups at $p < 0.05$.

RESULTS AND DISCUSSION

Nata de durio thickness

The thickness of Nata De Durio is the result of the metabolism of Acetobacter xylinum bacteria which is used as a parameter to determine the growth and ability of Acetobacter xylinum bacteria to convert glucose into cellulose (Hastuti et al., 2017). Acetobacter xylinum bacteria produce cellulose which will bind to each other to form a layer called nata (Akmal et al., 2020). The more layers of cellulose that are formed, the thicker the nata produced will be and the higher the thickness of the nata, the fiber content will also increase (Santosa et al., 2021).

Based on the results of the analysis of the thickness of nata de durio on day 7 (Table 1), it is known that the thickness of nata de durio is highest at a dry weight of 250 grams of durian seeds with an average of 0.4 cm and the lowest is at a dry weight of 100 and 200 grams of durian seeds. with an average of 0.3 cm. The ANOVA test shows p-value > 0.05 so it can be stated that different dry weights of durian seeds do not affect the thickness of nata de durio.

Table 1: Thickness measurementsNata De Durio on day 7

Dry Weight	Test			Average	P-Value
	1	2	3		
100 grams	0.2	0.3	0.3	0.3	0.178
200 grams	0.3	0.4	0.3	0.3	
250 grams	0.4	0.3	0.4	0.4	

Table 2: Nata De Durio thickness measurements on day 14

Dry Weight	Test			Average	P-Value
	1	2	3		
100 grams	0.3	0.4	0.5	0.4	0.236
200 grams	0.4	0.6	0.5	0.5	
250 grams	0.6	0.5	0.5	0.5	

Furthermore, analysis of the thickness of nata de durio on day 14 in (Table 2 and Fig. 2) shows that the thickness of nata de durio was the highest at dry weights of 250 grams and 200 grams of durian seeds with an average of 0.5 cm and the lowest at the dry weight of durian seeds is 100 grams with an average of 0.4 cm. The ANOVA test also showed a p-value > P0.05, so it was stated that different dry weights of durian seeds did not affect the thickness of the nata de durio on the 14th day.

Examination of the crude fiber content of nata de durio on the 14th day compared with nata de coco made in the feed chemistry laboratory which was incubated for the same time showed that nata de durio had a higher crude fiber content (Table 3). Examination of the total fiber content of nata de durio and nata de coco was carried out at the Food Chemistry Laboratory, Faculty of Animal Husbandry, Hasanuddin University.

DISCUSSION

Nata is a bacterial cellulose that was first made in the Philippinesusing coconut water known as nata de coco. Nata contains fiber in the form of cellulose around 35-62% which is the result of the accumulation of extracellular polysaccharides (Iguchi et al., 2000, Hamad and Kristiono, 2013). Nata is made by fermentation with the help of acetic acid producing bacteria, namely Acetobacter xylinum. Acetobacter xylinum can form thick polycles (nata) on the surface of a medium that contains quite high levels of carbohydrates (Toda, 2016).

Durian seeds contain 46.2% carbohydrates, 2.5% protein, 0.2% fat and 51.15% water. The carbohydrate levels contained in durian seeds are higher than the carbohydrate levels contained in cassava (34.7% Carbohydrates) and sweet potatoes (27.9% Carbohydrates) (Djaeni and Prasetyaningrum, 2010). The high carbohydrate content in durian seeds can increase the growth of nata-producing bacteria, namely Acetobacter xylinum, by adding a nitrogen source, carbon source and acetic acid as a nutritional source for Acetobacter xylinum bacteria. The availability of sufficient nutrients in the growing medium from durian seeds causes the Acetobacter xylinum bacteria to be able to carry out a fairly high metabolism, so that the production of nata polycles is greater (Kotatha and Rungrodnimitchai,

Table 3: Total crude fiber test of nata de durio and nata de coco

No.	Sample Code	Test Parameters
		Crude Fiber Content (%) (AOAC 942.05)
1	Nata De Durio	1.48
2	Nata de Coco	0.93

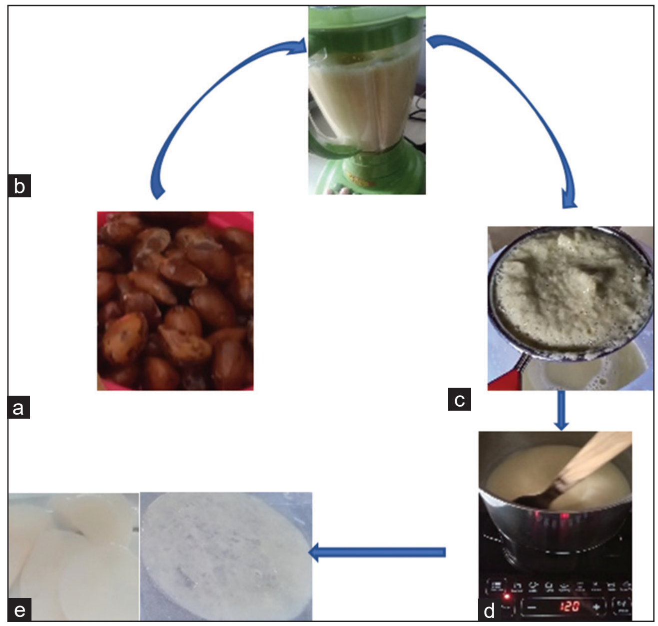

Fig 1. Scheme for making nata de durio: (a) dried durian seeds, (b) blenderized durian seeds, (c) filtering/separating the dregs and durian seed solution, (d) cooked durian seed solution, (e) nata de durio that has been formed. AQ6

2018). It can be seen in Fig. 2 that there are differences in the thickness of the nata formed based on the dry weight of the durian seeds used as the basic ingredient in making nata. Although statistical tests show that the difference in the dry weight of the durian seeds used does not have a significant effect on the thickness of the nata formed.

This research succeeded in proving that the glucose content in durian seeds can form nata de durio with the highest average thickness, namely 0.5 cm on day 14. However, it is thinner compared to the thickness of nata de coco on day 14, namely 0. 9 cm(Lubis and Harahap, 2018). This shows that the nutritional content contained in durian seeds is able to meet the needs of macronutrients and micronutrients for Acetobacter xylinum bacteria to grow and develop. If the activity of the Acetobacter xylinum bacteria increases, the nata produced will also be

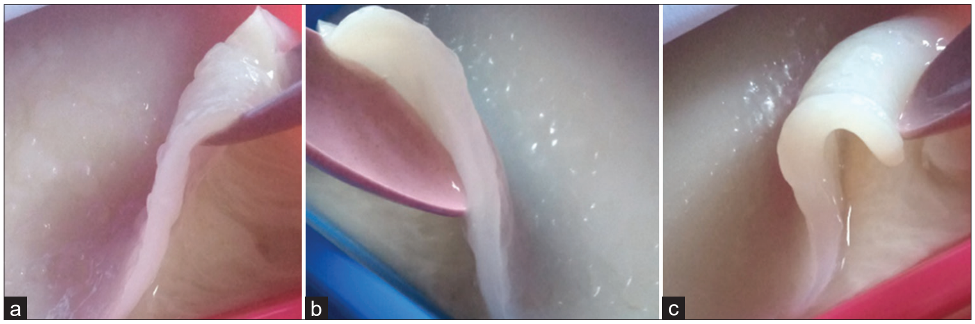

Fig 2. Nata de durio on day 14 with dry weight of durian seeds: (a) 100 grams, (b) 200 grams, and (c) 250 grams.

more numerous and thicker(Toda, 2016). Even though the thickness of nata de durio is thinner than nata de coco, the results of the examination of the crude fiber content of nata de durio (1.48%) are higher than the crude fiber content of nata de coco (0.93%). The higher the crude fiber content in nata, the better the quality of the nata formed. Increasing the crude fiber content will cause the texture of the nata to become chewier so that the tissue structure between the fibers will become tighter (Kartika, 2012).

The high crude fiber content in nata de durio may have health benefits, especially in the digestive system. So researchers conducted further research regarding the use of nata de durio as a source of natural fiber which is associated with intestinal health.

CONCLUSION

Based on the research results, it can be concluded that durian seeds can be used as the main basic ingredient in making nata, because they have a high carbohydrate content so they can provide nutrients for the growth of Acetobacter xylinum bacteria. The difference in dry weight of durian seeds used as a basic ingredient in making Nata De Durio does not affect the thickness of the nata formed. The dry weight of 250 gram durian seeds has a better Nata De Durio thickness compared to the dry weight of 100 grams and 200 grams of durian seeds.

Authors contributions

Tri Sutriani Syam (TSS) Contributed to the article and prepared the pre-manuscript. Syahrijuita Kadir (SK) and Ika Yustisia (IY) contributed to supervising the work and completing the writing of the paper. All authors discussed the main findings and contributed to the final manuscript.

BIBLIOGRAPHY

Akmal, N., M. Ridhwan, F. Maulidia and I. Irdalisa. 2020. The effect of using bean sprouts (*Phaseolus radiatus*) as an alternative nitrogen source in making nata De Coco. J. Biol. Educ. 8: 53-61.

Djaeni, M. and A. Prasetyaningrum. 2010. Feasibility of durian seeds as an alternative food ingredient: Nutritional and techno-economic aspects. Riptek. 4: 37-45.

Ferdiansyah, M. K., B. Supriyadi, A. R. Affandi and I. Muf seeni. 2018. Economic empowerment of housewives in banyumanik village, Banyumanik district, semarang city through making herbal syrup. LOGISTA Sci. J. Community Serv. 2: 15-20.

Hamad, A. and Kristiono. (2013). Effect of adding nitrogen sources on nata de coco fermentation results. Momentum J. 9: 62-65.

Hastuti, M. and M. Andriyani, A. Wiedyastanto, D. Savitskaya, G. Gisyamadia and M. Margono. (2017. Utilization of mung bean sprout extract as an alternative nitrogen source in making nata de lerry. Proc. Nat. Sci. Technol. Semin. 1: 1-5.

Ho, L. H., R. Bhat. 2015. Exploring the potential nutraceutical values of durian (*Durio zibethinus* L)-an exotic tropical fruit. Food Chem. 168: 80-89.

Iguchi, M., S. Yamanaka, A. Budhiono. 2000. Bacterial cellulose: A masterpiece of nature's arts. J. Mater. Sci. 35: 261-270.

Irhamniah, I. 2018. Comparison of the Quality of Nata from Cassava skin (*Manihot esculenta*), Golden Banana (*Musa acuminata* Colla) and Durian (*Durio zibethinus*) as an Effort to Utilize Waste. Alauddin Makassar State Islamic University, Indonesia.

Kartika, F. and Y. Ahrudi. Y. 2012. The effect of Adding N Sources and C Sources on the Physicochemical and Organoleptic Characteristics of nata de Boras from Palm Palm sap using Actobacter xylinum. [Eleven March Surakarta]. In thesis.

Kotatha, D. and S. Rungrodnimitchai. (2018). Synthesis and Characterization of Nanofiber of Oxidized Cellulose from Nata de Coco. Int. J. Chem. Eng. 2008: 2787035.

Lubis, A. W. and D. N. Harahap. 2018. Utilization of super red dragon fruit juice (*Hylocereus costaricensis*) in making nata de coco on the physical quality of nata. CHEDS: J. Chem. Educ. Sci. 2: 1-10.

Majesty, J., B. D. Argo and A. W. Nugroho. 2015. The effect of adding sucrose and fermentation time on nata fiber content from pineapple juice (nata de pina). J. Trop. Agric. Eng. Biosyst. 3: 80-85.

Masri, M., Irhamniah, U. T. A. Latif and Rusny. 2020. Comparison of Nata Quality From Cassava Peels (*Manihot esculenta*), ladyfinger bananas peels (*Musa acuminata* Colla), and durian peels (*Durio zibethinus*). Elkawnie. 6: 146-155.

Natania, K. and E. Wijaya. 2022. Optimization of roasting temperature and time of the durian seed (*Durio zibethinus* L.) as coffee substitution and its flavor profile. Food Res. 6: 279-287.

Safitri, M. P., M. W. Caronge. and K. Kadirman. 2017. The effect of providing nitrogen sources and acetobacter xylinum bacterial seeds on the quality of nata de tala results. J. Agric. Technol. Educ. 3: 95-106.

Santosa, B., R. Rozana. and A. Astutik. 2021. Utilization of organic nitrogen sources in making nata de coco. Food Technol. 12: 52-60.

Sutanto, R. and A. Rahayuni. 2013. Effect of substrate pH on fiber, Vitamin C, and nata de cashew (*Anacardium occidentale* L.) acceptance levels. Coll. J. Nutr. 2: 200-206.

Suzanni, M. A., A. Munandar and S. Saudah. 2020. Effect of pineapple extract concentration (*Ananas comosus*) and fermentation time on making nata de coco from coconut water waste. Serambi Eng. J. 5.

Toda, T. 2016. Cellulose nanofiber "Nata de coco". Cellulose Commun. 23: 76-80.

Verawati, B. and N. Yanto. 2019. Substitute wheat flour with durian seed flour in biscuits as an additional food for underweight toddlers. Indones. Nutr. Media. 14: 106-114.

Author Queries???

AQ5: Kindly provide volumn number

AQ6: Kindly cite figure 1 in the text part