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Effects of Addition of Soybean sprout cooking water and *Acetobacter xylinum* to Weight and Thickness of *Nata de Pitaya* from Dragon Fruit Skin (*Hylocereus polyrhizus)*

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***Abstract*:** *Red dragon fruit is consumed in fresh condition, and the skin is in the waste still contains about 8.4% sugar component. The composition of nutritional value of sugar on red dragon fruit skin has potential as raw material of nata. The aim of this research is to know the effect of soybean sprout cooking water and Acetobacter xylinum on weight and thickness of Nata de Pitaya. The design of the research was using Completely Randomized Design (RAL) Factorial. Data were analyzed using Variant Analysis followed by DMRT test. The results showed that the addition of soybean sprout cooking water and Acetobacter xylinum have significant effect on the weight and thickness of Nata de Pitaya (P <0,05). The combination of treatments that produced the heaviest and thickest Nata de Pitaya with the addition of soy bean stew water 750 gr / L and Acetobacter xylinum (McFarland no 2) of 451.7 grams for weight and 13.1 mm for Nata de Pitaya thickness.*

Keywords *- Decoction of Soybean Stew, Acetobacter xylinum, Weight and Thickness Nata de Pitaya*

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I. Introduction

Dragon fruit is horticultural crops that began to be developed in Indonesia [1]. Dragon fruit is also a tropical fruit that has benefits and nutritional value is high enough. The increasing of consumption level of red dragon fruit affecting the rest of the skin just thrown away. Red dragon fruit is consumed only in fresh condition. while 30-35% which is the red dragon fruit skin is wasted [2].

Dragon fruit skin contains carbohydrates, fats, protein and dietary fiber. The content of dietary fiber contained in the skin of red dragon fruit is 46.7%. Red dragon fruit skin contains a sugar component of 8.4%. Sugars include glucose, fructose, and maltose. The composition of nutritional value and sugar content of red dragon fruit skin, dragon fruit skin has the potential to serve as raw material for food processing, including skin syrup, jam, and dragon fruit skin nata (*Nata de pitaya*) [3].

Nata is a fermented food by *Acetobacter xylinum* bacteria that is rich in cellulose, which is chewy, transparent, and it feels resembling to sugar palm fruit. The fermentation medium used in the treatment of nata must meet the criteria as a source of energy, growth, motility and biosynthesis of macromolecules. Therefore, the medium used must contain a complete nutrient component and in accordance with the needs of microbes that run fermentation [4].

Various types of medium containing sugar can be processed through fermentation using Glucunacetobacter xylinum bacteria into nata or bacterial cellulose [5]. The results of Sutanto & Rahayuni (2013) study, using Acetobacter xylinum bacteria concluded that the initial pH of 5.0 media yielded nata fiber of 2.81% [6].

The addition of 5 grams of urea as a nitrogen source gives a better nata gain. In addition, the use of ZA chemicals that are usually used as fertilizer for plants, if used not in accordance with the dose in terms of making nata, it can cause new problems, such as disruption of consumer health. This is because there is still residual or residual ZA fertilizer on the resulting product. It is necessary to find alternative material to replace the ZA fertilizer function as a source of nitrogen in the manufacture of nata, such as the use of soybean sprout cooking water [7].

Soybean sprout cooking water has protein, fat, carbohydrate, vitamin, nitrogen, and others. By using soybean stew as a substitute for ZA fertilizer in making nata from dragon fruit skin can reduce environmental pollution and people do not worry in consuming nata from dragon fruit skin to meet daily fiber requirement.

Processing of dragon fruit skin extract in this case will use additional ingredients from soybean sprout cooking water (Glycine max) as a source of nitrogen replacement of ZA chemicals that help to help the growth of bacteria, as well as assistance from the activity of microorganisms Acetobacter xylinum bacteria that will assist in the process of making nata, thus reducing waste from the plantation.

The research was aimed a) to know the effect of soybean sprout cooking water on the weight of Nata de Pitaya, b) to know the addition of soybean stew and Acetobacter xylinum bacteria to the thickness of Nata de Pitaya.

II. Materials And Methods

2.1 Time and Place

This research was conducted on April 2018 at FKIP Unram Microbiology Laboratory.

2.2 Material

The materials used in this study are: Dragon fruit skin extract, Acetobacter xylinum bacterial starter, soybean sprout cooking water, ZA, Sugar, glacial acetic acid.

2.3 Testing Method

This research uses Completely Randomized Design (RAL) Factorial. The variables studied were treatment of soybean stew boiler addition and Acetobacter xylinum with nine combinations of treatments and three replications.

AX_1AK_1 : *Acetobacter xylinum* McFarland no 1 with 500 gr/L soybean sprout cooking water
AX_2AK_1 : *Acetobacter xylinum* McFarland no 2 with 500 gr/L soybean sprout cooking water
AX_3AK_1 : *Acetobacter xylinum* McFarland no 3 with 500 gr/L soybean sprout cooking water
AX_1AK_2 : *Acetobacter xylinum* McFarland no 1 with 750 gr/L soybean sprout cooking water
AX_2AK_2 : *Acetobacter xylinum* McFarland no 2 with 750 gr/L soybean sprout cooking water
AX_3AK_2 : *Acetobacter xylinum* McFarland no 3 with 750 gr/L soybean sprout cooking water
AX_1AK_3 : *Acetobacter xylinum* McFarland no 1 with 1000 gr/L soybean sprout cooking water
AX_2AK_2 : *Acetobacter xylinum* McFarland no 2 with 1000 gr/L soybean sprout cooking water
AX_3AK_3 : *Acetobacter xylinum* McFarland no 3 with 1000 gr/L soybean sprout cooking water.

2.3.1 Preparation of Dragon Fruit Skin Extract

Dragon fruit skin obtained from dragon fruit tourism garden in the village of Tanak Beak Pemangket Central Lombok, West Nusa Tenggara. The dragon fruit skin that has been separated from its flesh cleaned its scales and cleaned with water, after that cutting and destruction of 500 gr dragon fruit skin in 1 liter of aquades. Once filtered, 500 ml of dragon fruit skin extract is boiled with 100 gr sugar.

2.3.2 The Making of Soybean Sprouts Cooking Water

Clean the soybean sprouts from the epidermis, then wash the soybean sprouts with clean water and drain it. Next, weigh according to the treatment then boil the bean sprouts by adding aquades. The ratio of aquades added with soybean seedlings in accordance with the treatment of AK1 (500 g / L), AK2 (750 g / L), and AK3 (1000 g / L).

2.3.3 The making of Media

Boil the dragon fruit skin extract and boil the soy bean until water boiling. Pour vinegar into an already boiling extract while stirring. Measure the pH, then pour the media into a sterilized tray, then cover it with corn paper. Silence medium for ± 3 hours at room temperature.

2.3.4 Inoculation and Incubation Stage

a. Inoculation stage
1. Preparing media that has been silenced for ± 3 hours at room temperature.
2. Inoculate starter Acetobacter xylinum into the media
b. Incubation stage
After starter containing *Acetobacter xylinum* bacteria was inoculated into a dragon fruit skin extract medium, then incubated for 14 days, at a temperature of 28-310C and under anaerobic conditions.

2.4 Analysis

Data were analyzed using Variant Analysis (ANOVA) and Duncan Multiple Range Test (DMRT) test.

III. Results

Weight Nata de Pitaya

The effect of treatment on the weight of *Nata de Pitaya* obtained in this study can be seen in table 1 as follows:

Tabel 1. Weight *Nata de Pitaya* (gram)

Treatment	Repetition			Average
	1	2	3	
AX_1AK_1	300	290	305	298,3
AX_2AK_1	360	320	335	338,3
AX_3AK_1	255	240	240	245
AX_1AK_2	340	280	330	316,7
AX_2AK_2	435	470	450	451,7
AX_3AK_2	370	390	375	378,3
AX_1AK_3	270	280	250	266,7
AX_2AK_3	350	355	340	348,3
AX_3AK_3	220	225	210	218,3

Tabel 2. Various effects of soybean sprout cooking water and Acetobacter xylinum to Nata de Pitaya weight

SK	**d.b**	**J.K**	**K.T**	**F_{count}**	**F_{tabel}**	**Sig**
Treatment	8	138268.519	17283.565	45.147		
***Acetobacter xylinum* (AX)**	2	58451.852	30267.593	74.529	3.55	
Cooking water (AK)	2	60535.185	30267.593	75.941	3.55	.000
AX*AK	4	19281.481	4820.370	15.059	2.93	
Error	18	4883.333	271.296			
Total		143151.852				

From the results of variance analysis it was found that P < 0.05 indicating that there is a very obvious difference between treatments. It means that the addition of soybean sprout cooking water and *Acetobacter xylinum* infusion effect on the weight of *Nata de Pitaya*.

Thickness Nata de Pitaya

The effect of treatment on the thickness of *Nata de Pitaya* obtained in this study can be seen in table 3 as follows:

Tabel 3. Thickness of *Nata de Pitaya* (mm)

Treatments	**Repetition**			**Average**
	1	2	3	
AX_1AK_1	6,5	4,0	6,9	5,8
AX_2AK_1	9,2	7,3	8,0	8,17
AX_3AK_1	5,0	4,2	4,2	4,47
AX_1AK_2	7,52	6,3	7,2	7,06
AX_2AK_2	12,1	14,0	13,2	13,1
AX_3AK_2	9,5	10,1	9,43	9,7
AX_1AK_3	5,3	5,45	5,0	5,25
AX_2AK_3	8,0	8,2	7,5	7,91
AX_3AK_3	3,2	4,0	2,1	3,1

Table 4. Variety of influence of soybean stew boiled water and *Acetobacter xylinum* against thick *Nata de Pitaya*

SK	**d.b**	**J.K**	**K.T**	**F_{count}**	**F_{tabel}**	**Sig**
Treatment	8	2.274	.284			
***Acetobacter xylinum* (AX)**	2	0.939	.469	74.529	3.55	
Cooking water (AK)	2	0.956	.478	75.941	3.55	
AX*AK	4	0.379	.095	15.059	2.93	.000
Error	18	.113	.006			
Total		2.387				

From the results of variance analysis it was found that P <0.05, which showed that there was a very significant difference between treatments. This means that the addition of soybean sprout cooking water and *Acetobacter xylinum* infections affect the thickness of *Nata de Pitaya*.

IV. Discussion

Weight Nata de Pitaya

The weight analysis of *Nata de Pitaya* was done by weighing each Nata mold formed by each treatment and replication. The weight of *Nata de Pitaya* obtained from the treatment and replication given in the study can be seen in tables 1 and 2. The weight of *Nata de Pitaya* obtained varies. In AX1AK1 has an average value of 298,3 grams; AX2AK1 has an average rating of 338,3 grams; AX3AK1 has an average value of 245 grams; AX1AK2 has an average rating of 316,7 grams; AX2AK2 has an average value of 451,7 grams; AX3AK2 has an average value of 378,3 grams; AX1AK3 has an average value of 266,7 grams; AX2AK3 has

an average rating of 348,3 grams; AX3AK3 has an average value of 218,3 grams; The results of the analysis showed significant differences between each treatment. Provision of bacterial composition with soybean sprout cooking water will give a better weight. Addition of soybean sprout cooking water as a source of nitrogen for bacteria *Acetobacter xylinum* provides a very important role in determining *Nata* particle. The addition of less nitrogen and starter sources will result in thin Nata because the nitrogen source for cellulose formation is poorly met. However, the use of an excessive source of nitrogen and starter *Acetobacter xylinum* will also produce less thick and heavy *Nata*.

Acetobacter xylinum bacteria starter is a bacterium that produces very fine cellulosic fibers and multiplies in a sugar-containing medium [8]. The amount of starter bacteria given will have an effect on the weight of *Nata de Pitaya* produced in the study. The number of starter each treatment should be proportional to the amount of nutrient availability on the media, otherwise unbalanced will disrupt the cellulose formation process [9]. In accordance with the results of research that researchers do that the higher concentration of bacteria *Acetobacter xylinum* given the more severe. The difference in weight due to the amount of starter on the media is not balanced with the amount of starter bacteria in addition. The results of Ashari's research showed that *Acetobacter xylinum* bacteria in forming nata in carbon-fortified media and nitrogen can break down sucrose into glucose and then fermented into alcohol, then *Acetobacter xylinum* oxidizes alcohol to acetic acid as the main metabolite [10].

Based on research Nisa et al., Using soybean sprout extract as substitute of ZA obtained by weight of *nata* 23,79 gr with fermentation time 14 days. From several studies that used some variation of sprout boiled water, so in this study the use of soybean sprout cooking water more potential to produce the weight of *Nata de Pitaya* heavier [11].

Thickness Nata de Pitaya

The thickness of *Nata* is the high of cellulose layer that is capable of being produced by *Acetobacter xylinum* bacteria [12]. Based on the data of the research that has been done, in table 3 it is known that there are differences of *Nata* thickness between treatments used. The amount of nitrogen and bacteria *Acetobacter xylinum* content in nata-making medium becomes the factor of difference of *Nata* thickness [13]. Other factors that influence the formation of *Nata* are the source of sugar, the incubation temperature, the acidity of the medium [14]. The length of fermentation will affect the acid content produced and affect the *Nata* fiber content. One of the factors affecting the thickness of *Nata de Pitaya* is the concentration of media used. The average value of *Nata* thickness in each treatment obtained the thickest result that is on AX2AK2 of 13.1 mm and the thinnest in AX3AK3 of 3.1 mm. The data in Table 3 shows that the thickest composition is produced in the AX2AK2 treatment.

In this study various ingredients added to the medium provide the specific nutrients needed by Acetobacter xylinum bacteria. Sugar added to the media serves as a carbon source or provider of energy and soybean sprout cooking water as a protein source used for the growth and development of bacteria *Acetobacter xylinum.*

Another factor that affects the formation of nata, namely the starter age of bacteria. *Acetobacter xylinum* that is good to obtain optimal results is the starter of *Acetobacter xylinum* bacteria which is 78 hours [15]. To obtain the optimal Nata required starter *Acetobacter xylinum* bacteria with the right concentration [16]. In accordance with the research undertaken in this study the higher the starter concentration of *Acetobacter xylinum* bacteria given in each treatment, obtained the thickest results in the treatment AX2AK2. The formed nata layer is harvested after 14 days. The duration of harvesting of the *Nata* layer will affect the thickness of the resulting *Nata* [16]. According to Kornmann *et al*., Nutritional factors also have a strong influence on the nature, result and composition of cellulose formed. Adequacy of soybean sprout cooking water concentration as a nitrogen source for *Acetobacter xylinum* in the medium can stimulate microorganisms to synthesize cellulose and produce *Nata* with stronger and more cellulose bonds, thus affecting the resulting *Nata* thickness [17].

V. Conclusion

The addition of soybean sprout cooking water and *Acetobacter xylinum* significantly influenced the weight of *Nata de Pitaya* from the skin of dragon fruit ($p < 0.05$). Similarly, the addition of soybean sprout cooking water and *Acetobacter xylinum* acted significantly to the thickness of *Nata de Pitaya* from the skin of dragon fruit ($p < 0.05$).

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