Development of Local Food Biodiversity of Nata De Taro from Talas Beneng (*Xanthosoma undipes* k. koch.)

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ABSTRACT. This research aimed to produce and formulate nata from Talas Beneng with different concentration of *Acetobacter xylinum*. The raw material of talas beneng extract to starch then its residual water boiled, added 5% sucrose, 2% acetate acid and 1% ZA. Then it cooled until 25 °C, added *Acetobacter xylinum*, and fermented for 13 days. The concentration of *Acetobacter xylinum* addition with four levels namely 10%, 15%, 20% and 25%. The parameters were physical analysis (yield, thickness, and hardness), chemical (crude fiber), and organoleptic (appearance, texture, flavor, and taste). The results showed that the addition of 25% concentration of *Acetobacter xylinum* was the highest yield and thickness as 30.98%, and 9.55 mm, then it has crude fiber 4.89% and hardness 0.1 mm/g.s. For organoleptic evaluation, the addition of 25% concentration of *Acetobacter xylinum* showed appearance, flavor, texture, and taste higher than others treatment.

1. Introduction
Talas beneng (*Xanthosoma undipes* K. Koch.), a local biodiversity originally from Pandeglang Banten which is a wild plant grow easily and fast in the forest of Mount Karang, Pandeglang. Talas Beneng began to be cultivated in several location. There are 70 hectares of taro beneng land in 13 sub-districts Pandeglang with a total production of 10 tons per month. This plant can reach a weight of 30 kg, length 1.2-1.5 meters within 2 years crop and called large and yellow (besar dan koneng “beneng”). It is also have oxalate content which is experienced as irritative (itching-stinging) sensation in the mouth and throat and also antinutrient for humanbody (Zainal et al, 2015). So far the use of Talas Beneng is still limited, namely, made boiled taro, chips, flour, and starch but commercialized and industrialized yet.

The proximate analysis from flour and starch of Talas Beneng has been studied in previous research which contain water content, ash content, fat, protein, and carbohydrates in flour, respectively 10.46%, 4.85%, 0.28%, 3.4%, and 82.56% while its starch content 13.79%, 0.38%, 0.13%, 0.22%, and 89.27% then, Apriani (2016) reported crude fiber as 7.19%. The relatively high carbohydrate and fiber content of Talas Beneng potential to be developed into various kinds of derivate products, one of the example is nata de taro. Nata is a product of fermentation cultur of *Acetobacter xylinum* in growth medium enriched with carbon, nitrogen, hydrogen, and minerals. This research is first step to produce nata from Talas Beneng. There are many factors that effected to maximize yield of nata such us material composition, environmental conditions, and *A. xylinum*. The previous study by Pratiwi *et al* (2015) showed a positive correlation between the thickness and the weight of nata de coco with addition concentration of *A. xylinum*. Research about nata from Talas Beneng still not publish yet,
some nata studies were made from coconut (Hamad et al, 2011), whey (Nisa, 2001), and yam bean (Wardhana et al, 2016).

This early research focused on the effect of different concentrations of \( A. \ xylinum \) in characteristics of nata. This nata called nata de taro which in the future can be developed into a local gift of Pandeglang.

2. Material and Method

2.1. Material

This research has been conducted from May until July 2017. Talas beneng which one year old from planting was supplied from farmer in Juhut, Pandeglang. Starter \( A. \ xylinum \) was purchased from the local nata de coco industry in Rangkasbitung. Others material were sucrose, acetic acid, urea, and aquades. Equipment were trays, scales, knives, measuring cups, blender, pans, stoves, stirrers, filters, paper, rubber bracelets, measuring cups, stirrers, volume pipettes, erlenmeyer, spatula, desiccator, and calipers.

2.2. Method

The raw material of talas beneng as 1 kg was sorted, peeled, washed and shredded. The grated taro added 1 litre of water then it sedimented for 24 hours until water and starch will be separate. This residual water was used for growth medium of nata then it boiled, added 5% sucrose, 2% acetate acid, 1% ZA food grade cooled until 25 \(^\circ\)C, and added \( A. \ xylinum \) with four levels namely 10%, 15%, 20% and 25% concentrations with three replication then nata was fermented until 13 days and covered by paper to avoid contamination. The analysis parameters were yield, thickness, hardness, crude fiber, and organoleptic.

Yield analysis was performed by digital scales which calculate total volume of all fermented material and with final weight of nata. Thickness was analyzed by caliper and hardness by penetrometer at five different measurement point. The sensory properties which assessment of colour, flavor, texture, and taste were evaluated by 25 panelist. Questionnaires for the panelists were prepared using the modified 5-point hedonic scale from very dislike until very like. Crude fiber was analyzed by method from AOAC.

This study design using completely randomized design. Statistical analysis was carried out using the program SPSS 16.0 s and the results were expressed as mean values. Significant statistical differences all variables between the different treatment were established by Duncan test at \( p=0.05 \).

3. Result and Discussion

Nata de taro from Talas beneng requires 13 days to form a compact layer. The previous research from Putriana and Aminah (2013) showed same result that also requires 13 days for fermentation nata de cassava. \( A. \ xylinum \) form a increasingly thickened layer until 13 days and still grow to form cellulose. Nata that harvested after 13\(^{th}\) day will not form to be a new nata layer due to the activity of \( A. \ xylinum \) bacteria stops nutrients used in fermentation media and produce acetate acid, metabolite that inhibit microbial growth. When visually observed the form of nata produced is not too different from nata de coco. Before washing the color of nata de taro is yellowish white and after being washed and boiled the color becomes brighter (Figure 1).
3.1. **Yield**

The average yield of nata de taro ranged from 12.74% to 30.98% (Table 1). The higher the concentration of *A. xylinum* tends to produce higher yield and thickness. The highest of cellulose yield was at addition 25% concentration of *A. xylinum* and there was significantly different with 10% treatment but no significant different with 20% and 25%. The yield is affected by variations in substrate, material composition, environmental conditions, and the ability of *A. xylinum* to produce cellulose. The higher the concentration of *A. xylinum* also tends to produce higher yield in nata de coco process (Pratiwi, 2012). The resulting layer of nata de coco is caused by cellulose which is also increased by the activity of *A. xylinum* bacteria which can convert sugar into a substance that resembles a gel on the surface of the fermented liquid (Budiarti, 2008).

3.2. **Thickness**

Same as with the result of yield, the thickness of the nata is also proportional to the addition of the concentration of *A. xylinum*. The thickest layer of nata in the addition of 25% concentration treatment was at 0.95 cm and significantly different from other treatments. The thickness of the nata is generally between 0.9 - 1.5 cm. According to Budiarti (2008) the resulting layer of nata from coconut is caused by cellulose which is also increased by the activity of *A. xylinum* bacteria which can convert sugar into a substance that resembles a gel on the surface of the fermented liquid.

3.3. **Hardness**

The average hardness of nata de taro with different concentrations of *A. xylinum* 10%, 15%, 20% and 25% was 0.1 mm/g.s (Table 1). The hardness of the nata de taro in all treatments has the same value of 0.1 mm/g.s which means elastic. The hardness of nata is 0.21 mm / g.s means rather elastic, while the average hardness value is 0.17 mm / g.s means elastic. (Awwaly, 2011). Thickness of nata influences the water holding capacity which in turn has a bearing on the physical textural and organoleptic properties. Nata-de-coco has distinct textural properties like a firm chewy, soft and smooth surface which is preferred. (Jagannath *et al*., 2008).

3.4. **Crude fiber**

The average levels of crude fiber in this study ranged from 2.65% to 5.86% (Table 1). The highest crude fiber was at addition 20% concentration of *A. xylinum* and there was no significant different with 25%. Standard crude fiber nata according SNI No. 01-4317-1996, was maximum fiber content as 4.5%. The concentration of *A. xylinum* will affect the metabolic process of glucose to cellulose and affect the levels of fiber (Putriana and Aminah, 2013). Crude fiber is the result of sugar breakdown in the fermentation medium by the activity of *A. xylinum* (Anastasia, 2008). According to Wijayanti (2010) explained that the high percentage of crude fiber was influenced by the activity of *A. xylinum* in the process of glucose metabolism into cellulose.
3.5. Organoleptic
Organoleptic tests are carried out using a scoring test with criteria that the higher the number the better the quality. Aspects assessed include the level of preference for color, flavor, texture and taste from a scale of 1-5 (very dislikes, dislikes, enough, likes, and very like). In terms of color and aroma is not significant between treatments. The addition of 20% and 25% A. xylinum concentrations was considered to be enough preferred by panelists in terms of color and flavor.

For texture and taste, the higher the concentration of A. xylinum, the higher the panelist's acceptance. Addition of A. xylinum concentration is 25% significantly higher and categorized as quite preferred compared to other treatments. The all organoleptic showed the addition of A. xylinum 25% concentration had the highest organoleptic value (colour, flavour, and taste) compared to others treatment.

Table 1. Effect of Addition of A. xylinum Concentration to Characteristics of Nata de Taro

| No | Characteristic       | Concentration of A. xylinum |
|----|----------------------|-----------------------------|
|    |                      | 10% | 15% | 20% | 25% |
| 1  | Yield (%)            | 12.74<sup>a</sup>  | 22.18<sup>b</sup> | 25.18<sup>b</sup> | 30.98<sup>b</sup> |
| 2  | Thickness (cm)       | 0.25<sup>a</sup>   | 0.60<sup>b</sup>  | 0.62<sup>b</sup>  | 0.95<sup>c</sup>  |
| 3  | Hardness(mm/g.s)     | 0.1<sup>a</sup>    | 0.1<sup>b</sup>   | 0.1<sup>b</sup>   | 0.1<sup>b</sup>   |
| 4  | Crude fiber (%)      | 2.65<sup>a</sup>   | 4.07<sup>b</sup>  | 5.86<sup>b</sup>  | 4.89<sup>b,c</sup>|
| 5  | Organoleptic (scale 1-5) | | | | |
|    | Colour               | 2.99<sup>a</sup>   | 3.04<sup>a</sup>  | 3.12<sup>a</sup>  | 3.27<sup>a</sup>  |
|    | Flavour              | 2.83<sup>a</sup>   | 2.81<sup>a</sup>  | 3.01<sup>a</sup>  | 3.09<sup>a</sup>  |
|    | Texture              | 2.64<sup>a</sup>   | 2.75<sup>a,b</sup>| 2.85<sup>a,b</sup>| 3.01<sup>b</sup>  |
|    | Taste                | 2.60<sup>a</sup>   | 2.63<sup>a</sup>  | 2.89<sup>a,b</sup>| 3.05<sup>b</sup>  |

<sup>bar with different letters indicate significant differences in Duncan test (p=0.05)</sup>

Addition 25% concentration of A. xylinum to the medium has influenced the formation of nata optimum results with yield 30.98%, thickness 9.55 mm, hardness 0.1 mm/g, crude fiber 4.89% and organoleptic between 3.05-3.27 (enough preferred).

4. Conclusion
Nata de taro from Talas beneng was successfully made that requires 13 days to form a compact layer of nata. The effect of the addition of A. xylinum concentration affected the characteristics of nata. The higher the concentration of A. xylinum tends to produce higher yield, thickness, crude fiber, and organoleptic (texture and flavor). The addition of 25% concentration of A. xylinum was the highest yield and thickness as 30.98%, and 9.55 mm, then it has crude fiber 4.89% and hardness 0.1 mm/g.s. For organoleptic evaluation, the addition of 25% concentration of A. xylinum showed appearance, flavor, texture, and taste higher than others treatment.

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