Utilization of safira taro flour (*Colocasia esculenta*) as addition of natural stabilizers on yoghurt products

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Abstract. Yogurt is a processed food biotechnology made from milk that has been fermented by *Lactobacillus* and *Streptococcus* lactic acid bacteria that have antioxidant activity. The manufacturing process has decreased water holding capacity (whey off), this is caused by a decrease in pH in the range of casein isoelectric points that affect the quality of the final product. The purpose of this study is to maintain the final quality of yogurt with the addition of natural taro flour stabilizers. The research method used is to compare the concentrations of natural stabilizers of 2.5%, 1.25%, 0.165%, 0.1% and incubation time of 9 hours, 18 hours, 24 hours, 34 hours. Parameters observed: analysis of the physico-chemical properties of yogurt. The results showed the best yogurt with fat content (0.51%), potassium (2354.64 mg / kg), nutrient content (energy 612.8 kcal; protein 12.7; carbohydrate 9.85 g; calcium 120.29 g ; phosphorus 223, 5g; Iron 20.3g; Vitamin A 484mg; vitamin B 0.387mg; vitamin C 1.81 mg)), and organoleptics showed that panelists preferred the yogurt variant (sweet taste). The best yogurt is that there is no decrease in water binding capacity by adding natural stabilizers with an incubation period of 24 hours with a 0.1% stabilizer.

1. Introduction

Increased public awareness of healthy living, the demands of consumers for food that has good nutritional value, appearance, good taste, and also must have certain physiological functions for the body. This phenomenon gave birth to the concept of functional food (food for specified health Use). Yoghurt fermented milk is one of the functional food products because it contains a biopeptide β-lactoglobulin compound which is a precursor β-lactopin which can act as an antioxidant also claimed to have antitumor activity with the utilization of lactic acid bacteria activity. The weakness of yoghurt products is that in the manufacturing process there is a decrease in water holding capacity (whey off), this is because pH is in the range of the casein isoelectric point. Casein gel which is in the environment of isoelectric pH has a relatively weak binding power of water molecules, encouraging the release of water molecules on the gel surface or syneresis and viscosity / viscosity reduction [1]. This decrease in water binding capacity can affect the quality of the yoghurt's final product. Alternative to anticipate this problem by adding a stabilizer [2].

Besides being able to bind water which is a bacterial growth medium, the other stabilizer function is to increase the shelf life of yoghurt by suppressing the growth of decomposing bacteria [3]. Both natural and artificial stabilizers are widely used in the food industry. Commercial stabilizers include: gelatin, pectin, sodium alginate and various types of gum as well as CMC and agency. This stabilizer will reduce the occurrence of syneresis, increase the viscosity of the processed product so as to improve emulsion stability and increase the prebiotic in the product. The Faculty of Animal Husbandry of Brawijaya University has started conducting yoghurt research by adding gelatin as a stabilizer.
Based on the results of research by Sawitri et al. [4] the used of gelatin as a stabilizer is able to give a real influence on texture. But in fact the need for stabilizers in Indonesia has still depended on imports from European, American, Australian and Chinese countries at high prices. According to a report from the Central Statistics Agency (BPS), there was an increase in imports of gelatin. In 2006, the number of gelatin imports up to May amounted to 1,213,111 kg with a value of US $ 4,215,779. Taro tuber bulbs (Colocasia esculenta) as one of the local potentials can be developed to become an alternative source of industrial stabilizers in Indonesia.

Taro is included in one type of tubers from the family Araceae [5]. Talas is easy to grow in Indonesia with the amount of taro productivity from several regions is 661 quintals / hectare. According to Nurbaya and Estiasih [6] that the addition of taro starch can be increased the binding capacity of water in the process of making cookies. This occurs through electrostatic interactions with casein molecules (COO --- Ca2 + - COO-) so that there is inhibition of hydrophobic interactions in nonpolar or molecular molecules that have nonpolar groups that are fused due to the acidification process. The composition of secondary metabolites of taro tubers is reported to contain 2.65% flavonoids, 1.01% alkaloids, 0.70% saponins and 1.06% tannins. DPPH, ABTS, and ORAC analysis on the total contribution of polyphenols and flavonoids showed 7 antioxidant activities of taro tubers were higher and significantly different (P <0.05) from the tuber so the potential for increased immunity to human diseases caused by free radical reactions such as cancer, heart disease, diabetes and aging. Chemical content of taro which functions as anti-diabetes, anti-inflammatory, anti-oxidant and anti-cancer such as: pelargonidin-3-glucoside, cyanindin-3-rhamnoside, cyanidin-3-glucoside, orientin, isoorientin, vitexin, isovitexin and luteoin-7-O-sophoroside and claimed to have antitumor activity by utilizing the activity of lactic acid bacteria.

So far there has been no study related to the utilization of the local potential of taro plants to improve the quality of yoghurt based on physico-chemical, microbiological and antioxidant activities. Thus research is needed on testing the addition of taro flour as a stabilizer to fix problems in the process of making yoghurt products and the effect of suppressing the growth of decomposing bacteria, so that later can produce the best yoghurt products and increase the shelf life of yoghurt and can support the fulfillment of food consumption needs. Functional and reduce dependence on imported products. The purpose of research to know influenced addition stabilizer safira taro flour to characteristic of yoghurt, nutrient content and organoleptic test.

2. Materials and Methods

2.1. Tools and Materials

The equipment used in this study is tuber peeler, basin, cabinet dryer, tray, slycer, scales, filter, and blender, measuring cup, thermometer, spatula, stove, yoghurt packer, spoon and pan. The materials used in this study are water, salt, citric acid, fresh milk (cow’s milk), Safira taro flour, starter, and sugar.

2.2. Place and Time of Implementation

The process of made taro flour and yoghurt is housed in post-harvest laboratory at the Assessment Institute for Agriculture Technology, August 1 to September 28, 2018.

2.3. Design of Research

The research method used is a type of experimental research method. Preliminary research is by making taro flour and making yoghurt. Apply taro flour as a stabilizer to yoghurt. Design of this study used two treatments, namely the first comparison of taro flour consisting of 4 levels, namely 2.5%, 1.25%, 0.165%, and secondly, the duration of the incubation period consisted of 3 levels, namely 9 hours, 18 hours, 36 hours at room temperature Laboratory analysis of acidity, nutritional analysis (energy, protein, carbohydrates, calcium, phosphorus, iron) and organoleptic test. Calculating thenutritional content of taro yams based on food composition data (DKBM) per 100 ml, the nutrient content to be calculated istotal energy, protein, fat, carbohydrates, calcium, phosphorus. Organoleptic tests were carried out based on hedonic tests. The hedonic scale is made nine levels (level 1-9), starting from 1 (very very like), 2 (very like), 3 (like), 4 (somewhat like), 5 (neutral), 6 (somewhat dislike), 7 (dislike), 8 (very dislike), 9 (very dislike)[7]. The organoleptic quality testing method for food is used to distinguish the quality of food directly in taste, acidity, color, and texture.
2.4. Stage of research

The manufacturing process is very varied, but basically the same, namely fermenting milk using *Lactobacillus bulgaricus* and *Streptococcus thermophilus* cultures. Before entering at the stage of making yoghurt all the tools must be sterile, there is a sterilization process, the method is done independently, namely heating water to a temperature of 120°C by washing all the tools needed in the process of making yoghurt, so that the bacteria used in the yoghurt making process can still be inoculated according to the environment and not contaminated by other pathogenic bacteria. The process of making yoghurt as in Figure 1.

![Figure 1. Process of making yoghurt](image)

3. Results and Discussion

3.1. Yoghurt quality with the addition of safira taro flour stabilizer

Safira is a Japanese taro tuber (Satoimo) but after being cultivated in Indonesia the name changes according to the location of each. The results of cultivation in Yogyakarta, especially in Gunungkidul regency, are called Safira. So safira is identical to Japanese taro. Comparison of the concentration of safira taro flour and the incubation period used a comparison of taro flour with a percentage of 2.5%, 1.25%, 0.165%, with 9, 24, and 34 hour incubation period. The results of the study were stabilization of taro flour at different concentrations as in the Table 1.

Based on the table 1 during the 24-hour incubation period, it produces a aroma like yoghurt in general, the pH is not too acidic (5) with the concentration of Safira taro flour 2.5% and 1.25%. research objectives and must be repeated with different methods. While the concentration of 1.65% aroma and sour taste.
Table 1. Characteristics of yoghurt in the 9, 24 and 34 hours of incubation period.

| Incubation period (hour) | Composition of safir taro flour (%) |
|-------------------------|-------------------------------------|
| 9                       |                                    |
| Aroma                   | Milk                                |
| Taste                   | Acid (pH 5)                         |
| Texture                 | Thick, heavy (water and yoghurt do not blend) |
| Aroma                   | Milk                                |
| Taste                   | Acid (pH 5)                         |
| Texture                 | Pudding-like thickness (water and yoghurt do not blend) |
| 24                      |                                    |
| Aroma                   | Acid-like yoghurt                   |
| Taste                   | A little acid (pH 5)                |
| Texture                 | Thick, heavy (water and yoghurt do not blend) |
| Aroma                   | Acid-like yoghurt                   |
| Taste                   | A little acid (pH 5)                |
| Texture                 | Thick, melted (water and yoghurt do not blend) |
| 34                      |                                    |
| Aroma                   | Acidic yoghurt                      |
| Taste                   | Very acidic (pH<4.5)                |
| Texture                 | Thick, heavy (water and yoghurt do not blend) |
| Aroma                   | Acidic yoghurt                      |
| Taste                   | Very acidic (pH<4.5)                |
| Texture                 | Dilute (water and yoghurt do not blend) |

3.2. Nutrient content

Nutrient / nutrient content of yoghurt with a composition of 100 ml fresh milk, 100 ml bio kul starter, 1 g taro flour (0.1%), 100 g granulated sugar and 30 g powdered milk as in Table 2. Based on the calculation of nutritional value in accordance with the table data list of food ingredients composition (DKBM) can be known the nutritional value of yoghurt that has been studied, namely. Per 100 ml of yoghurt.

3.3. Organoleptic Test

Organoleptic test for original yoghurt (without added sugar) with code 285 and yogourt variant (added sugar) with code 599 and using hedonic tests of 13 panelists with 9 scales and 4 aspects of assessment obtained the following data.

Based on the results of the taste assessment, the panelists preferred the yoghurt variant in the flavor, for the yoghurt the acidity level liked, for the texture between plain yoghurt and variant yoghurt, the average panelist was very like and very like, and for the colors in plain yoghurt average panelists really like it, so for the level of feeling the panelists prefer yoghurt variants, for acidity between plain yoghurt and yoghurt the same level variants are like, for the texture and color between plain yoghurt and yoghurt the same level variant is very like.
Table 2. Nutritional value / nutrition of yoghurt

| Material  | Energy | Fat | Carbohydrate | Calcium | Phosphor | Iron | Protein | Vitamin A | Vitamin B | Vitamin C |
|-----------|--------|-----|--------------|---------|----------|------|---------|-----------|-----------|-----------|
| Milk      | 1000   | 100 | 1000         | 1000    | 1000     | 1000 | 1000    | 1000      | 1000      | 1000      |
| fresh     | 100×   | 100 | 100×4.30     | 100×    | 100×     | 100× | 100×    | 100×      | 100×      | 100×      |
| 100 ml    | 61     | 3.50| = 43 gr      | 143.00  | 60       | ×     | 3.20    | = 130     | = 0.03    | = 10 1    |
| Kkal      | 610    | 35g | = 1430       | 2.00    | 22 g     | 130  | 0.3 mg  | 5 g       | -         | -         |
| Starter   | 90     | 0.5 g| 15 g         | -       | -        | -    | 5 g     | -         | -         | -         |
| 100 ml    | Kkal   | -   | -            | -       | -        | -    | -       | -         | -         | -         |

Sugar   | 100 | 0.00 | 100 | 100 | 10 | - | - | - | - | - | - |

| Material  | Energy | Fat | Carbohydrate | Calcium | Phosphor | Iron | Protein | Vitamin A | Vitamin B | Vitamin C |
|-----------|--------|-----|--------------|---------|----------|------|---------|-----------|-----------|-----------|
| Milk      | 0×     | 0   | 0×94.00      | 0×      | 0×1.0    |      |         |           |           |           |
| 100 gr    | 364    | = 94 g| 5.00 =       | 1.09    |          |      |         |           |           |           |
| Kkal      | 364    | 5.00 g| 1.09         | -       | -        | -    | -       | -         | -         | -         |

Milk powder | 30 | 30 | 30 | 30×30 | 30×30 | 30×30 | 30×30 | 30×30 | 30×30 | 30×30 |

| Material  | Energy | Fat | Carbohydrate | Calcium | Phosphor | Iron | Protein | Vitamin A | Vitamin B | Vitamin C |
|-----------|--------|-----|--------------|---------|----------|------|---------|-----------|-----------|-----------|
| Milk      | 10×    | 10 | 0×36.20      | 10×     | 10×0×    |      |         |           |           |           |
| 30 gr     | 509    | = 10.86 g| 905.00       | 694×    | ×        | 1.570×0.29 | 24.60 | 6.00    |            |           |
| Kkal      | 152.7 | = 9 g | = 271.2       | 208.2 g | 100×     | 471 mg | 0.087 | 7.38 g | 1.8 mg | 0.3 |

Table 3. Nutritional content of yoghurt

| Nutritional content | Amount | Nutritional content | Amount |
|---------------------|--------|---------------------|--------|
| Energy (Kcal)       | 87.5   | Iron (g)            | 2.9    |
| Protein (g)         | 1.8    | vitamin A (mg)      | 69.14  |
| Carbohydrates (g)   | 1.4    | vitamin B (mg)      | 0.03   |
| Calcium (g)         | 17.27  | vitamin C (mg)      | 0.26   |
| Phosphor (g)        | 31.9   |                     |        |
4. Conclusion
The use of Safira taro flour as a natural stabilizer in yoghurt products can be concluded that: (1) utilization of taro flour as a stabilizer in the best plain yoghurt products at a ratio of 0.1% taro flour with an incubation period of 18 hours, while the sweetest yoghurt yields the best at a ratio of 0.1% with 24-hour incubation period; (2) yoghurt with the addition of taro flour as a natural stabilizer has acidity at pH 4.5 with 0.61% fat, 2345.64 mg/kg potassium and every 100 ml of yoghurt has as much nutrient content: energy (612.8 Kcal), protein (12.7 g), carbohydrates (9.85 g), calcium (120.29 g), phosphorus (223.5 g), iron (20.3 g), vitamin A (484 mg), vitamin B (0.5 mg), vitamin C (1.82 mg); (3) the organoleptic test results can be concluded that panelist plain yoghurt states neutral to like and for sweet yoghurt panelists express their likes.

Utilization of Safira type of taro flour (Colocasia esculenta) as an addition to natural stabilizer in yoghurt products can be developed in other types of taro tuber so that it can lift local taro tuber commodities to have high economic value so that this research can continue and can be an innovation in the industrial world.

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