Sensory evaluation of synbiotic yoghurt with Banten taro flour as prebiotic

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Abstract. Banten taro is indigenous food in Banten Province, Indonesia. The functional value of yogurt can be increased by the addition of Banten “beneng” taro flour to stimulate the growth of probiotic bacteria in the digestive tract. Banten taro had potential as prebiotic. Sensory quality was an importance aspect of food product. Flavor change caused by adding Banten taro flour in yoghurt was undetermined. This study was aimed to determined the effect of variation lactic acid bacteria starter for the sensory quality of Banten taro yoghurt synbiotic. A seven-point facial hedonic scale was used to evaluate six yogurt samples. Variation of lactic acid bacteria starter and fortification of modified taro flour was not given significant effect for organoleptic quality (taste, texture, and smell) of synbiotic yogurt. The results showed that the best combination starter to produce yogurt was Lactobacillus bulgaricus + Lactobacillus acidophilus + Streptococcus thermophilus.

1. Introduction
Fermentation products such as yoghurt had been recognized for its beneficial effects on human health, longevity, and wellness [1]. The addition of lactic acid bacteria into the food can improving digestion, optimizing absorption of nutrition, and enhancing food safety [2,3]. Fermentation was a low cost cooking technique and easy to apply in household level. Probiotics are live microorganisms when administered in adequate amounts confer health benefits on the host. The reported beneficial effects of probiotic consumption include improvement of intestinal health, amelioration of symptoms of lactose intolerance, enhancement of the immune response, reduction of serum cholesterol, control of urogenital and respiratory tract infections, and reduction of the risk of colon cancers [2,3].

Synbiotics consist of both probiotic microorganisms and prebiotic compounds. Synbiotic products contain probiotics (useful bacteria) and prebiotics (indigestible carbohydrates) that stimulating beneficial bacteria growth. Synbiotics have antimicrobial, anticancer, antiallergic and immunestimulating properties. Synbiotics can improving absorption of minerals, preventing incidence of diarrhea, and optimizing assimilation of nutrients [4].

Prebiotics can stimulate selective probiotics growing in health human colon [5]. One of the most familiar prebiotic was inulin. Inulin is polysaccharides (mostly fructan) that consist of fructose with glycosidic bond β-(2-1) and glucose terminal at the ends [6]. Inulin is expensive so synbiotic products with inulin have higher price. Cheaper prebiotics was needed such as dahlia flour [6], taro starch [7], gembili [8], banana [9] and others. Taros was one of potential alternative prebiotic that contain of inulin, rafinosa and resistant starch [7]. Banten taro (Xanthosoma undipes K. Koch) had bigger tuber than other taro and easily cultivated. Banten taro (figure 1) is indigenous food from Juhut village
Pandeglang districts Banten province. Banten taro called Beneng (besar koneng) because of its huge tubers and yellowish colour. Banten taro had produce 20 kg tubers for 2 years. Banten taro had more starch (75.62%) than hijau taro, mentega taro, and semir taro [10]. Banten taro flour can be cheaper alternative but flavor changes of synbiotic yoghurt was undetermined.

Figure 1. Banten taro.

The objective of this study was to determined the effect of variation lactic acid bacteria starter for the sensory quality of Banten taro yoghurt synbiotic and to determined consumer acceptability of synbiotic yoghurt with Banten taro flour as prebiotic.

2. Materials and Methods

2.1. Preparation of Yoghurt Starter

Yoghurt starter was freezed dried. Five grams of starter was used for one litre of milk. S1 was \textit{Lactobacillus bulgaricus} + \textit{Streptococcus thermophilus}, S2 was \textit{Lactobacillus bulgaricus} + \textit{Lactobacillus acidophilus} + \textit{Streptococcus thermophilus}, and S3 was \textit{Lactobacillus bulgaricus} + \textit{Lactobacillus acidophilus} + \textit{Streptococcus thermophilus} + \textit{Lactobacillus casei} + \textit{Bifidus longum}.

2.2. Yoghurt Manufacturing

Standardized milk with 2.4% fat was heated 140°C for 4 seconds then mixed with 5% sugar and 1% Banten taro flour, cooled to 40°C, then add yoghurt starter. Fermented in yoghurt maker for 8 hours. Yoghurt was refrigared before served. Y1 (milk without Banten taro flour, S1), Y2 (milk with 1% Banten taro flour, S1), Y3 (milk without Banten taro flour, S2), Y4 (milk with 1% Banten taro flour, S2), Y5 (milk without Banten taro flour, S3), Y6 (milk with 1% Banten taro flour, S3).

2.3. Panel selection

To be eligibl for participation, subjects had to be over the age of 18 years, capable of understanding the intent of the study and able to provide informed consent. Fifty untrained panelists were selected to evaluate variations of yogurt. A total of 12 untrained male panelists and 38 untrained female panelists between the ages of 18 - 61 years old completed the sensory evaluation.

2.4. Sensory Evaluation

Sensory evaluations were privately conducted while participants were seated in a quite area with privacy. Tastings occurred between the hours of 16:00 - 20:00 to correspond with regular meal times. Prior to the tastings, all ingredients were disclosed to the participants to ensure cultural or religious restrictions would not be violated by participation. Each panelist was given a pen for recording on her/his evaluation sheet and a glass of water to cleanse the mouth between tastings. A seven-point facial hedonic scale in which 7 = “liked extremely”, 4 = “neither liked nor disliked” and 1 = “disliked extremely” was used by each participant for sample evaluation. Approximately 20 ml of each homogen sample were presented in a plastic cup with a plastic spoon and a plastic straw. Six samples were served one by one in a random order. Hedonic organoleptic parameters were taste, texture, and smell [11].
3. Results and discussion

3.1. Banten taro flour

Banten taro flour was made by cleaning (soak in NaCl 10% for 1 hour), chopping, drying (50°C-60°C for 6-12 hours), milling, and sieving. Banten taro flour yield is 10.24% [12]. Banten taro contain high oxalic acid. Oxalic acid gives itchy feel. Banten taro in Juhut had oxalic acid lesser than others because cultivated in less acidic soil [13]. Step soak in NaCl 10% was to reduced oxalic acid in Banten taro. This step can reduce oxalic acid 50% [14]. Banten taro flour characteristics was shown in Table 1 [15].

Table 1. Banten taro flour characteristics.

| Characteristics    | % w/w |
|--------------------|-------|
| Water content      | 6.10  |
| Ash content        | 6.11  |
| Fat                | 0.39  |
| Protein            | 6.70  |
| Carbohydrate       | 80.70 |

3.2. Sensory properties

Sensory properties (taste, smell, and texture) obtained by hedonic aspect. In this research, consumer acceptability change was determined by compared yoghurt with and without Banten taro flour and compared variety of starter for synbiotic yoghurt (yoghurt with Banten taro flour as prebiotic). Overall, participants preferred yogurt products which were sweet and little bit sour with fruity sour aroma and those which maintained a smooth and homogenous texture.

Hedonic value (taste, smell, and texture) of all yoghurt sampel (Y1, Y2, Y3, Y4, Y5, and Y6) had 5-6 poin from 7 scale (slightly like to like). All samples had given good acceptability (above 4 point). Y1 and Y2 showed no difference in texture and smell (Figure 2). Y2 (with Banten taro flour) had lower acceptability score than Y1 for taste. Yoghurt with Banten taro flour had more soursness than the original, but panelists able to handle the soursness. Comparison Y3 and Y4 or Y5 and Y6 were given the same result. Banten taro flour in yoghurt changed taste but texture and smell was similar with the original. Fermentation time had effect of soursness yoghurt. Yoghut with Banten taro flour was fermented for 5, 6, and 7 hours. Yoghurt that fermented for 6 hours had similar soursness with original yoghurt that fermented for 8 hours. Then, added Banten taro flour to yoghurt did not change the taste just made fermentation process faster. Adding Banten taro flour changed yoghurt colour. Yoghurt symbiotic had more yellowish darker colour than the original. This colour change had no effect in organoleptic evaluation because panelists evaluated sample one by one and cant compared between samples.

Comparison hedonic score Y2, Y4, and Y6 was to determine effect of different starter in symbiotic yoghurt (figure 3). Y2 with standart yoghurt culture had the lowest score for taste, smell, and texture. Adding more lactic acid bacteria (Y4 and Y6) improve acceptability hedonic score for taste, smell, and texture. For taste and smell Y4 had the highest hedonic score. Y4 had taste sweet and sour that given sour fresh fruity like aroma. For texture Y6 had the highest hedonic score. Y6 had liquid texture that the easiest to swallowed. Y4 and Y6 had similar organoleptic features, but Y6 was more fluid than Y4. In commentary column, most panelist preferred Y5 from all sample because it had slightly sour taste with fruity aroma and easy to swallowed. For acceptability and economic reason, starter 2 was the best starter to produce symbiotic yoghurt with good acceptability. Starter 2 produced Y3 and Y4 that had organoleptic score for taste 5.8; 5.5 (slightly like to like), smell 5.1;5.3 (slightly like to like), and texture 5.9;5.8 (slightly like to like). Viability test of lactic acid bacteria need to be done to decide the best starter for symbiotic yoghurt in health aspect and optimization for amount of Banten taro flour that added.
Figure 2. Organoleptic hedonic score (compared yoghurt with and without Banten taro flour).

Figure 3. Organoleptic hedonic score (synbiotic yoghurt with starter variation)
4. Conclusion
Yoghurt with Banten taro flour 1% had more sour taste than the original yoghurt. The sour taste of symbiotic yoghurt was still acceptable (hedonic 5-5.5 poin from 7 scale) in this community. Texture and smell of the original yoghurt and symbiotic yoghurt was indistinguishable. Variation of starter affect the texture and smell of yoghurt. S2 and S3 made yoghurt with texture like fluid. S1 made creamy like yoghurt. S3 made yoghurt with smell like sour fresh fruity that the most acceptable aroma of all yoghurt (Y5). For acceptability and economic reason, the results showed that the best combination starter to produce yoghurt was Lactobacillus bulgaricus + Lactobacillus acidophilus + Streptococcus thermophilus (S2).

5. References
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