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PRODUCT DEVELOPMENT OF SYNBIOTIC YOGHURT MADE FROM OF COW'S MILK AND PURPLE SWEET POTATO PUREE

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ABSTRACT

Increased the beneficial of purple sweet potato puree that contain high levels of anthocyanins and antioxidants can be done through the manufacture of yoghurt sinbiotic, purple sweet potato puree as a prebiotic and a probiotic Lactobacillus rhamnosus R23.This study aimed to obtain a yoghurt product formulations sinbiotic of a mixture of cow's milk with sweet potato puree purple and assess physicochemical characteristics and total lactic acid bacteria yogurt products sinbiotic produced. In the early stages of making yoghurt made by mixing milk, purple sweet potato puree at a concentration of 4, 6, and 8%. Then proceed with the manufacture of yoghurt sinbiotik using L. rhamnosus R23 with rasio 1: 1: 1, 1: 1: 2, 1: 1: 3 (v / v). Determination of yogurt products chosen based on the parameters: pH, total of titration acid, total dissolved solids and total lactic acid bacteria. Mixture of purple sweet potato puree 8% (w / v) and L. rhamnosus R23 3% (v / v) is chosen sinbiotic yoghurt with characteristics of pH 4.17, total of titration acid 1.23%, viscosity 559.3 cp, total dissolved solids 10.9^{0}Brix and total lactic acid bacteria1.4x10^9 cfu/ml.

***KEYWORDS**: cow'smilk, purple sweet potato puree, yoghurt sinbiotic*

1. INTRODUCTION

Milk is one of the livestock products consumed by the people of Indonesia in the form of fresh or in the form of processed milk because of its nutritional content is very good for health, especially for the growth of children. Fresh milk is a liquid derived from healthy and clean cows, obtained by proper milking, whose natural nutritional content is not reduced or added anything and has not received any treatment except cooling (SNI, 2011). The nutritional content of milk is also very good for the growth of microorganisms. Therefore, to improve the quality and extend the shelf life of fresh milk needs further processing, among others, processing of fermented milk or better known as yoghurt. Yoghurt is a dairy product obtained from the work of lactic acid bacteria namely, Streptococcus thermophilus and Lactobacillus bulgaricus. The presence of lactic acid bacteria activity, causes lactose dihidrolisa into glucose and galactose that will be more easily digested and absorbed by the digestive tool.

According to Krasaekoopt et al. (2003) yogurt cultures commonly used L. bulgaricus and S. thermophilus, will produce β-galactosidase in yoghurt, but the bacteria can not survive and grow in the intestinal tract because of low bile salt tolerance. The addition of probiotics is aimed at increasing the functional value of yoghurt. Probiotics are living microorganisms that when consumed can survive when passing through the condition of the stomach and digestive tract, and can inhibit the growth of unwanted microorganisms in the body. Generally microorganisms included in probiotics are lactic acid bacteria. The probiotic strain used in this study was L. rhamnosus R23 which, according to Nuraida et al.

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(2011) is a probiotic candidate lactic acid bacteria that can be used in sinbiotic fermentation milk products. In addition, L. rhamnosus R23 via in vivo testing was reported to have the ability to prevent diarrhea by suppressing the amount of E. coli in the stool as soon as the mice were given E. coli 1.1 intake (Nuraida et al., 2012).

In the manufacture of yoghurt can be added other foodstuffs aimed at improving the functional value of yoghurt and also to improve the appearance of yoghurt. One of the ingredients that can be added in the manufacture of yogurt is purple sweet potato puree (Ipomoea batatas) with the characteristics of the skin and the color of the fruit is purple. The purple color of sweet potatoes shows the amount of anthocyanin pigment content that is very useful as an antioxidant in the body. In addition, this purple color can be used to improve the appearance of the color of processed food. In this case, the purple color of this purple sweet potato can improve the color of the resulting yoghurt product, so the product's color becomes attractive. Also purple sweet potato can serve as a prebiotic, because it contains oligosaccharides and fiber that can support the growth of probiotic bacteria. Potassium oligosaccharides are potentially prebiotic by supporting the growth of Lactobacillus and Bifidobacteria that are known to survive in the gastrointestinal tract (Nuraida et al., 2008). The aim of this research is to obtain the formulation of sinbiotic yoghurt product from cow milk mixture with purple sweet potato puree and to study physicochemical characteristics including pH, total titrated acids, viscosity, total soluble solids and total lactic acid bacteria of sinbiotic yoghurt product.

2. METHODS

2.1 Tools and materials

The raw materials used in this research are fresh milk from the farm of IPB Faculty of Animal Husbandry, purple sweet potato obtained from Balai research of beans and tubers (BALITKABI), Malang-East Java. Skim milk (SUNLAC), granulated sugar (Gulaku). The probiotic cultures used in this study were S. thermophilus FNCC1-903, L. bulgaricus FNCC004P, L. rhamnosus R23 (Nuraida's private collection). Media grows microorganisms such as MRSA (de Man Rogosa Sharpe Agar from Oxoid) and MRSB (de Man Rogosa Sharpe Broth from Oxoid). Chemicals used include NaCl (Oxoid), indicator phenolphthalein 1%, NaOH 0.1 N.

The tools used in this research are pH-meter, Brokfield viscometer, refractometer, food processor, scales, pan, stirrer spoon, micropipette, bunsen, magnetic stirrer, incubator, autoclave, refrigerator, vortex, laminar air flow, waterbath, ose, petridish cup, and oven.

2.2 Method

This research consists of two stages of making purple sweet potato puree, and making of fresh milk mixed yoghurt product with purple sweet potato puree as yoghurt base formula at puree concentration (4%, 6%, 8%). The determination of selected yoghurt products was based on the results of pH analysis, viscosity, total titrated acids, and total dissolved solids. In the second stage, the production of yoghurt sinbiotik based on the basic formula. Furthermore the selected basic formula was added probiotic L. rhamnosus R23 at concentrations (1%, 2%, 3%). The resulting product is analyzed pH, viscosity, total titrated acids, total dissolved solids, and total lactic acid bacteria.

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2.3 Raw Material Preparation

The purple sweet potato puree is obtained through several stages of the process, ie fresh purple sweet potatoes are sorted and washed, steamed for 45 minutes, peeled, then crushed using a food processor.

2.4 Making starter culture

Starter culture was started by making a 12% skim milk solution, sterilized by autoclaving at 121° C for 15 minutes, and cooled. After cooling, the milk solution was inoculated with 1% pure culture of S. thermophilus FNCC1-903, L. bulgaricus FNCC004P, L. rhamnosus R23, and incubated at 37 ° C for 24 hours.

2.5 Making yogurt mix fresh milk with purple sweet potato puree (yoghurt base formula)

Making yoghurt is done by mixing 3% skim milk and 3% sucrose into fresh milk, then added purple sweet potato puree (4%, 6%, 8%) and stirred. The mixture is pasteurized at 90 ° C for 30 minutes, and cooled to 45 ° C. A 2% yoghurt starter was added with a starter combination consisting of S. thermophilus FNCC1-903 and L. bulgaricus FNCC004P at a ratio of 1: 1 (v / v) and inserted into a plastic cup container and incubated at 37 ° C for 24 hours.

2.6 Making sinbiotic yoghurt

The production of yoghurt sinbiotik is done by mixing 3% skim milk and 3% sucrose into fresh milk, then added purple sweet potato puree (selected concentration from first stage study) and stirred. The mixture was pasteurized at 90 ° C for 30 minutes, and cooled to 45 ° C and then added 2% yoghurt starter with three variations of starter combination comprising S. thermophilus FNCC1-903, L. bulgaricus FNCC004P, L. rhamnosus R23 on three combinations 1: 1: 1 (v / v), 1: 1: 3 (v / v) ratio and inserted into a plastic cup container and incubated at 37 ° C for 24 hours.

2.7 Degree of yoghurt acidity

The tool is calibrated first using a buffer solution representing low pH (4.00) and high pH (7.00). A total of 25 ml samples were placed in 100 ml cup glasses. Then the pH meter electrode is immersed in the sample, and the pH value can be read on the pH meter screen.

2.8 Total tertitrasi acid (AOAC 2006)

A total of 10 ml samples were incorporated into the erlenmeyer, then added 3 drops of 1% phenolphthalein indicator. The sample was titrated with a standardized NaOH 0.1 N solution until pink was formed which is the end point of titration. The calculated total of titrated acids can be calculated based on AOAC (2006).

2.9 Viscosity (AOAC 2006)

The viscosity analysis was performed using a Brokfield viscometer. A total of 200 ml samples were put into a 250 ml cup glass. The spindle is dipped into the sample and adjusted the viscometer's height until the line is dotted. Measurements are made by pressing the ON button and then left the spindle spinning for 20 -30 seconds, and the designated number of the spindle is read correctly.

2.10 Total dissolved solids (Retnowati and Kusnadi 2014)

Samples were taken using dropper drops. Put in a refractometer prism. The value of the measurement is determined by looking at the scale shown on the refractometer.

2.11 Test of BAL Viability (BAM 2001 modified)

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A total of 10 ml of yogurt samples were diluted into 90 ml of sterile NaCl diluent to obtain 10-1 dilution. The samples were stirred until homogeneous and then diluted to 10-9 dilution. Fertilization is done by duplo. The method used is the method to pour with MRSA. MRSA is poured 15 ml into a cup containing the culture and then flattened by rotating the cup and then allowing it to freeze. After frozen the cup was incubated in reverse position at 37 ° C for 48 hours. The number of colonies was calculated based on BAM (2001).

2.12 Data analysis

Data from result of physicochemical test of yoghurt done twice replication was analyzed using ANOVA variance analysis with software of Minitab 16. If result of ANOVA showed difference in treatment continued with Tukey real difference test.

3. RESULTS AND DISCUSSION

3.1 Making yogurt mixed with cow's milk and purple sweet potato puree

Yogurt production was done by adding 2% culture of lactic acid bacteria mixture of S. thermophilus FNCC1-903 and L. bulgaricus FNCC004P ratio of 1: 1 (v / v) and purple sweet potato puree concentration (4%, 6%, 8%). The result of physicochemical analysis of the resulting product can be seen in Table 1.

Table 1. Result of measurement of physicochemical yoghurt analysis

Puree Concentration (%)	pH	Total Acidified Acid (%)	Viscosity (cp)	Total Dissolved Solids (oBrix)
0	4.59±0.050^{a}	1.39±0.23^{a}	416±11.3^{b}	11.1±0.14^{b}
4	4.28±0.011^{b}	1.16±0.04^{a}	718±108.9^{ab}	11.9±0.14^{a}
6	4.22±0.004^{bc}	1.25±0.00^{a}	822.5±92.6^{ab}	12.1±0.21^{a}
8	4.14±0.007^{c}	1.26±0.07^{a}	1154.5±231.2^{a}	12.2±0.07^{a}

Information:
* value = mean ± standard deviation with two replicates (n = 2)
* the numbers in the same column followed by different letters show a real difference at the 5% level (Tukey real difference test)

From Table 1 it is found that the pH value of the resulting product ranges in the range 4.14-4.59. The more puree added the lower the pH value. Changes in pH values are caused by the activity of starter culture converts lactose into lactic acid. This is supported by Leroy and Vuyst (2004) which describes lactose changes in yoghurt production by starter culture to lactic acid causing a pH range of 4.2-4.5 and during pH storage may decrease to 4.0. During the fermentation process lactic acid bacteria will ferment the existing carbohydrates to produce lactic acid. The formation of lactic acid is what will cause a decrease in pH value which indicates an increase in acidity in the product.

The result shows that the total value of the resulting titrated acids ranges from 1.16% to 1.39%. This has fulfilled the quality requirement of yoghurt according to SNI (2009), that is 0.5% -2.0%. Total titrated acids are the amount of lactic acid formed during the fermentation process which is the result of lactose breakdown by lactic acid bacteria. The result of statistic analysis of 4%, 6%, 8% purple sweet potato puree concentration had no significant effect on total titrated acids produced. This is presumably because the concentration of purple sweet

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potato puree used is not much different so that the amount of lactic acid formed during the fermentation process is not significantly different.

Measurements of yoghurt viscosity (Table 1) yielded viscosity values ranging from 416-1154.5 range. From Table 1 it can be seen that the higher concentration of purple sweet potato puree given will increase the viscosity of the resulting yoghurt. The result of statistical analysis showed that purple sweet potato puree as much as 4% and 6% were not significantly different and gave significantly different result on 8% purple sweet potato puree. The increase in viscosity is due to the increasing amount of starch added during the manufacture of yoghurt. In the pasteurization process occurs gelatinisasi starch so that water content in the product decreases and the viscosity of yogurt is increasing.

The statistical results show that giving purple sweet potato puree to as much as 8% in yogurt making does not affect the total dissolved solids of the product. The result of measurement (Table 1) shows the total value of the dissolved solids produced ranges in the range 11.1-12.2 and the value has met the quality requirements of yogurt based on SNI (2009) that is the total value of soluble solids of at least 8.2. During storage the total value of dissolved solids may decrease due to the activity of lactic acid bacteria in remodeling the simple sugars present in yoghurt (Kusuma, 2007).

3.2 Production of synbiotic yoghurt with different concentrations of probiotics

At this stage, yoghurt is made by using variation of starter culture as much as 2% with three levels of comparison of S. thermophilus FNCC1-903, L. bulgaricus FNCC004P, L. rhamnosus R23 (1: 1: 1), (1: 1: 2) , and (1: 1: 3) and the addition of purple sweet potato puree concentration is 8%. The results of physicochemical analysis including pH, total titrated acids, viscosity and total dissolved solids can be seen in Table 2.

Table 2. Results of physicochemical analysis of sinbiotic yogurt with starter culture variation.

Starter Variations	pH	Total Acidified Acid (%)	Viscosity (cp)	Total Dissolved Solids (oBrix)
1%	4.10±0.007[b]	1.28±0.02[a]	592.3±7.4[a]	11.2±0.07[a]
2%	4.12±0.011[b]	1.23±0.01[a]	565.5±2.8[b]	10.9±0.28[a]
3%	4.17±0.035[a]	1.23±0.01[a]	559.3±3.9[b]	10.9±0.07[a]

Information:

* value = mean ± standard deviation with two replicates (n = 2)

* the numbers in the same column followed by different letters show a real difference at the 5% level (Tukey real difference test)

From Table 2 it can be seen that the pH value obtained is between 4.10-4.17. The results of statistical analysis showed probiotic concentrations of 1% and 2% were not significantly different, and significantly different at 3% probiotic concentration. The resulting pH value of 4.0 still shows the acid pH value. This is due to the activity of lactic acid bacteria that ferment the sugars (sucrose, lactose, glucose) to most lactic acid and a small amount of other acids.

The total value of titrated acids (Table 2) has no significant effect on all probiotic concentrations. The total value of titrated acids obtained ranged in the range of 1.23-1.28%. Total tertitrasi acid is expressed as the percent of lactic acid formed from the fermentation of milk into yoghurt. Lactic acid levels are formed by the activity of lactic acid-forming microorganisms that are affected by the

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presence of sugary foods and other ingredients necessary for their growth (Sukardi et al., 2001).

The viscosity value (Table 2) with 1% probiotic concentration was significantly different between probiotic concentrations of 2% and 3%, while the probiotic concentrations of 2% and 3% were not significantly different. The viscosity value obtained ranges from 559-595 cp. The yoghurt produced in the form of thick yoghut, where thick yoghurt has a viscosity value of 500-890 cp (O'neil, 1997 in Pramitaningrum, 2011).

The result of statistical analysis showed the addition of probiotic concentration up to 3% did not affect the total value of dissolved solids. The total value of the dissolved solids obtained is in the range 10.9-11.2. The total value of the dissolved solids of the yoghurt products produced has met the quality requirements of yoghurt based on SNI (2009) that is at least 8.2.

3.3 Viability of Lactic Acid Bacteria

The results of viability of lactic acid bacteria in the resulting sinbiotic yoghurt is about 1.1x109 -1.6x109 cfu / ml. From the statistical analysis showed total lactic acid bacteria that was not significantly different in each treatment of starter culture variation. This is presumably because the probiotic concentration of 1% -3% is not quite different. This is supported by research Saufani (2009) that the use of starter L. casei as much as 1.5% -3.5% in the manufacture of fermented milk does not increase the number of lactic acid bacteria. The higher starter concentration used will be the more glucose obtained from the result of milk lactose reshuffle, whereas glucose is the main substrate in the growth of probiotic bacteria.

4. CONCLUSION

The giving of purple sweet potato puree as much as 8% and the addition of probiotic L. rhamnosus R23 as much as 3% can be selected as the best concentration in making sinbiotic yoghurt. The result of physicomic analysis obtained was pH 4.17, total acid tertitrasi 1.23%, viscosity 559.3 cp, total dissolved solids 10.9o Brix and total lactic acid bacteria 1.4x109 cfu / ml. The result of this analysis has fulfilled the quality requirement of yoghurt based on SNI 2009 that is total of acitated acids ranged from 0.5-2.0%, total dissolved solids minimum 8.2^{o} Brix.

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