Effect Unripe Berline Banana Flour on Synbiotics Yogurt of Physicochemical And Microbiological Properties

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Effect Unripe Berline Banana Flour on Synbiotics Yogurt of Physicochemical And Microbiological Properties

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ABSTRAK

Latar Belakang: *Yoghurt sinbiotik tergolong dalam produk susu fermentasi yang mengkombinasikan antara bakteri probiotik dengan bahan yang mengandung komponen prebiotik. Tepung pisang berlin mentah memiliki kandungan pati resisten yang dapat berperan sebagai prebiotik.*
Tujuan: *Penelitian bertujuan untuk mengetahui pengaruh penambahan tepung pisang berlin mentah pada yogurt sinbiotik terhadap properties fisikokimia dan mikrobiologi*
Metode: *Penelitian ini merupakan penelitian True Experimental dengan rancangan acak lengkap. Kelompok perlakuan terdiri atas 4 kelompok yakni P0 (inulin 2%), P1 (UBF 1%), P2 (UBF 2%), dan P3 (UBF 3%). Proses pembuatan yoghurt sinbiotik tepung pisang berlin mentah yaitu diawali dengan membuat tepung pisang berlin, starter yogurt, dan yogurt sinbiotik. Uji yang dilakukan yakni uji fisikokimia dan mikrobiologi. Data uji fisikokimia dianalisis secara deskripitif dan uji mikrobiologi dianalisis menggunakan kruskall walls dengan taraf 95% menggunakan SPSS.*
Hasil: *Pada uji fisikokimia diketahui bahwa pada kelompok dengan penambahan UBF (P1, P2, P3) memiliki kadar abu, total asam, TAT pati resisten dan viskositas yang lebih tinggi dibandingkan kelompok inulin (P0). Pada uji mikrobiologi diketahui bahwa terdapat perbadaan signifikan antar kelompok perlakuan (P=0.002), tidak terdapat perbedaan terkait parameter koliform antar kelompok (P=0,707), dan salmonella teridentifikasi negative pada semua kelompok.*
Kesimpulan: *Yogurt sinbiotik dengan penambahan UBF berpotensi untuk dapat diaplikasikan sebagai produk pangan fungsional yang bermanfaat bagi kesehatan*

KATA KUNCI*: Fisikokimia; Mikrobiologi; Pati resisten; UBF; Yogurt Sinbiotik*

ABSTRACT

Background: *Synbiotic yogurt is a fermented milk product that combines probiotic bacteria with ingredients that contain prebiotic components. Unripe berlin banana flour contains resistant starch that can act as a prebiotic.*
Objectives: *This study aimed to determine the effect of the addition of unripe banana flour to synbiotic yogurt on physicochemical and microbiological properties.*
Methods: *This research is true experimental with a completely randomized design. The treatment group consisted of 4 groups, namely P0 (2% inulin), P1 (1% UBF), P2 (2% UBF), and P3 (3% UBF). The process of making unripe berlin banana flour synbiotic yogurt begins with making berlin banana flour, yogurt starter, and synbiotic yogurt. The tests conducted were physicochemical and microbiological tests. Physicochemical test data was analyzed descriptively and microbiological was using the Kruskall walls test with 95% level confidence using SPSS.*
Results: *In the physicochemical test, it was found that the group with the addition of UBF (P1, P2, P3) had higher ash content, total acid, resistant starch TAT, and viscosity than the inulin group (P0). In the microbiological test, it was found that there were significant differences between treatment groups (P=0.002), there were no differences related to coliform parameters between groups (P=0.707), and salmonella was identified as negative in all groups.*
Conclusions: *Synbiotic yogurt with the addition of UBF has the potential to be applied as a functional food product that is beneficial for health.*
KEYWORD*: Physicochemistry; Microbiology; Resistant starch; UBF; Synbiotic Yogurt*

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INTRODUCTION

Synbiotic yogurt is a fermented milk product that combines probiotic bacteria and prebiotic components. This alternative food option is popular among those who want to easily maintain a healthy lifestyle. It is considered a functional food, which is processed food that contains one or more functional components that have certain physiological functions, proven to be safe and not harmful to health. Synbiotics aim to stimulate the growth or activity of Bifidobacteria and Lactobacilli by using carbohydrates with several probiotic starches. This combination increases the survival of probiotic bacteria because specific substrates are available for fermentation, resulting in greater benefits for the body (1).

The production of synbiotic yogurt is generally done by using lactic acid bacteria that function as probiotics such as *Bifidobacterium bifidum, Lactobacillus casei*, or *Lactobacillus acidophilus* to improve the quality and added value of yogurt as a health drink (2). Prebiotics are indigestible food components that support beneficial bacteria (3).

Resistant starch (RS) has a high prebiotic capacity because it is an indigestible carbohydrate, but it has a favorable influence on the probiotic microflora environment in the gut, thus providing health effects for humans (4).

Unripe banana flour is a food ingredient that contains prebiotics. Unripe banana flour supports the growth of probiotic bacteria that are resistant to α-amylase and trypsin hydrolysis (5). The resistant starch (RS) content in unripe banana flour is a natural source that contributes to the development of prebiotics (6). RS is a plant prebiotic classified as a type of dietary fiber that can help food reach the healthy human colon and has clinically beneficial effects on colon health (7,8).

The analysis of unripe berlin banana flour contained 40.01% RS from 100 g of flour, while ripe berlin banana flour contained 39.76% (9). Resistant Starch (RS) has potential as a prebiotic due to its ability to resist digestion, pass through the colon, and positively stimulate the fermentation of the gut microbiota. RS also stimulates hormones that play a role in appetite control, preventing fat accumulation and thus aiding in weight management (10).

Synbiotic yogurt with the addition of unripe berlin banana flour which has RS content is beneficial as a prebiotic that is beneficial to health. The purpose of this study is to analyze the effect of the addition of unripe Berlin banana flour on total lactic acid bacteria (LAB), RS content, and acceptability of synbiotic yogurt with the addition of unripe berlin banana flour.

MATERIALS AND METHODS

This research was conducted at the Dietetics Laboratory, Clinical Nutrition Study Programme, Jember State Polytechnic. In addition, the research was also conducted in the Analysis Laboratory at the Food Industry Technology Study Programme, Jember State Polytechnic and Microbiology Laboratory, FMIPA, University of Jember. The research was conducted in July-August 2023. The type of banana used in this study is the Berlin banana. The main ingredients used in this study were unripe banana flour (UBF), skimmed milk, sugar, and inulin, and the starter used was Maltodextrin and active bacterial cultures (*Bifidobacterium longum, Lactobacillus rhamnosus, Lactobacillus casei, Lactobacillus helveticus, Lactobacillus bulgaricus, Lactobacillus acidophilus, Streptococcus thermophilus*).

This research is True Experimental research with a completely randomized design. The treatment groups consisted of P0 (synbiotic yogurt with the addition of

inulin), P1 (synbiotic yogurt with the addition of UBF 1%), P2 (synbiotic yogurt with the addition of UBF 2%), and P3 (synbiotic yogurt with the addition of UBF 3%). The process of making unripe berlin banana flour synbiotic yogurt begins with making berlin banana flour with the manufacturing process according to Putri Damayati et al, 2020 (11). Furthermore, make a yogurt starter by dissolving 125 grams of powdered skim milk into 1 L of warm water at 45ºC. A dry yogurt starter 3 grams was put into a warm sterile milk solution which was then incubated for 24 hours in a closed container. The next stage is the preparation of unripe Berlin banana flour synbiotic yogurt by preparing unripe Berlin banana flour first with the following percentages P0 = 2% Inulin, P1 = 1% unripe banana flour, P2 = 2% unripe banana flour, and P3 = 3% unripe berlin banana flour. 13 grams of skimmed milk, and 0.5 grams of sugar, then mix and dissolve with water up to 100 mL and heat to a temperature of 80°C. After cooling to 45°C, inoculated with yogurt starter as much as 3 mL for each treatment. Each treatment was then incubated at 42°C for 12 hours.

Analysis of ash, fat, protein, carbohydrate, and resistant starch using standardized analysis methods in SNI 01-2891-1992. Total energy analysis refers to SOP number 13/PL17.3.03/SOP/2021, viscosity SOP number 4/PL17.3.2.03/SOP/2021, Total acid and total titratable acid (TAT) refers to AOCa.947.05, pH analysis refers to SNI 2973-2011. The lactic acid bacteria analysis test uses the spread plate method, the coliform test uses the 3-tube APM method while the salmonella test uses the salmonella selective media test. Physicochemical test data were analyzed descriptively and microbiological tests were analyzed using Kruskall walls and continued with Mann Whitney test with a 95% confidence level.

RESULTS AND DISCUSSIONS

Table 1. Physicochemical Properties of Unripe Berlin Banana Flour Synbiotic Yogurt

Parameters	Groups (Mean ± SD)				Quality Requirements
	P0	P1	P2	P3	SNI
Ash (%)	0.97 ± 0.03	1.05 ± 0.03	1.14 ± 0.04	1.21 ± 0.04	max 1.0
Fat (%)	3.33 ± 0.04	3.30 ± 0.00	3.25 ± 0.00	3.23 ± 0.04	min 3.0
Protein (%)	3.81 ± 0.08	3.75 ± 0.06	3.64 ± 0.06	3.23 ± 0.04	min 2.7
Carbohydrate (%)	5.47 ± 0.37	5.74 ± 0.01	5.93 ± 0.14	3.59 ± 0.03	-
Energy (Kkal/100gr)	67.03 ± 1.52	67.14 ± 0.57	67.53 ± 0.34	68.51 ± 0.71	-
Acid Total (%)	0.93 ± 0.03	0.88 ± 0.01	0.82 ± 0.03	0.78 ± 0.04	0.5%-2%
TAT (%)	3.93 ± 0.00	3.96 ± 0.00	4.00 ± 0.00	4.02 ± 0.00	-
Resistant Starch (%)	2.47 ± 0.06	2.59 ± 0.03	2.61 ± 0.09	2.77 ± 0.03	-
Viscosity (mm/s)	0.25 ± 0.00	1.03 ± 0.04	0.73 ± 0.04	0.50 ± 0.00	-
pH (%)	3.93 ± 0.01	3.96 ± 0.01	2.61 ± 0.09	4.02 ± 0.01	3.80-4.50

The ash content of P0, P1, P2, and P3 were 0.97%, 1.05%, 1.14%, and 1.21%, respectively. These results show that the P1 group is following the ash content standard set by SNI 2891:2009, which is a maximum of 1.0%. The mineral content present in food products can also affect the assessment of the ash content of the product. The most mineral content found in bananas is potassium (12).

The fat content in all treatment groups follows the product standards said to be yogurt, namely a fat content of min 3%. Group P3 has lower fat content than other groups. In unripe bananas, the fat content is known to be 0.18% (13). The results of the analysis of fat content in unripe berlin banana flour were 1.07% (14). Functional foods that utilize the presence of prebiotics effect to improving the fatty acid profile (15).

The protein content in the table above shows that all treatment groups are following the protein content standards set by SNI 2891: 2009, which is a minimum of 2.7%. The P1 group had higher protein levels compared to the P2 and P3 groups. The carbohydrate content of P2 is at a higher level than the other groups. The carbohydrate source in the sugar content is inulin in P0 and unripe banana flour in P1, P2, and P3. All yogurt formulations use 2.5 g/100 ml of sugar which fulfills the claim of low-sugar yogurt products (16). Inulin is a type of carbohydrate that acts as a prebiotic (17). The carbohydrate content of unripe berlin banana flour is 82.6% per 100 g flour (14). The

total energy of the yogurt was below the calorie requirement of yogurt per serving which is less than 120 kcal/ serving (18).

Total acid in all groups had values around 0.78%-0.93% and these values were following the SNI quality requirements with a range of values of 0.5%-2%. LAB activity ferments the presence of fibre in unripe banana flour as an energy source which will produce lactic acid. The value of total titratable acid (TAT) in yogurt products ranged from 0.78-0.93. This value has met the standard value of SNI 2891: 2009 regarding Yogurt Quality, which is a TAT value of 0.5-2.0% (19). The fermentation activity carried out by LAB during yogurt making causes the accumulation of lactic acid products produced so that the value of total aspirated acid can increase (20).

The most resistant starch was found in the P3 group. The greater the addition of unripe banana flour, the greater the resistant starch content. Resistant starch (RS) in unripe bananas has the potential to act as a prebiotic due to its ability to resist digestion and pass through the colon, positively stimulating gut microbiota fermentation (10). The lowest viscosity was found in the P0 compared P1, P2, and P3 groups. Banana flour contains pectin can increase the viscosity of yogurt (21). Pectin is a hydrocolloid that is able to bind water strongly, with this strong water binding ability it will reduce syneresis in yogurt (22).

The highest pH value of yogurt was obtained in P3 with a value of 4.02, while the lowest pH value was in P2 with a pH value of 2.61 According to SNI 2009, good yogurt quality requirements have a pH value ranging from 3.80-4.50. In the results, it is known that the P0, P1, and P3 groups meet the quality requirements of yogurt.

Table 2. Microbiology Properties of Unripe Berlin Banana Flour Symbiotic Yogurt

Parameters	Groups (Mean ± SD)				P-value	Quality Requirements SNI
	P0	P1	P2	P3		
BAL Total (10^7CFU/ml)	1.25^{a}	8.6^{b}	4.65^{ab}	0.70^{a}	0.002	Min 10^7
Coliform (APM index/ml)	19^{a}	7^{a}	23^{a}	32^{a}	0.707	Max 10
Salmonella	negative	negative	negative	negative	negative	negative/25g

Notes: The different superscripts within the same row showed significant differences (P<0.05)

Based on the analysis of the number of lactic acid bacteria (LAB) in unripe banana flour synbiotic yogurt, it is known that there are differences between treatment groups p=0.002. Group P1 had a greater number of LAB compared to the other groups.

The higher the addition of unripe berlin banana flour in the synbiotic yogurt product, the less the amount of LAB. The results of coliform testing on yogurt products showed no significant difference p=0.707. Group P1 is known to have a coliform result of 7 and is following the quality requirements of yogurt in SNI 2891: 2009 which is a maximum of 10. Salmonella test showed negative results in all treatment groups. This condition follows the quality requirements of yogurt in SNI 2891: 2009 which is negative. Salmonella bacteria are inhibited through the process of making synbiotic yogurt by pasteurization with a temperature of about 80°C. In addition, the presence of Lactobacillus acidophilus bacteria is known to have a role in inhibiting the growth of pathogens such as Salmonella (23).

CONCLUSIONS AND RECOMMENDATIONS

Synbiotic yogurt with UBF can be a potential application as a functional food product with beneficial health properties

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