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Research Paper

The effect of the use of three cultures of lactic acid bacteria with the addition of the concentration of strawberry juice on the organoleptic value of frozen yogurt

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ABSTRACT: *This study aimed to determine the effect of* Streptococcus thermophilus, Lactobacillus fermentum *strain SK152 and* Lactiplantibacillusplantarum *strain heal19 as a starter in making yogurt with the addition of strawberry juice on the organoleptic values of taste, flavor, and texture in frozen yogurt. Goat's milk was used in this research. The experimental method used with data processing in a Randomized Block Factorial Design 3x3 with three replications. The treatment were differencesof starter concentration as well as 4% (A1), 5% (A2), 6% (A3), and differences in the concentration of strawberry juice for 0% (B1), 12.5% (B2), 25% (B3). The variables measured were organoleptic tests of taste, flavor, and texture. The results showed a significant effect (P<0.05) on the addition of the starter concentration and the concentration of strawberry juice on the organoleptic value of taste 4.00, flavor 2.08, and texture 2.10. Therefore, based on the study results, it can be concluded that the addition of a starter concentration of 6% and a concentration of 25% strawberry juice gave the best results in the organoleptic test and was favored by the panelists.*

KEYWORDS: *Streptococcus termophilus, Lactobacillus fermentum strain SK152, Lactiplantibacillusplantarum strain heal19, frozen yogurt, strawberry juice*

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I. INTRODUCTION

Lactic acid bacteria are good bacteria that have many benefits for human health and can be applied in food products, one of which is milk. The role of lactic acid bacteria can improve the quality of nutrients in these food products. According toKusmiati and Malik [1], lactic acid bacteria play a role in changes in texture, aroma, color, digestibility, and nutritional quality of fermented products. For example, lactic acid bacteria can be applied in the manufacture of yogurt by substituting *Lactobacillus bulgaricus* to produce a denser yogurt texture and be accepted by the customer.

Yogurt is a dairy product that has been pasteurized and fermented using certain bacteria so that it gets a distinctive acidity, odor, and taste, with or without the addition of other ingredients [2]. Meanwhile, the national standardization agency of Indonesia [3] assign yogurt as a product obtained from fermented milk and reconstituted milk using *Lactobacillus bulgaricus* and *Streptococcus thermophillus* bacteria and other suitable lactic acid bacteria with or without the addition of other food ingredients and permitted food additives. Based on research conducted by Purwati et al. [4],replacing *Lactobacillus bulgaricus* with *Lactobacillus fermentum* L23 in yogurt with the addition of dragon fruit extract at the addition of 4%, 5%, and 6% to get the best results in the addition of a starter of 5%.

To improve the quality of yogurt becomes a functional food, the addition of strawberry juice is done to increase people's preference. Strawberry (*Fragaria ananassa L*) is known as a fruit rich in antioxidants. The purpose of adding strawberries (*Fragaria ananassa L*) into yogurt is to increase the antioxidant and vitamin C content. Strawberries contain many phytochemicals, especially phenolic compounds that are beneficial for health [5],and red strawberries contain anthocyanins [6]. [7], addition of strawberry pulp in the manufacture of yogurt with a percentage of 15% and 30%, got the best results at the addition of 30% but had a relatively acidic pH value.

II. METHODS AND METHODS

Research Materials

The material used for the study was goat's milk, strawberry juice, sugar, skim milk, isolate of *Streptococcus termophilus, Lactobacillus fermentum* strain *SK152* dan *Lactiplantibacillus plantarum* strainheal19

Strawberry juice making process

Strawberry juice was made based on the modification of [8]. First, the strawberries are sorted and separated from the damaged strawberries, then wash them clean to remove the dirt that sticks. Then the strawberries are mashed with a blender to extract the juice.

Research Methods

The method used in this research is Randomized Block Factorial Design 3x3 with three replications. These treatments are:

Factor A is the addition of starter concentration, consisting of:
A1: Addition of 4% concentration of starter
A2: Addition of 5% concentration of starter
A3: Addition of 6% concentration of starter

Factor B is the addition of strawberry juice concentration, consisting of:
B1: Addition of 0% concentration of strawberry juice
B2: Addition of 12,5% strawberry juice concentration
B3: Addition of 25% strawberry juice concentration

Parameters

1.Organoleptic Test

Organoleptic quality properties are product quality properties that can only be measured by organoleptic assessment. Organoleptic testing commonly used to test preferences for food products is the hedonic test (liking). According to [9] estimate the sample in this study, the panelists were asked for their responses. The preference responses are presented in the form of levels called hedonic scales. This hedonic scale can range from very much like, to dislike by being assessed by several panelists. This test uses 25 panelists. Then the panelists fill out the form provided. Finally, the organoleptic test results were tabulated in a table for further analysis.

III. RESULTS AND DISCUSSION

1. Taste

Table 1. The average value of taste organoleptic test

Factor A (Concentrasi of starter)	Factor B (Concentration of strawberry juice)			Average
	B1	B2	B3	
A1	$3,32^{f}$	$3,68^{cde}$	4^{abc}	3,67
A2	$3,4^{ef}$	$3,84^{abc}$	$3,64^{bcd}$	3,63
A3	$3,60^{de}$	$4,00^{a}$	$4,00^{ab}$	3,87
Average	3,44	3,84	3,88	

description: **abcdef** The mean with different lowercase superscripts shows a significant difference($P<0.05$)

Based on the results of Friedman's analysis of diversity, it showed that the addition of different concentrations of starter (factor A) with the addition of strawberry juice (B) showed a significant interaction ($P<0.05$) on the taste value of frozen yogurt. The average organoleptic value of frozen yogurt flavor ranged from 3.32 to 4.00. The most potent organoleptic frozen yogurt flavor was found in the A3B2 treatment, which was 4.00, and the lowest was found in the A1B1 treatment, which was 3.32.

Significantly different ($P<0.05$), the treatment is given to the organoleptic value of frozen yogurt flavor due to the panelists' acceptance of the acidity level caused by the addition of starter up to 6% and the addition of strawberry juice up to 25% which was still in almost the same pH range, namely pH starter around 4.74. So it can be said that the addition of starter and strawberry juice has a preferred value in the variety of 3.32-4.00. On

the other hand,Yulistiani et al. [10] stated the sour taste in frozen yogurt because yogurt starter was able to increase the growth of lactic acid bacteria. As a result in an increase in the breakdown of substrate components during the fermentation process, such as the breakdown of protein into simpler peptides and an increase in the number of organic acids produced as lactose fermented by lactic acid bacteria.

In addition, *Streptococcus thermophillus* bacteria play a role in flavor formation during yogurt fermentation, while *Lactobacillus bulgaricus* plays a role in aroma formation. A similar idea also states byWahyudi[11] that the presence of lactic acid causes the distinctive flavor of yogurt, remnants of acetaldehyde, diacetyl, acetic acid, and other volatile materials produced. The existence of a sour taste in frozen yogurt, apart from the metabolism of LAB, also comes from the addition of strawberry juice that contains vitamin C and citric acid to affect the taste of frozen yogurt itself. Therefore, organic acids from bacterial fermentation of lactic acid and folic acid and vitamin C from strawberry juice were able to affect the organoleptic taste test of frozen yogurt and were favored by the panelists.

2. Flavor

Table 2. Average of flavor organoleptic test

Factor A (Concentration of starter)	Factor B (Concentration of strawberry juice)			Average
	B1	B2	B3	
A1	1,60^{e}	1,98^{bc}	1,96^{abc}	1,85
A2	1,64^{e}	1,92^{cd}	1,88^{c}	1,81
A3	1,78^{de}	2,06^{ab}	2,08^{a}	1,97
Average	1,67	1,99	1,97	

Description: **abcde**The mean with different lowercase superscripts shows a significant difference($P<0.05$)

Based on the results of Friedman's analysis of diversity, it showed that the addition of different concentrations of starter (factor A) with the addition of strawberry juice (B) showed a significant interaction ($P<0.05$) on the flavor value of frozen yogurt. The average organoleptic value of frozen yogurt flavor ranged from 1.60 to 2.08. The most potent organoleptic flavor of frozen yogurt was found in the A3B3 treatment, which was 2.08, and the lowest was found in the A1B1 treatment, which was 1.60.

Significantly different ($P<0.05$) the treatment given to the organoleptic flavor value of frozen yogurt was due to the panelist's assessment showing a pretty different mean value ($P<0.05$), causing an effect on the frozen yogurt flavor. So it can be said that the addition of starter and strawberry juice has a preferred value in the range of 1.60-2.08. In frozen yogurt, the reception of flavor by the panelists can also be related to the results of LAB metabolism, which produces lactic acid and organic acids that can remove the savor from goat's milk. Therefore, the increasing addition of starter to frozen yogurt will give a distinctive flavor of yogurt that panelists easily accept. Substances produced by lactic acid bacteria and volatile components can provide sour and flavor characteristics in yogurt [12].

Acetaldehyde, the main flavor component in yogurt, is produced in sufficient quantities by the symbiotic activity of the starter [13]. Winarno [14] explains that flavor is one aspect in organoleptic that determines the preference of panelists for a product. Panelists'liking for a food product is caused by a combination of color, flavor, and taste. The addition of strawberry juice will affect the flavor value of frozen yogurt because the high acid content, namely citric acid and vitamin C, can make frozen yogurt preferred by the panelists. The sour flavor is obtained from the breakdown of glucose in strawberries [15]. In addition, citric acid has a distinctive and fresh citrus flavor [16], giving yogurt a new flavor. The combination of the flavor of lactic acid fermented yogurt with citric acid and vitamin C in strawberries makes frozen yogurt strawberries accepted by the panelists.

3. Texture

Table 3. Average of organoleptic texture test

Factor A (Concentration of starter)	Factor B (Concentration of strawberry juice)			Average
	B1	B2	B3	
A1	1,62[d]	1,92[bc]	1,94[b]	1,83
A2	1,70[d]	1,88[c]	1,96[b]	1,85
A3	1,86[c]	2,02[ab]	2,10[a]	1,98
Average	1,71	1,94	2,00	

Description: **abcd**The mean with different lowercase superscripts shows a significant difference(P<0.05)

Based on the results of Friedman's analysis of diversity, it was shown that the addition of different concentrations of starter (factor A) with the addition of strawberry juice (B) showed a significant interaction (P<0.05) on the texture value of frozen yogurt. The average organoleptic value of frozen yogurt texture ranged from 1.62 to 2.10. The highest organoleptic consistency of frozen yogurt was found in the A3B3 treatment, which was 2.10, and the lowest was found in the A1B1 treatment, which was 1.62.

Significantly different (P<0.05) the treatment given to the organoleptic value of frozen yogurt texture was due to the panelist's assessment showing a slightly different mean value (P<0.05), causing an effect on the frozen yogurt texture. So it can be said that the addition of starter and strawberry juice has a preferred value in the range of 1.62-2.10. During the fermentation process, there was clumping of milk carried out by LAB, resulting in a decrease in the pH value and an increase in the viscosity value of yogurt. The more the starter is added, the faster the clotting process in the milk will affect the texture of the yogurt.

The type and number of microorganisms in the starter played an essential role in yogurt's formation, taste, and texture. Besides that, the length of fermentation and environmental temperature also affect the manufacture of yogurt [17]. Furthermore, the consistency of yogurt is formed due to the presence of casein in coagulated milk, which creates a gel-like structure caused by bacterial activity [18]. Casein is the main protein in milk that changes in pH or acidity [19]. If the pH of milk becomes around 4.6 or lower, casein is unstable and coagulates (clumps), and forms a yogurt gel. In addition, the texture of frozen yogurt is also influenced by the crude fiber content of the strawberry juice, which can make the frozen yogurt texture thicker so that the panelists like it.

IV. CONCLUSION

To sum up. The study results concluded that the concentration of starter with the addition concentration of strawberry juice had a significant effect (P<0.05) on each factor on taste, flavor, and texture value. Therefore, based on the study results, it can be concluded that the addition of 6% concentration with the addition of 25% strawberry juice concentration gave the best results in the organoleptic test.

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