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KAJIAN FISIKOKIMIA YOGHURT BEET (*BETA VULGARIS*) SEBAGAI INOVASI PANGAN DIET SEHAT

Yoghurtbeet (Beta Vulgaris) Physicochemical Study As A Healthy Diet Food Innovation

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ABSTRACT

*Yoghurtbeet is a blend of fermented products (yogurt) with fruit juice, Yoghurtbeet is included in the Greek Yogurt group because it is obtained from the lactic acid fermentation process through three times the filtration process so that it has a lower carbohydrate content, but the amount of protein is higher than ordinary yogurt. Beetroot (*Beta vulgaris L*) is a source of nutrients rich in primary metabolites and secondary metabolites, so if consumed it is good for the health of the body. By combining yogurt and beet juice, it is expected that a food product with the best nutritional value will be obtained from the combination of the two ingredients. This activity aims to determine the physico-chemical characteristics of yogurt combined with Beet fruit juice and provide knowledge/experience in producing Yoghurtbeet. The results showed that the chemical composition of yogurt, namely Ash content of yogurt showed a value of ($p > 0.05$) (0.9 g/100g), Moisture content in Beet yogurt was ($p \leq 0.05$) worth (77.9 g/100g). Yoghurt with Beet fruit content has a protein content of (3.3g/100g) ($p \leq 0.05$). And fat content was (2.5 g/100g) ($p \leq 0.05$). Lactose content was (3.3 g/100 g) and carbohydrate content was (15.3g/100 g) with a value of ($p \leq 0.05$). Yoghurtbeet has a fairly high pH of (4.1) ($p \leq 0.05$) This can be caused because beetroot is rich in antioxidants which are generally composed of phenolic compounds. Color analysis showed that yogurt supplemented with beet fruit extract/juice gave a pink color ($L^* = 50$, $a^* = 31$ and $b^* = 2.3$).*

Keywords: *physicochemical properties; yogurt beet; healthy food; high nutrition*

ABSTRAK

Yoghurtbeet merupakan paduan antara produk hasil fermentasi (yoghurt) dengan jus buah, Yoghurtbeet ini masuk ke dalam golongan Yoghurt Greek karena diperoleh dari proses fermentasi asam laktat melalui tiga kali proses penyaringan sehingga memiliki kandungan karbohidrat yang lebih rendah, namun jumlah proteinnya lebih tinggi dari yoghurt biasa. Buah Beet (*Beta vulgaris L*) merupakan sumber nutrisi yang kaya metabolit primer dan metabolit

sekunder, sehingga jika dikonsumsi baik untuk kesehatan tubuh. Dengan mengkombinasikan yoghurt dan jus buah Beet, diharapkan akan diperoleh satu produk pangan dengan nilai nutrisi terbaik dari gabungan kedua bahan tersebut. Kegiatan ini bertujuan untuk mengetahui karakter fisika kimia yoghurt yang dikombinasikan dengan jus buah Beet dan memberikan pengetahuan/pengalaman memproduksi Yoghurtbeet. Hasil penelitian menunjukkan bahwa komposisi kimia dari yoghurt yakni Kadar Abu yoghurt menunjukkan nilai ($p > 0,05$) (0,9 g/100g), Kadar air pada yoghurtBeet sebesar ($p \leq 0,05$) senilai (77,9 g/100g). Yoghurt dengan kandungan buah Beet ini memiliki kadar protein sebesar (3,3g/100g) ($p \leq 0,05$). Dan kadar lemak senilai (2,5 g/100g) ($p \leq 0,05$). Kadar laktosa (3,3 g/100 g) dan kadar karbohidrat senilai (15,3g/100 g) dengan nilai ($p \leq 0,05$). Yoghurtbeet memiliki pH yang cukup tinggi yakni (4.1) ($p \leq 0,05$) Hal ini bisa disebabkan karena buah bit kaya antioksidan yang umumnya tersusun oleh senyawa fenolat. Hasil Analisa warna menunjukkan bahwa Yoghurt yang ditambah dengan ekstrak/jus buah beet memberikan warna pink ($L^* = 50$, $a^* = 31$ dan $b^* = 2.3$).

Kata kunci : yoghurt greek, buah beet, makanan sehat, nutrisi tinggi

INTRODUCTION

The rapid, practical, and quick lifestyle of contemporary culture also influences patterns of speedy food consumption. The consumption of fast processed food ingredients has a negative impact on health and can cause a number of stomach issues. Ironically, immune system issues are strongly correlated with anything gastrointestinal. Because the intestine is where hormones are produced, which is crucial to the body's metabolic system².

Greek yogurt is a dairy product that promotes gut health because it contains microorganisms that can actively contribute to reestablishing the intestine's normal function as a site of digestion and hormone production. Greek yogurt has a taste that most people enjoy in addition to having a significant amount of nutritious content. Greek yogurt is made differently than other types of yogurt because the whey is removed during the

filtering process.

Greek yogurt is a type of yogurt that was first produced in Greece. It is made by fermenting lactic acid and then filtering it three times, resulting in a lower carbohydrate content but a greater protein content than conventional yogurt. Greek yogurt has a higher nutritional value than fresh milk as a primary component, mostly due to the larger total solids content, which enhances the content of other nutrients. Additionally, yogurt is good for those who have lactose intolerance or are lactose intolerant³. Among the several varieties of yogurt, Greek yogurt is thought to be the healthiest. Greek yogurt is well-known for having a different nutritional profile from other varieties of yogurt, according to research by Vieira⁴. The protein level of this particular yogurt is 32.4%, which is higher than the 10–20% protein content of other varieties. Greek yogurt also has a carbohydrate level of 34%, which is

significantly lower than other yogurt, which has a content of 48–60%³.

A source of vitamin C is the beet fruit (*Beta vulgaris* L). In addition, beet has a lot of vitamin B and only a little vitamin A, making it beneficial for the body's health. Because of this, beet is also advised to be consumed in significant amounts by those with low blood pressure. Beets can also be cooked or mixed into a variety of salads, especially the tubers³. Beet Fruit's Nutrient Content (*Beta vulgaris* L) The nutritional value of beet fruit includes: (a) folic acid, which is 34% and helps the body grow new cells and replace damaged ones; (b) potassium, which is 14.8% and helps the body maintain fluid balance; (c) fiber, which is 13.6%; and (d) vitamin C, which is 10.2% and helps the body grow new cells.

The nutritional value of beets as an ingredient in yogurt has not been investigated, despite studies on their bioactivity still being developed. It is intended that by combining yogurt with beet fruit juice, a food product with the optimum nutritional value can be generated from the two elements³. In this study, the physical and chemical characteristics of probiotic yogurt with beets added, or yogurt beet, are examined.

MATERIALS AND METHODS

a. Location Preparation And The Necessary Tools.

Physical and chemical tests were conducted in the microbiology lab at the University of PGRI Madiun, and yogurt-making instruction was provided in the meeting room of the Environmental Area

Pagottan Sugar Factory. At the same time, training materials such as banners, brochures, LCD projectors, screens, pointers, cameras, and tables were prepared. as a drill.

Ingredients for YogurtBeet: 1 kg of fruit Beet, 1000 ml of UHT liquid milk, 10 g of Biokul (10% milk by volume), 250 g of sugar sand, and 500 ml of water.

YoghurBeet instruments include a big plastic spoon, a tablespoon, an egg whisk, a boiler (with a sieve included), parchment paper, a cake pan, a knife, a serving plate, a glass jar, a filter cloth, a thermometer, and a foambox.

b. Preparation Yogurt

YogurtBeets (Yogurt Greek Fruit beets) (Yogurt Greek Fruit beets)

Method for Making Yogurt Liquid milk and sugar are combined, then skim milk is added to boost the milk's solid content and improve yogurt consistency. The basic ingredient mixture is also pasteurized at 85 °C for 30 minutes in a water bath and chilled to 42 °C. Additionally, 0.1 g/l of culture probiotic (*Lactobacillus Casei*) and 30 mL/L of starter culture (*Streptococcus thermophilus* and *Lactobacillus delbrueckii* ssp. *bulgaricus*).

c. Making Beet Fruit Juice

Using a fruit processor, organic vegetables are washed and pulverized (blender). The juice is then put in a glass container, heated to 80 °C in a water bath for

20 minutes, then chilled to 37°C in an ice bath. Additionally, the yogurt solution was blended directly with beet fruit juice, which was then kept at 4°C for 28 days in a polypropylene flask with dimensions of 52 mm in height by 52 mm in diameter.

d. Statistical Evaluation

A completely random design study was used to conduct the Complete Experiment twice. At each iteration of the experiment, which was conducted every seven days over the course of 28 days, physicochemical and textural analyses were performed in triplets Sample organoleptic test.

e. Organoleptics Evaluation

Evaluation is performed following training based on survey data with parameters for organoleptic form, color, aroma, texture, and flavor to provide a description of the level of satisfaction with the product. Paper sheet containing survey organoleptic shared after product sample yogurtBeet. Yogurt based was given to participants training Sheet survey filled and the results were analyzed as a reference to the results of organoleptic tests using the survey method The survey method will be measured with method ranking based on degrees of satisfaction participants training on the results of product samples. The sort of product that you want to measure will affect the organoleptic parameters. Organoleptic

characteristics of yogurtBeet include color, scent, texture, sweetness, and sourness⁵.

RESULTS AND DISCUSSION

The analysis of the composition is calculated starting with day 6 of the product's storage. A Digital Potentiometer (Tecnal) that had been calibrated with phosphate buffer (Synth) at pH 4.0 and 7.0 was used to measure the pH. A colorimeter was used to analyze colors (Minolta , model CR400). Formulation was compressed with a 36 mm diameter cylinder test (P36 R) to a depth of 10 mm at a constant velocity of 1 mm/s. Textural parameters (firmness, consistency, homogeneity, and viscosity index) were determined by a single compression test using an analyzer texture (TA-XT plus, Stable Micro System Ltd., Godalming, Waverley District, UK) outfitted with a 5 Kg load cell (speed pre-testing and testing)⁷ conducted physicochemical and textural analysis

Chemical Composition

This study used chemical analysis to determine the amount of water, ash, protein, and fat as well as the amount of lactose and K. **Table 1.** displays the findings about the chemical makeup of yogurt.

Table 1 . Chemistry Composition (g/100g) sample Yogurtbeet

PARAMETER	SAMPLE YOGURTB EET1	SAMPLE YOGURTB EET 2
RATE WATER	77,8 ± 0.2	77.9 ± 0.2

PROTEINS	3,3± 0.2	3,4± 0.2
FAT	2.5± 0.2	2,3± 0.2
RATE ASH	0.9± 0.2	0.8± 0.2
LACTOSE	3,3± 0.2	3,2± 0.2
CARBOHYDRATE	15,3± 0.2	15,1± 0.2

Sign ± state standard deviation

Ash Content

The amount of ash in the process indicates how many inorganic components are present⁸. The amount of remaining minerals that will be burned or incinerated will be calculated. A value of ($p > 0.05$) (0.9 g/100g) for the ash content of yogurt in this study suggests that the yoghurt successfully manufactured by adding beet fruit has an adequate level of minerals.

Water content

The amount of water in food ingredients affects how well they may be used, how fresh they are, and how resistant they are to microbial contamination⁹. When beet fruit extract is used in food products, water content is a consideration that needs to be considered. The water content of yogurtBeet was measured in this investigation at a value of ($p < 0.05$) worth (77.9g/100g). Microorganisms and chemicals can decide a product's shelf life since the water content is high enough. In an environment with a high water content, bacteria will have the chance to grow quickly¹⁰. Chemically, the oxygen in the

water that is still present after extraction might cause hydrolyzed fat to break down and create glycerol and fatty acids. If the beet fruit extract has a sufficient amount of water, the hydrolysis process might happen very quickly.

Protein Content

Yogurt containing beetroot has a protein value of (3.3g/100g) ($p < 0.05$), which is relatively high. According to SNI, 2.7 grams of protein minimum is the legal amount for yogurt. Therefore, probiotic yogurt with beets added satisfies SNI protein content requirement¹¹. The primary beet's components, which have a high protein nutritional content, have a significant impact on this.

Fat level

In this investigation, the probiotic yogurt with beets added had a fat content that was within the SNI guidelines of no more than 3%. Moreover, the fat content of the yogurt beet is (2.5 g/100g) ($p < 0.05$).

Lactose Levels

Yogurt fortified with beets has an equal lactose level of (3.3 g/100 g), which is made possible mostly by lactose in milk that hasn't entirely fermented into lactic acid¹².

Carbohydrate Content

Yogurtbeet carbs in this study were worth (15.3g/100 g) and had a p-value of 0.05. Given that this yogurt is Greek yogurt and that it has undergone three rounds of filtering during the

process, the result is a very small number. In other words, this yogurt is minimal in calories and therefore beneficial to your health¹³. The yoghurt sample is compatible with the fruit mix used, as shown in Table 1. This composition's value is quite similar to the composition value nutrition in yogurt with fruit active components identified in earlier investigations¹³. Thus, it can be deduced that the sample yogurt, i.e. yogurtbeet, has nutritional value that is almost identical to other yogurt fruits that are available on the market.

Study Physicochemistry And Characteristics Texture

Results analysis for the sample yogurt's physicochemistry and texture On Table 2, the beet while cooling is depicted.

Table 2. Study Physicochemistry Sample Yogurt

Parameter	Day 3rd storage	Yogurt Sample 1	Yogurt Sample 2
pH	1	4.6 ± 0.0	4.5 ± 0.0
	7	4.3 ± 0.0	4.2±0.0
	14	4.1 ± 0.0	4.1 ± 0.0
	21	4.1 ± 0.0	4.0 ± 0.0
	28	4.1 ± 0.0	4.1 ± 0.0
L*	1	50.6 ± 0.6	50.5 ± 0.6
	7	50.1 ± 0.6	50.0 ± 0.6
	14	50.9 ± 0.6	51.0 ± 0.6

a*	21	51.0 ± 0.6	50.9 ± 0.6
	28	50.9 ± 0.6	50.8 ± 0.6
	1	30.7 ± 0.4	30.7 ± 0.4
	7	30.4 ± 0.4	30.5 ± 0.4
	14	30.8 ± 0.4	30.8 ± 0.4
b*	21	30.9 ± 0.4	30.9 ± 0.4
	28	30.4 ± 0.4	30.4 ± 0.4
	1	2.3 ± 0.3	2.3 ± 0.3
	7	2.1 ± 0.3	2.1 ± 0.3
	14	2.1 ± 0.3	2.1 ± 0.3
Softness (g)	21	2.4 ± 0.2	2.3 ± 0.3
	28	2.31 ± 0.4	2.32 ± 0.3
	1	24.8 ± 1.7	24.7 ± 1.7
	7	26.4 ± 1.1	26.5 ± 1.1
	14	25.7 ± 1.7	25.6 ± 1.7
Consistency (g.sec)	21	25.8 ± 1.7	25.6 ± 1.7
	28	23.8 ± 1.7	24.9 ± 1.7
	1	143.1 ± 0.3	143.1 ± 0.3
	7	142.3 ± 0.3	142.3 ± 0.3
	14	148.1 ± 0.3	148.1 ± 0.3
Cohesiveness (g)	21	147.1 ± 0.3	147.1 ± 0.3
	28	146.1 ± 0.3	146.1 ± 0.3
	1	5.7 ± 0.3	5.7 ± 0.3
	7	5.6 ± 0.3	5.6 ± 0.3
	14	5.8 ± 0.3	5.7 ± 0.3
Cohesiveness (g)	21	5.7 ± 0.3	5.8 ± 0.3

	28	5.8 ± 0.3	5.7 ± 0.3
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L* range from 0 (black) to 100 (white), a* range from red (+a*) to green (-a*), range (b*) from yellow (+b*) up to blue (-b*)

Yogurtbeet's own pH is sufficiently high, at (4.1), (p0.05), to matter. The beet fruit is rich in antioxidants, the majority of which are phenolic compounds, making this feasible¹⁴. Additionally, as the fermentation process progresses, lactic acid created by cell secretions will build up in the fermentation medium, and milk lactose will chemically transform into lactic acid during this time¹⁵. While lactose is the preferred substrate used by bacteria, which results in the development of organic acids, protein content in milk and fruit is also likely to act as a yogurt pH buffer to ensure that the pH is still stable from storage day 1 until day 28¹⁶. This is why the pH is so high. Data show that the pH value declined throughout a 28-day period of storage in a refrigerator. This rise in acidity is a consequence of post-acidification product and is connected to continuing fermentation by bacteria sour milk during storage point, with manufacture from milk sour¹³.

Analysis Color with Use Colorimeter

Yogurt gives off a pink tint when combined with fruit beet juice or extract (L* = 50, a* = 31 and b* = 2.3). The color of the components used to make yogurt is one of the elements that affects its color. Whole milk is

handled regularly, and formulations with sugar, culture starter, and culture probiotics are all in powder form, therefore yogurt color is unaffected¹. Yogurt's color parameter is consistent (p > 0.05) for storage, which is significant for customer product acceptability because color is the key criterion for quality³. The parameters of Softness, Consistency, and Cohesiveness also showed stable numbers. Stability during storage is also an excellent character in determining the quality of yogurt. From the values obtained according to Table 2, it shows that Yoghurtbeet does not require additional Gum or other thickening additives⁷

CONCLUSIONS AND RECOMMENDATIONS

The beet yogurt that was made had a moisture content of (p0.05) worth (77.9 g/100g) and an ash content of (p>0.05) (0.9 g/100g). Protein content in yogurt including beet fruit is 3.3 g/100 g (p 0.05). Additionally, there were (2.5 g/100g) fat (p 0.05). With a value of (p0.05), the lactose content was (3.3 g/100 g) and the carbohydrate content was (15.3 g/100 g). A rather high pH of (4.1) (p0.05) is found in yogurtbeet. Yoghurtbeet has good cohesiveness, consistency, and softness, thus no additional additive thickeners are required to preserve texture. According to numerous studies, yoghurtbeet has the same high nutritious value as fruit yoghurt. Yoghurtbeet has good potential

because it is a low-fat and low-calorie yogurt.

Suggestions for this research are that further studies are needed to determine the bioactivity of yogurt combined with fruit, including antioxidant, antibacterial and

antimicrobial activities. It is also necessary to further study the physicochemical studies of yogurt combined with two or more fruits that have bioactivity.

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