Characterization of Soy-Yamghurt and Soy-Ipoghurt as Potential Healthy Drinks for Diabetics

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Abstract. Recent research uses many foodstuffs as supplementation or complementary treatment for certain diseases. Soy-Ipoghurt is yogurt with a modified addition of sweet potato juice. It is known that sweet potato (Ipomea batatas L.) is one of the food commodities that has the potential to be developed. Carbohydrates contained in sweet potatoes are included in the Low Glycemic Index (LGI, 54) category so it is very suitable for diabetics. This research was conducted to see the chemical characteristics and antioxidant activity of the samples. The methods used include the DPPH, Kjeldahl, gravimetric and Ostwald methods. Based on the test results, it is known that the antioxidant activity of soy-yamghurt and soy-ipoghurt respectively (11.19 and 9.48), water content (92.18% and 93.4%), protein content (5.43% and 4.07%), total solids (7.82% and 6.61%) and viscosity (1.68 and 4.2). Based on these results, it can be concluded that soy-yamghurt and soy-ipoghurt have strong antioxidant activity and chemical characteristics by SNI yogurt.

Keywords: Soy-yamghurt · Soy-ipoghurt · Activity antioxidant · Characteristics chemistry

1 Introduction

Technology in the field of health and food is the foundation that supports us to analyze the content of active compounds in food ingredients and products. Recent research uses many foodstuffs as supplementation or complementary treatment for certain diseases, both infectious and non-infectious diseases.

One type of preparation that is quite popular with the public is yogurt. Yogurt was originally only a product of fermented milk. Along with its development, yogurt is no longer only produced from animal milk, but can also be made with vegetable raw materials, such as soybeans [1]. Yogurt made from soy milk has several advantages, including lactose-free, cholesterol-free, low-fat, and high-protein. Thus, it is suitable for individuals who are lactose intolerant and have problems with cholesterol. The fermentation process causes the nutritional content of the raw materials to be better because they are easier to digest and absorb [2].

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Soybeans have a high protein content and several organic compounds such as folic acid, manganese, isoflavones, beta carotene, and sucrose [3, 4]. When compared with yogurt derived from animal milk, the antioxidant activity of yogurt from soy milk is still lower [5], as well as its viscosity. The antioxidant activity and viscosity of yogurt can be increased by adding other ingredients that have high antioxidant activity. Some foodstuffs with antioxidant activity and adequate nutritional content are yam and sweet potato.

Soy-yamghurt is a modification of soyghurt, which is given the addition of yam juice. Jicama juice contains antioxidant compounds, so it can function as an antidote to free radicals. However, its potential has not been explored to its full potential [6]. Similar to Soy-yamghurt, Soy-Ipoghurt is also yogurt with a modified addition of sweet potato juice. It is known that sweet potato (Ipomea batatas L.) is one of the food commodities that has the potential to be developed. This is because the availability is quite abundant, can be found in almost all areas, and has high processing flexibility and complete nutritional content [7].

Sweet potatoes or yams have several advantages, including having good antioxidant activity and containing vitamins A, B, and C as well as other minerals. Anthocyanins present in sweet potatoes have physiological functions as anti-cancer, anti-bacterial, and protection against heart damage and stroke [8]. Carbohydrates contained in sweet potatoes are included in the Low Glycemic Index (LGI, 54) category so it is very suitable for diabetics. Consumption of sweet potatoes will not raise blood sugar levels as drastically as eating foods with a high glycemic index. The natural oligosaccharide fiber stored in sweet potatoes is now a valuable commodity to enrich processed food products, such as milk [7].

With the nutritional content that has been described, Soy-yamghurt and Soy-ipoghurt have the potential to be developed into processed drinks that are good for consumption by diabetics.

2 Methods

This study used an experimental laboratory with a cross-sectional design. The research was carried out for 16 days, from 1 to 16 March 2022. The production of yam juice, sweet potato juice, Soy-yamghurt, and Soy-ipoghurt was carried out at the Traditional Medicine Laboratory of the Medica Farma Husada Mataram Polytechnic while testing the chemical properties of the preparation was carried out at the Chemistry Laboratory. Analytical Mathematics and Natural Sciences, University of Mataram.

2.1 Tools and Materials

The tools used in this study include a blender, water bath, UV-Vis spectrophotometer, Kjeldahl, analytical balance, stove, panic, filter, thermometer, porcelain dish, and furnace. While the raw materials in this study include soybeans, yellow sweet potato, yam, and skim milk.

2.2 Soybean Juice Making

Soybeans were sorted and washed, then soybeans were boiled for 30 min twice, before and after soaking in 0.2% NaHCO3 (Sodium bicarbonate) solution for 30 min. Soybean skin is then separated by kneading and washing with water many times until the skin is easy to separate. Soybeans without skin are added with hot water (1000 C) with a ratio of soybeans to hot water 1:6 and then milled or blended. Soybean porridge was filtered through a blanched filter cloth and then the soybean juice was left on low heat for 20 min at a temperature of 80 °C.

2.3 Jicama Juice Making

The yam tubers are cleaned and put in a juicer, added with water with a ratio of 1:1 yam to boiled water, filtered with a blanching filter cloth, then the juice is taken.

2.4 Sweet Potato Juice Making

The sweet potatoes are cleaned and put in a juicer, added with water with a ratio of 1:2 sweet potatoes, and boiled water, filtered with a blanching filter cloth, then the juice is taken.

2.5 Making Soy-Yamgurt

Soy-yamghurt is made from soybean juice and yam juice in a ratio of 1:1, then 15% skim milk, 2% sugar, and 3% starter are added and mixed with 0.6% Arabic gum. Furthermore, the incubation process is carried out by covering it with polyethylene plastic with holes. Incubation was carried out at 40 + 2 °C for 6 h. Soy-yamghurt that has been formed is stored in a refrigerator at 4 °C.

2.6 Making Soy-Ipoghurt

Soy-ipoghurt is made from soybean juice and sweet potato juice in a ratio of 1:1, skim milk is 15%, sugar is 2%, and the starter is 3% mixed with gum arabic as much as 0.6%. Furthermore, the incubation process is carried out by covering it with polyethylene plastic with holes. Incubation was carried out at 420 C for 6 h. Soy-ipoghurt that has been formed is stored in a refrigerator at 4 °C.

2.7 Traits Testing

Tests for the chemical properties of the preparations were carried out, among others, whether the antioxidant levels were determined using a UV-Vis Spectrophotometer, the DPPH method, the water content, and ash content was determined by the Gravimetric method using the BP3 technical guidelines of the Ministry of Agriculture 2005, the protein content determination using the Semi Macro Kjehdahl, determination fiber content using Gravimetry (SNI 01-2891-1992), determination of viscosity using the Ostwald method and determination of total solids using the Gravimetric method.

3 Results and Discussion

Soybean is a commodity with good nutrition. Soybean is one of the main sources of vegetable protein because it has an amino acid composition that almost resembles animal protein [9]. Soybeans are often processed into milk. However, before becoming milk and soyghurt, soybeans are first processed into soy juice. The chemical characteristics of soybean juice are presented in Table 1. (Antioxidant levels enter the phytochemical test).

Another commodity that is often found in Indonesia is tubers, including sweet potatoes. Sweet potatoes are often consumed as a substitute for staple foods, and also processed as additional food. One of the processed sweet potatoes that are commonly found is sweet potato flour [7]. However, so far the processing of sweet potatoes into sweet potato juice for use as an addition to yogurt has never been done. The chemical characteristics of sweet potato juice can be seen in Table 2.

Based on the results of laboratory tests (Tables 1 and 2), the water content of soybean and sweet potato extracts was still above 90%, namely (95.85% and 95.64%). It is very important to know the water content, this is related to the shelf life and the level of development of soybean juice. The lower the moisture content of a material, the longer the material can be stored. So far, the water content of soybean juice does not have SNI,

Table 1. Chemical Characteristics of Soybean Extract

Sample	Water content (%bb)	Ash Level (%bk)	Protein Level (%bk)	Crude Fiber Content (%bk)
Fresh	95,44	0,19	4,43	1,36
Save	96,22	0,18	4,37	1,33
Average	95,83	0,185	4,4	1,35

Table 2. Chemical Characteristics of Sweet Potato Juice

Sample	Water content (%bb)	Ash Level (%bk)	Crude Fiber Content (%bk)
Fresh	95,13	0,04	0,30
Save	96,15	0,04	0,32
Average	95,63	0,04	0,31

Table 3. Chemical and Functional Characteristics of Soy-yamghurt and Soy-ipoghurt

Sample	Water content (%bb)	Protein Level (%bk)	Total solids (%)	Viscosity (Poise)
Soy-yamghurt	92,18	5,43	7,82	1,68
Soy-ipoghurt	93,4	4,07	6,61	4,2

but ideally, processed beverages must have a high water content to make them easier to consume. This result is in line with the research conducted by Ginting and Anarlina [10] in which the water content of soybean juice/soy milk produced by the immersion method is above 90%. This is because the soybean soaking process can increase the water content of soybeans.

Likewise with Soy-yamghurt and Soy-ipoghurt where the water content is also above 90%, namely 92.18% and 93.4% (Table 3). The water content of Soy-yamghurt is slightly lower than that of Soy-ipoghurt. This may be related to the protein content in the sample. Usually, the higher the protein content of the sample, the lower the water content. This is because proteins have hydrophilic properties or can absorb water [11, 12].

According to Winarno et al. [13], in general, the water content of soyghurt ranges from 85-to 89%. This value is lower than the water content of Soy-yamghurt and Soy-ipoghurt. However, this can be explained by the addition of yam juice and sweet potato which also has high water content.

Analysis of ash content aims to separate organic and inorganic materials of food. Ash content also describes the number of minerals that are not burned at a temperature of 400–6000 C [14]. Total ash content in food is very limited. High ash content in foodstuffs is an indicator that the food is not good for consumption [15]. Soybean processed ash content should not be more than 1.5%.

Based on the results of laboratory tests, the ash content of soybean and sweet potato juices was 0.185% and 0.44%, respectively. The ash content of soybean extract obtained in this study is very different from the results of the research by Adawiyah et al. [16], where the ash content obtained is 5.15–5.36%.

Based on SNI 01-2981-2009 the maximum ash content in yogurt is 1%. When viewed from the test results, the ash content in the soy-yamghurt and soy-ipoghurt samples was still within the tolerable limits.

3.1 Determination of Protein Levels

Based on the results of laboratory tests, where protein content was determined in samples of soy, soy-yamghurt, and soy-ipoghurt, the protein content was 4.44%, 5.43%, and 4.07%, respectively. Based on SNI 01-2981-2009, the minimum protein content that must be present in yogurt and its modifications is 2.7%. The protein content in soy-yamghurt and soy-ipoghurt is still above the minimum value, so in this case, it is included in the quality standards that have been set.

3.2 Determination of Total Coarse Fiber

Fiber that is in raw materials or processed foods are also known as dietary fiber which is part of plants and can be consumed. This dietary fiber is composed of carbohydrates and is good for human digestion. In the intestine, this fiber can undergo fermentation and improve the absorption of food in the intestine (AACC Report, 2001). Based on the results of laboratory tests, the result of determining the fiber content in soybean juice is greater (1.34%) than the total fiber in sweet potato juice (0.31%).

3.3 Determination of Total Solids and Viscosity

Determination of viscosity is carried out to see a description of the nature of the liquid that can increase the strength to withstand relative movement (Manab, 2008). In simple terms, viscosity is the degree of viscosity of a liquid.

Factors that affect the value of viscosity include protein content and total solids. Protein can bind water molecules so that the higher the protein, the higher the viscosity [17]. If it is associated with the total solids present in the sample, the higher the total dissolved solids, the higher the viscosity [18]. However, in this study, this was not the case. The total solids in soy-yamghurt (7.82) were higher than that in soy-ipoghurt (6.61), but the viscosity was inversely proportional (Table 3). This difference is thought to be caused by the addition of yam juice and sweet potato juice in the form of liquid. If you look closely, yam juice is more liquid/watery than sweet potato juice. Thus, causing the volume of yogurt to increase.

This is in line with the opinion of Celik and Bakirici [19] where a decrease in viscosity can occur in yogurt that is added to concentrate in liquid form which tends to reduce product consistency and reduce protein capacity to hold water so that the viscosity of yogurt is reduced. So, the more liquid the additives in yogurt, the lower the total amount of dissolved solids and the viscosity.

In addition, sweet potatoes have a higher glucose content than yam. Glucose is used by lactic acid bacteria for growth so that it will affect the Physico-chemical, microbiological and sensory properties of yogurt. In the end, along with the activity of the lactic acid bacteria, the viscosity will increase [20].

In addition to testing the characteristics or chemical properties, the samples were also tested for their antioxidant activity. The results of testing the antioxidant activity of yam juice, soybean juice, sweet potato juice, Soy-yamghurt, and Soy-ipoghurt can be seen in Table 4.

Antioxidants are substances that can reduce free radicals by donating one or more of their free electrons. Antioxidant activity is expressed by IC50 in units of g/ml. The

Table 4. Antioxidant Activity

Sample		IC50 (μg/ml)
Jicama juice	Fresh	9,26
	Save	9,69
Soy Sauce	Fresh	17,76
	Save	17,01
Sweet Potato Juice	Fresh	18,08
	Save	18,20
Soy-yamghurt	Fresh	10,87
	Save	11,52
Soy-ipoghurt	Fresh	9,17
	Save	9,79

Table 5. The Level of Antioxidant Power by the DPPH Method

Antioxidant Intensity	Score IC50 (ppm)
Very strong	<50
Strong	50–100
Currently	100–250
Weak	250–500

value or number obtained indicates the concentration of the sample required to inhibit free radical activity by 50%. That is, the lower the IC50 value, the higher the antioxidant activity in the sample. This is because the sample concentration needed to stop free radicals in the test solution is getting smaller. The highest antioxidant activity was found in the Soy-ipoghurt sample, while the lowest antioxidant activity was found in the sweet potato juice sample.

Based on the results of laboratory tests, the antioxidant activity of soy-yamghurt and soy-ipoghurt were 11.19 and 9.48, respectively. The antioxidant activity of soy-ipoghurt is higher than that of soy-yamghurt.

However, when referring to the provisions of the level of antioxidant power by the DPPH method (Table 5), then all samples have very strong antioxidant intensity. The value of antioxidant activity and viscosity in soyghurt can be increased by adding other ingredients [22].

Based on the results of the proximate test, soy-yamghurt and soy-ipoghurt can be used as healthy drinks for diabetics and non-diabetics. This is because the results of the tests carried out are included in the national standards that have been set and have a fairly high antioxidant activity. However, to see a more specific effect on diabetics, it is necessary to conduct further research on subjects with induced diabetes.

4 Conclusion

From this study, it was concluded that soy-yamghurt and soy-ipoghurt have the potential as probiotic drinks or healthy drinks for diabetics. This is indicated by the results of proximate testing that have met SNI standards and have very strong antioxidant activity.

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