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The Characteristics of Slice Jam from Bisbul Fruit (*Diospyros blancoi A. DC*) and Beetroot (*Beta vulgaris* L)

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ABSTRACT

Slice jam is a modification of spread jam in the form of sheets, plasticized and non-sticky. In this research, slice jam was made from bisbul fruit (Diospyros blancoi A. DC) because it contains antioxidants, vitamins, and minerals. Bisbul fruit also has a uniquely fragrant and strong smell. To improve the color and nutritional value, beetroot is added, and to improve the textureof the slice jam, agar is added. This study aims to determine the best treatment of the proportion of bisbul and beetroot as well as the addition of seaweed agar which can produce slice jam with the best characteristics and is preferred by consumers. This study used a completely randomized design(CRD) factorial pattern with two factors and three replications. Factor I is the proportion of bisbul and beetroot (60:40), (70:30), (80:20), and factor II is the concentration of seaweed agar (1%,2%,3%). The data obtained were analyzed using ANOVA level 5% if there is a significant difference, followed by Duncan's Test (DMRT) level 5%. The results showed that the proportion of bisbul fruit: beetroot (80:20) with the addition of 3% seaweed agar was the best treatment which produced slice jam with a moisture content of 25.52%, crude fiber of 4.36%, the antioxidant content of 22.63%, total sugar of 65.80%, total dissolved solids of 66.13°brix, and has total preference ranking of taste 140, color 150.5, aroma 158.5, texture 162, which is the most preferred by the panelists.

Keywords: Slice jam, bisbul fruit, beetroot, seaweed agar

Introduction

Slice jam is a modification of jam that was originally spread-wet texture into sheets that are compact, plasticized, and non-sticky. Using slice jam can make bread serving more practice. The general principle of making jam is heating a mixture of crushed fruit, pectin, thickening agents, sugar, and acid to obtain a gel structure. The requirements for making jam accord- ing to Muchtadi (2010) and Buckle et al. (2007) are a pectin content of 0.75-1.5%, sugar content of 65-70%, and acid with pH of around 3.2-3.4.

Bisbul fruit (*Diospyros blancoi* A. DC) or commonly known as butter fruit is a fruit that has high antioxidant activity. In addition, bisbul fruit is also rich in other nutritional content such as carbohydrates, protein, fiber, calcium, phosphorus, iron, vitamin A, and vitamin C and is low in calories. Bisbul fruit has a pungent smell and sweet taste. The water content in bisbul fruit is quite high, namely 82.13% so it cannot be stored for too long (Kurniawan, 2018). Currently, the use of bisbul fruit is still very rare so there is a need for innovation to make a product. In a preliminary test on bisbul fruit, it was found that the pectin content in bisbul fruit was around 1.24%, making it possible to develop it into jam products.

The addition of beetroot in this study aims to give an attractive color to the resulting product. Beetroot can produce a purplish red color which can add to the attractiveness of the product. Beetroot contains betalain pigments of 1000 mg/100g dry weight or 120 mg/100 g wet weight.

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There are two groups of betalain pigments in beetroot, namely red-violet betacyanin pigments and betaxanthin pigments (Andarwulan, 2012). This pigment is widely used not only as a coloring agent but also as an antioxidant and radical saving as protection against disorders caused by oxidative stress (Moreno et al, 2008). This betalain pigment will give an attractive color to the bisbul slice jam product.

Another problem in making slice jam is that the resulting texture is not good, so hydrocolloid is added, namely, agar, to improve the quality of the slice jam. Seaweed agar is widely used in various fields as a thickening agent, emulsifier, stabilizer, and various other functions in the food sector (FAO, 2003). Based on the facts above, this study aims to study the effect of the proportion of bisbul and beetroot and the addition of seaweed agar on the characteristics of the slice jam and determine the best treatment in terms of the chemical and organoleptic properties of slice jam.

Material and Methods

The materials used in this study were bisbul fruit obtained from farmers in Nganjuk, beetroot obtained from the Soponyono market in Surabaya, sugar, seaweed agar, margarine, and citric acid and chemical reagents for analysis.

This study used a factorial completely randomized design (CRD) with two factors and three replications. The factor I is the proportion of bisbul and beetroot (60:40), (70:30), (80:20), and factor IIis agar concentration (1%,2%,3%). The data obtained were analyzed using ANOVA level 5% if there is a significant difference, followed by Duncan's Test (DMRT) level 5%.

Preparation of slice jam

Bisbul fruit and beetroot, respectively, were peeled, washed, cut, and blanched at 70°C for 5 minutes, then crushed to form fruit pulp. The pulp of bisbul and beetroot were mixed according to the treatment, then seaweed agar was added (based on the treatment), 40% sugar, 0.2% citric acid, and 5% margarine. Furthermore, the mixture was cooked at a temperature of 90°C for 15 minutes, sheet formation (± 3 mm thickness and dried with a cabinet dryer for 6 hours. The slice jam obtained was then analyzed for moisture content, antioxidant activity, crude fiber content, total sugar, total dissolved solids, and sensory tests (Haque et al., 2009).

Results and Discussion

Chemical composition of slice jam

The results of the chemical analysis of the slice jam can be seen in Table 1.

Table 1. Chemical composition of slice jam products

The proportion of bisbul: beet	Concentration of agar	Moisture content (%)	Crude fiber content (%)	Antioxsidan content (%)	Total sugar (%)	Total dissolved solids (%)
60: 40	1%	18,18 ± 0,20^{a}	3,26±0,051^{a}	13,54 ± 0,40^{a}	62,43 ± 0,01^{c}	63,18 ± 0,06^{b}
	2%	21,04 ± 0,15^{c}	3,33±0,056^{b}	15,34 ± 0,27^{b}	59,03 ± 0,04^{b}	62,01 ± 0,01^{b}
	3%	23,09 ± 0,11^{d}	3,49±0,025^{c}	16,86 ± 0,27^{b}	57,42 ± 0,04^{a}	60,54 ± 0,04^{a}
70: 30	1%	20,73 ± 0,08^{b}	3,57±0,043^{d}	17,90 ± 0,13^{c}	64,93 ± 0,01^{e}	65,80 ± 0,04^{e}
	2%	22,72 ± 0,30^{d}	3,70±0,081^{e}	18,56 ± 0,54^{d}	63,56 ± 0,08^{d}	64,69 ± 0,01^{d}
	3%	24,45 ± 0,14^{f}	3,83±0,014^{f}	19,70 ± 0,27^{d}	61,31 ± 0,04^{b}	63,33 ± 0,02^{c}
80: 20	1%	20,82 ± 0,38^{b}	3,96±0,064^{g}	20,45 ± 0,27^{e}	68,56 ± 0,06^{g}	67,99 ± 0,01^{g}
	2%	23,34 ± 0,23^{e}	4,04±0,024^{h}	22,16 ± 0,27^{f}	66,94 ± 0,05^{f}	66,70 ± 0,04^{f}
	3%	25,52 ± 0,10^{f}	4,31±0,051^{i}	22,63 ± 0,13^{f}	65,80 ± 0,01^{e}	66,13 ± 0,01^{e}

* numbers followed by different notations showed a significant difference (p≤0.05)

Table 1 shows that the average moisture content of the slice jam ranges from 18.18%-25.52%. The higher the proportion of bisbul fruit and the higher the concentration of agar, the water content and crude fiber content will increase. It is because the crude fiber in bisbul fruit is easy to bind waters. In addition, in bisbul fruit there is a fairly high pectin content, where pectin iseasy to bind water so that the higher the pectin, the more water is bound, thereby increasing the water content of the slice jam. These results are following Sukmana and Lukmayani (2017), pectin is a gel-forming hydrocolloid that can bind water, so the more pectin, the greater the water bound by pectin.

The higher addition of agar also causes the water content to be higher. This is because agar has hygroscopic properties. After all, it has a hydroxyl group. According to Afif (2018), the number of hydroxyl groups can affect the absorption of water in the material so the more the number of hydroxyl groups, the higher the water content. The hydroxyl group functions as a binder of free water that is outside and can form hydrogen bonds with water so that it tends to produce high water content. The addition of agar can also increase the fiber content of the product. Seaweed agar contains chain polysaccharide compounds consisting of agarose and agaropectin which are fiber components. The agar and carrageenan are components of seaweed polysaccharides which include soluble dietary fiber. The addition of agar in the manufacture of slice jam will cause an increase in the fiber content of slice jam.

Table 1 shows that the average antioxidant content of slice jam ranges from 13.54% - 22.63%. The highest antioxidant 22.63% was found in the treatment of bisbul fruit: beetroot (80:20) with a concentration of 3% agar. The higher the proportion of bisbul fruit and the higher the concentration of agar, the higher the antioxidant of the slice jam will be.

This is due to the high antioxidant content of the bisbul fruit (32.67%). According to Sukmana and Lukmayani (2017), the ripe bisbul fruit extract has a total flavonoid content of 0.56% and a total polyphenol content of 25.09%. In addition, beets also contain antioxidant compounds of 1.98 mmpl/g (Ananda, 2008). Treatment with the addition of 3% agar concentration gave high antioxidant activity. Agar-Agar has 3 hydroxyl groups that will form hydrogen bonds with water molecules and produce a protective layer that can protect antioxidant activity from damage when heating. The high concentrations of agar can form stronger colloidal dispersions (double helix structure) which will inhibit oxidation.

Table 1 shows that the average total sugar of slice jam ranges from 57.42 – 68.56%. The standard for making jam must have a sugar content of at least 55%. The results of the analysis show that the resulting slice jam has met the requirements to produce a good jam. The sugar content of bisbul is higher than that of beetroot, so the higher the proportion of bisbul, the higher the total sugar. However, the higher the concentration of agar that is added, the total sugar in the slice jam will decrease. This is because the higher the concentration of agar, the water content will increase so that dissolved solids including sugar will also de-crease. According to Tirtosastro and Anggraini (2007) sugar content is less than 65% and a pectin concentration of 1% can produce gels with fairly good hardness. The sugar will affect the texture of the resulting slice jam.

Table 1 shows that the average total dissolved solids of slice jam range from 60.54°brix – 67.99°brix. The spread jam must have total dissolved solids of at least 65% or 65° Brix sucrose. The higher the proportion of bisbul fruit, the higher the total dissolved solids, but the higher the agar concentration, the lower the total dissolved solids. This is because bisbul fruit contains a lot of sugar, pectin, and protein, thereby increasing the total soluble solids of the slice jam. However, the higher the addition of agar, the lower the total dissolved solids, because agar is easy to bind water so the number of water-soluble components will decrease. This is by the statement of Buckle et al. (2007), some of the sugar dissolved in water and heated will decompose into glucose and fructose. So, the higher the sugar, the higher the dissolved solids are obtained.

Sensoric properties of slice jam

The organoleptic test of the slice jam was carried out using a hedonic test with 25 panelists and the data obtained was carried out by the Friedman ranking test to determine the panelists' acceptance of the color, taste, aroma, and texture of the slice jam. The results of the clock slice hedonic test can be seen in Table 2.

Table 2. Total ranking of slice jam preferences

The proportion of Bisbul: beet	Agar con-centration	Total hedonic ranking			
		color	taste	texture	smell
60: 40	1%	83,5	110,5	71	94,5
	2%	92,5	112	78,5	98,5
	3%	99	115,5	92,5	106,5
70: 30	1%	124,5	122	131	115
	2%	129,5	125,5	138,5	124,5
	3%	136,5	129,5	146,5	133
80: 20	1%	144	137	153	141,5
	2%	157	133	152	151
	3%	150,5	140	162	158,5

The results showed that the proportion of bisbul fruit: beetroot and agar concentration had a significant effect on the aroma, color, and texture of the slice jam, but had no significant effect on the taste of the slice jam. The highest total ranking was obtained in the treatment of the proportion of bisbul: beetroot (80:20) and the concentration of 3% agar. According to the panelists, the slice jam produced in this treatment had the right taste, which was quite sweet and slightly sour. The sweet taste is obtained from the bisbul fruit and the addition of sugar while the sour taste is obtained from the addition of citric acid. In addition, this treatment produces slice jams that are soft, easy to chew, not sticky, not too soft, or too stiff. The texture of the slice jam is related to the gelling properties due to the presence of pectin in the bisbul and beetroot aswell as the added hydrocolloid. The more agar addition, the higher the strength of the gel so that it becomes more studied. The more agar concentration, the more H_2O molecules are trapped inside and making a better gel. The higher the agar concentration, the more compact the gel formed

The proportion of Bisbul fruit: beetroot (80:20) and 3% agar concentration produced slice jam which had the most preferred aroma and color by the panelists. The resulting slice of jam has a buttery aroma that comes from bisbul fruit. According to (Nariah et l, 2008), bisbul fruit smells good, a combination of cheese and durian smell. So that the panelists gave respons as the highest level of aroma. In addition, the resulting slice jam has the most attractive and brightest colors. The color of the resulting slice jam is purplish red which comes from the addition of beetroot. Substances that play a role in giving a purplish red color to beetroot are betalain pigments (Andarwulan et al., 2012). Beta-alanine pigments will remain stable if the pH is right with low acidic conditions, namely 4.5. When the pH drops, the red pigment will turn purple, while when the pH rises it will turn brown. The higher concentration of agar also causes the slice jam to be clearer. Thiscauses the slice jam to have a bright purplish-red color.

Conclusion

The slice jam in the treatment of the proportion of bisbul: beetroot (80:20) and a concentration of 3% is the best treatment with a moisture content of 25.52%, crude fiber of 4.36%, the antioxidant content of 22.63%, total sugar of 65.80 %, total dissolved solids of 66.13°brix, and has a high total ranking of preference, namely, the taste of 140, color of 150.5, aroma of 158.5, and texture of 162.

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