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PHYSICAL AND ORGANOLEPTIC PROPERTIES OF CHOCOLATE JAM WITH THE ADDITION OF COBIA GELATIN

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ABSTRACT

Chocolate spread or most people know it as chocolate jam is one of the cocoa products that is favoured by everyone. Besides having a delicious taste, chocolate also contains nutrients that are good for the body. Chocolate jam requires physical properties, especially the right texture so that it can be applied to food products such as bread. The addition of gelatin is expected to improve the texture of chocolate jam. The purpose of this study was to determine the effect of the addition of cobia gelatin with different concentrations on the physical and organoleptic properties of chocolate jam and to determine the best addition of cobia gelatin to chocolate jam. This research was conducted using a completely randomized design with one factor, namely the different concentrations of cobia gelatin. Cobia gelatin was added to chocolate jam with different concentrations of 0%, 0.5%, 1%, and 1.5%. The tests carried out include texture test, density test, and organoleptic test which includes a hedonic test of chocolate jam, spreadability, and ease of meltability in the mouth. The results showed that the addition of gelatin concentration in chocolate jam affects the texture, density, and organoleptic values. Chocolate jam with the addition of 1.5% cobia gelatin gave the highest value in the hardness parameter of 0.65, cohesiveness of 0.33, and gumminess of 0.31, while the highest value for adhesiveness and density was found in the chocolate jam with the addition of 1% cobia gelatin. The organoleptic test showed that the favorability of the chocolate jam increased as the concentration of cobia gelatin increased. The addition of cobia gelatin to the chocolate jam can produce a chocolate jam texture that is more compact and denser but easy to spread.

Keywords: chocolate jam, gelatin, organoleptic, texture.

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INTRODUCTION

Cocoa is one of the food commodities that have high economic value. According to the Central Bureau of Statistics (BPS), in 2021, Indonesia was able to produce 707,500 tons of cocoa. This cocoa produces food products in the form of chocolate which has a unique taste that is loved by children to adults. In the food industry, cocoa beans can produce products such as chocolate powder, chocolate bars, chocolate paste, chocolate candy, and many more. Besides having a delicious and unique taste, chocolate is also considered to have beneficial content for the body. According to Aprilia and Suryadarma (2020), chocolate contains bioactive compounds in the form of polyphenols that function as antioxidants. The total polyphenol content in cocoa powder is higher than in wine or tea. The group of polyphenolic compounds that are widely found in cocoa are flavonoids.

One of the diversification processes from cocoa beans is processing cocoa into chocolate jam. Chocolate jam is a product made from chocolate paste that is used as a spread on the surface of bread. Chocolate jam contains cocoa butter, oil, milk, and food additives and preservatives. In general, chocolate jam consists of at least 45% chocolate pulp and 55% thickened sugar (Ginting, 2011). Texture is an important characteristic of chocolate jam. The soft texture of chocolate jam can affect the level of acceptance of panelists and the ease of application on bread (Sampebarra *et al*., 2019). To get a good chocolate jam texture, additional ingredients are needed, one of which is fish gelatin.

Gelatin is a product resulting from the heat denaturation or breakdown of collagen. Gelatin is obtained through extraction and hydrolysis of water-insoluble collagen. Materials that can be used as gelatin include skin and bones from cows and pigs. However, currently many develop gelatin using materials such as fish bones and skin, one of which is cobia (*Rachycentron canadum*). According to Febrianti *et al*., (2022), cobia skin and bones have a lot of collagen content which when made into gelatin will produce more yield. This is reinforced in the research of Aziza *et al*. (2022), which states that the yield of cobia gelatin is 17.88%, catfish is 13.24% and payus is 15.47%. Gelatin is one of the additives that is often used in the food industry. The function of gelatin is as an emulsifier, stabilizer, foaming agent, encapsulant, and film-forming material. In addition, gelatin also greatly affects the texture of a product. Gelatin can increase chewing ability, and act as a gelling agent, thickener, adhesive, and many more (Cahyaningrum *et al*., 2021). According to Erlina *et al*. (2017), the addition of gelatin has a significant effect on texture, spreadability, and color in carrot jam. Putri *et al*. (2023) stated that the addition of gelatin affects the texture of white sweet potato jam. Another research on chocolate jam is the addition of chicken gelatin by Almeida *et al*. (2017) which produces chocolate jam that is still spreadable even though it is

stored at 20℃. The addition of cobia gelatin to chocolate jam has never been done. Therefore, it was done for the first time in this study. The purpose of this study was to determine the effect of the addition of cobia gelatin with different concentrations on the physical and organoleptic properties of chocolate jam and to determine the best addition of cobia gelatin to chocolate jam.

MATERIALS AND METHODS

The main ingredients used in this study were cocoa butter and pure cocoa powder obtained from Bodag Chocolate House, Madiun, East Java, Indonesia. Cobia bones were obtained from Gang Baru Market, Semarang, Central Java, Indonesia. Other ingredients used in making chocolate jam include milk powder and liquid sugar obtained from local markets in Semarang, Central Java, Indonesia.

Cobia Gelatin Preparation

Cobia bone gelatin extraction was carried out based on the method of Wardhana & Sugiharto (2022) with modifications. Cobia bones were cleaned by washing using running water, then boiled in boiling water in a ratio of 1:2 for 30 minutes. Next, the bones were cut to a size of 1.5 - 2 cm. The cobia bones were immersed in 2% HCl solution with the ratio between cobia bones and HCl solution (1:4) for 48 hours to form ossein. The cobia bones were then washed under running water to remove the remaining HCl solution in the ossein. The ossein was then extracted using distilled water (1:3) at 80℃ for 6 hours using a water bath. The gelatin solution obtained was then filtered and poured into an aluminum tray. Next, the gelatin solution was dried in an oven at 60℃ for 6 hours. The dried gelatin in the form of sheets was blended to obtain gelatin powder. The gelatin powder was then packaged using PP plastic, put into an airtight jar, and stored at room temperature.

Chocolate Jam Preparation

The preparation of chocolate jam was based on Almeida *et al*. (2017) with modifications. Cocoa butter was heated at 70°C for 10 minutes to melt all the fat crystals, then milk powder, liquid sugar, and cobia gelatin were added at 0% (A); 0.5% (B); 1% (C); and 1.5% (D). Each chocolate jam was then mixed thoroughly using a mixer until homogeneous. The mixture was then packaged in glass bottles and stored at room temperature.

Table-1. Composition for making chocolate jam with added gelatin.

Material	A	B	C	D
Cocoa Butter	20	20	20	20
Liquid Sugar	54	54	54	54
Milk Powder	26	25.5	25	24.5
Gelatin	0	0.5	1	1.5
Total	100	100	100	100

Note:
A: Chocolate jam with the addition of 0% gelatin
B: Chocolate jam with the addition of 0.5% gelatin
C: Chocolate jam with the addition of 1% gelatin
D: Chocolate jam with the addition of 1.5% gelatin

Texture Analysis (Rochman *et al*., 2020)

This texture test aims to measure the hardness, cohesiveness, gumminess, adhesiveness, and fracturability of the jam. This measurement was carried out using a texture analyzer (TA-TX Analyzer, Brookfield, USA) by pressing the sample (jam) at a speed of 100mm/minute. The first method was to put the jam into the prepared container and then press using a round probe with a diameter of 0.5 inches.

Density Analysis

Density testing was carried out based on Almeida et al. (2016) by putting the sample into a beaker glass until it was full and then measuring the volume and weight. Density is expressed as the ratio of weight to volume, with units of g/mL.

Organoleptic Analysis (BSN, 2015)

Organoleptic testing was carried out based on the hedonic test which aims to determine the level of panelist preference for the samples given on the parameters of appearance, aroma, flavor, and texture. This test was carried out by giving score sheets to 30 untrained panelists containing parameters with a rating scale of 1-9. The rating scale from score 1 = dislike extremely, 2 = dislike very much, 3 = dislike moderately, 4 = dislike slightly, 5 = neither like nor dislike, 6 = like slightly, 7 = like moderately, 8 = like very much and 9 = like extremely.

Analysis of Spreadability and Meltability in the Mouth

The analysis of spreadability and meltability in the mouth was carried out based on Dipowaseso et al. (2018) with the organoleptic testing method on 30 untrained panelists. Panelists gave scores on the attributes of spreadability and meltability in the mouth with a rating scale of 1-9. The rating scale is the value of 1 = extremely difficult, 2 = very difficult, 3 = difficult, 4 = slightly difficult, 5 = neutral, 6 = slightly easy, 7 = easy, 8 = very easy and 9 = extremely easy.

Statistical Analysis

This research was conducted using a completely randomized design (CRD) with three repetitions. The data obtained were analyzed using ANOVA. Data that showed significant differences were analyzed using Tukey's test. Data analysis was performed using SPSS IBM Statistic 23 software.

RESULTS AND DISCUSSIONS

Texture

The texture test in this study was conducted for the parameters of hardness, cohesiveness, gumminess, adhesiveness, and fracturability. The results of the texture test are presented in Table-2.

Table-2. Texture and density test results of chocolate jam with the addition of gelatin.

Chocolate jam	Hardness	Cohesiveness	Gumminess	Adhesiveness	Density (g/mL)
A	0.23±0.050[a]	0.12±0.002[a]	0.008±0.001[a]	0.078±0.003[bc]	1.30±0.040[a]
B	0.51±0.020[b]	0.22±0.100[b]	0.018±0.000[b]	0.069±0.007[a]	1.95±0.030[b]
C	0.61±0.030[c]	0.31±0.005[c]	0.029±0.006[c]	0.081±0.001[c]	2.28±0.030[c]
D	0.65±0.007[c]	0.33±0.008[d]	0.031±0.003[c]	0.070±0.002[ab]	2.47±0.940[d]

Note:
Data with different letters in the same column showed significant differences (P<0.05)
A: Chocolate jam with the addition of 0% gelatin
B: Chocolate jam with the addition of 0.5% gelatin
C: Chocolate jam with the addition of 1% gelatin
D: Chocolate jam with the addition of 1.5% gelatin

Hardness

The hardness test is a texture test in the form of hardness using a texture analyzer. Based on Table-2, it can be seen that different concentrations of gelatin affect the hardness of chocolate jam. Chocolate jam with the lowest hardness was obtained in the addition of 0% cobia gelatin, which was 0.23 kgf, while the highest hardness was in a chocolate jam with the addition of 1.5% cobia gelatin, which was 0.65%. The results showed that the higher the concentration of gelatin added, the higher the hardness produced. This can occur because gelatin can form a triple helix network that will trap water, causing an increase in gel strength (Mukkum *et al*., 2023). Purwakusuma (2018) stated that increasing the concentration of gelatin can increase the hardness value of jam because the more gelatin is added, the more gel mass is formed, so the gel matrix will trap more water and make the texture of the jam firmer. Cozentino *et al*. (2022) added that hazelnut chocolate jam with the addition of emulsifiers has a hardness value of 0.42-0.55 kgf. This value is smaller when compared to the chocolate jam in this study.

Cohesiveness

Cohesiveness is a test used to determine the relation between the strength and compactness of materials that interact with each other. Iswara *et al*., (2019), stated that cohesiveness is the compressive area from the second compression to the first compression. Cohesiveness is the material level when it can be destroyed by mechanical movement. The cohesiveness value of chocolate jam between treatments was significantly different. Chocolate jam with the addition of 0% cobia gelatin has the lowest cohesiveness value of 0.12 while jam with the addition of 1.5% cobia gelatin obtained the highest cohesiveness value of 0.33. According to Shaliha *et al*. (2018), the higher the integrity or compactness of a material, the higher the cohesiveness value produced. This is shown in Table 2, where the higher the gelatin added, the higher the cohesiveness value so that the resulting chocolate jam will be denser and more compact. Sunyoto *et al*. (2017) stated that the addition of gelling agents such as gelatin, agar, and carrageenan can increase the cohesiveness value which will make the texture of food ingredients denser and more compact. A product such as jam when added with gelatin will cause the matrix network in the material to become dense, so that the resulting jam will have a higher cohesiveness value when compared to jam without the addition of gelatin (Rochman *et al*., 2019).

Gumminess

Gumminess is the energy required to crush food products with a semi-solid texture to a state that is ready to be swallowed (Setiaboma *et al*., 2021). Table-2 shows that the addition of cobia gelatin had a significant effect on the value of gumminess or chewiness of chocolate jam. The highest level of gumminess was in jam with the addition of 1.5% cobia gelatin, which amounted to 0.031 and the lowest was in jam with the addition of 0% cobia gelatin at 0.008. This showed that the more concentration of gelatin added, the higher the gumminess value. This statement is in line with the research of Mahat *et al*. (2020), which stated that gelatin or agar is a gelation material that provides a soft and semi-solid texture to gummy and other food products. The chewiness or gumminess of a product is influenced by the amount of gelatin contained in the product. The hardness value of the product usually affects the gumminess value. If the hardness value of a product is low, the gumminess value of the product also tends to be

low. This study also showed that the lowest hardness and gumminess of chocolate jam was in jam with the addition of 0% cobia gelatin and the highest hardness and gumminess values were obtained in jam with the addition of 1.5% cobia gelatin. According to Apriantini *et al*. (2021), low gumminess values are caused by low hardness values in a product. Mostafa *et al*.'s research (2022) stated that chocolate jam with different liquid sugar additions had the highest gumminess value of 0.027 while the lowest was 0.005. This value is lower than this study because in this study chocolate jam was added with gelatin which functions as a texture enhancer.

Adhesiveness

Adhesiveness is the force needed to overcome the tensile strength between the surface of the food and the surface of other materials in direct contact with the material (Ratnawati and Afifah, 2018). According to Rahmadi *et al*. (2021), adhesiveness is a separate characteristic to describe the adhesiveness of food products with teeth during the chewing process. The value of adhesiveness in chocolate with the addition of gelatin had results ranging from 0.069-0.081. This is not in line with the research of Samanta *et al*. (2019) which stated that the adhesiveness value will decrease along with the addition of gelling agent (gelatin) to food ingredients. The low value indicates that the food ingredients produced are increasingly sturdy and sticky. Gelatin is an elastic gel and tends to be sticky, resembling the character of carrageenan. Increasing gelatin concentration produces a stickier product because the gelatin forms a gel in the product. The thing that can affect stickiness besides gelatin concentration is the cooking process of the chocolate jam. According to Dipowaseso *et al*. (2018), gelatin will more easily form a solid and sticky gel if the gelatinization temperature at the time of cooking the jam is appropriate.

Density

The density test is the ratio between the mass of the material and the volume and content of the material. The density value in this study showed significantly different results. The density value of chocolate jam increases with the addition of cobia gelatin. Chocolate jam with the addition of 0% cobia gelatin produced the smallest density value of 1.30 g/mL, while jam with the addition of 1.5% cobia gelatin had the highest density value of 2.47 g/mL. The increase in density value in chocolate jam is influenced by the amount of gelatin powder added to the jam. This is to the research of Hadi *et al*. (2022), which stated that the density value is influenced by the shape, size, and number of particles added to a food ingredient. In addition, the composition of the ingredients, the characteristics of the added ingredients, and also the processing of the product affect the density value. Research by Almaeda *et al*., (2017), stated that the addition of gelatin made from chicken by-products added to chocolate jam will affect the physical and chemical characteristics of the chocolate jam. Chocolate jam with 0.5% chicken gelatin has the lowest density value of 0.93 g/mL, while chocolate jam with the addition of 1% chicken gelatin produces a density of 1.07 g/mL. These density values are lower when compared to the chocolate jam with cobia gelatin added in this study.

Organoleptic

The organoleptic test is a test used to compare the physical characteristics of chocolate jam based on the level of preference. These physical characteristics include the appearance, aroma, flavor, texture, spreadability, and meltability of the jam. The results of the organoleptic test of chocolate jam with the addition of gelatin are presented in Table-3.

Table-3. Organoleptic test results of chocolate jam with the addition of gelatin.

Chocolate Jam	Appearance	Aroma	Flavor	Texture	Spreadability	Meltability
A	7.26±1.01^{a}	7.46±0.68^{a}	8.06±0.82^{b}	6.66±0.88^{a}	7.06±0.69^{a}	7.86±0.73^{b}
B	7.77±0.80^{a}	7.50±0.57^{a}	6.96±0.76^{a}	7.53±0.86^{b}	7.40±0.85^{a}	7.26±0.58^{a}
C	8.06±0.69^{b}	7.56±0.89^{ab}	7.13±0.68^{a}	7.56±0.85^{b}	7.40±0.77^{a}	7.56±0.77^{ab}
D	8.13±0.68^{b}	7.90±0.48^{b}	8.20±0.61^{b}	7.73±0.82^{c}	7.70±0.65^{a}	7.56±0.62^{ab}

Note:
Data with different letters in the same column showed significant differences (P<0.05)
A: Chocolate jam with the addition of 0% gelatin
B: Chocolate jam with the addition of 0.5% gelatin
C: Chocolate jam with the addition of 1% gelatin
D: Chocolate jam with the addition of 1.5% gelatin

Appearance

Appearance is one of the first parameters that affect the level of consumer preference for a product. This can happen because the appearance of a good product tends to be considered to have good taste and high quality (Damapolii *et al*., 2021). The highest chocolate jam appearance value was in a chocolate jam with the addition of 1.5% gelatin at 8.13, while the lowest appearance value was in a chocolate jam without the addition of gelatin at 7.26. The value is categorized as like moderately to like

very much. The addition of gelatin to chocolate jam tends to increase the panelists' level of preference because, with the addition of gelatin, the appearance (color) of the jam becomes increasingly brown. The darker the jam seems to have more chocolate content so the panelists like it more. Savitri *et al*. (2021) produced a chocolate spread with an appearance value of 5.5-6.8. This value is lower than the chocolate jam produced in this study. The increase in brown color in jam is due to the Maillard reaction. The Maillard reaction can occur due to the reaction between primary or free amino groups from proteins with aldehydes or ketones from reducing sugars to produce brown color compounds. The occurrence of the Maillard reaction in jam is due to the protein contained in gelatin (Sipahelut, 2019).

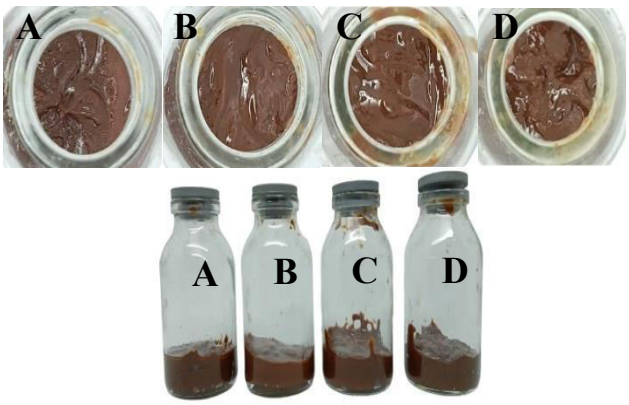

Figure-1. Appearance of chocolate jam with added gelatin A: 0%, B: 0.5%, C: 1% and D: 1.5%.

Aroma

Aroma is a distinctive odor that appears in food ingredients and can usually be assessed subjectively by the sense of smell (Palupi *et al*., 2021). The sensory value of aroma in Table 3 showed that the highest value was obtained in jam with 1.5% gelatin added while the lowest value was in jam with 0% gelatin added. The resulting value is included in the like category because it has a value of more than 7. According to Sampebarra *et al*. (2019), the aroma of chocolate jam that consumers like is jam that has an aroma like real cocoa. The addition of gelatin was considered capable of holding back the aroma of chocolate jam so the chocolate aroma was still very dominant in the 1.5% treatment. According to Yunus (2018), gelatin added to products usually does not have a distinctive aroma, so it does not damage the original aroma of the product. This is reinforced in Simamora and Rossi's research, (2017), which stated that the higher the concentration of gelatin added to food ingredients will increase the sensory value of the aroma of the ingredients. Gelatin acts as a stabilizer that can maintain the aroma of the product.

Flavor

Flavor is one of the important parameters for the sensory value of a product. Organoleptic test of jam with flavor parameters had the highest value in the addition of 1.5% gelatin, namely 8.20, with the category of like very much, while the lowest value was jam with the addition of 0.5% gelatin, namely 6.96% which fell into the category of like slightly. Sampebarra *et al*.'s research (2019) stated that the requirements for good chocolate jam are easy to spread and have the aroma and flavor of real cocoa fruit. Gelatin added to jam affects the sensory value of flavor, whereas the panelists prefer chocolate jam with more gelatin added. According to Samantha *et al*. (2019), gelatin added to food is usually a white powder that has no flavor or aroma, but the higher gelatin concentration in food ingredients can make jam have a stronger flavor. It is suspected that gelatin can trap flavors in the product.

Texture

The addition of cobia gelatin to chocolate jam affects the texture based on organoleptic analysis. The most favorable texture was in the addition of 1.5% gelatin at 7.73 while in the addition of 0% gelatin at 6.66, with the category like slightly. The addition of cobia gelatin caused the texture of the jam to become denser, but still acceptable to the panelists. Chocolate jam without the addition of cobia gelatin had a mushy texture that was less favorable, while jam with the addition of 1.5% cobia gelatin produced a soft but slightly denser texture. According to Ma'arif *et al*. (2021), the texture of jam will be more compact and denser when given additional gelling agents such as gelatin. Gelatin has a function as a good stabilizer for gel formation. The texture of the jam affects the level of consumer preference. The more mushy the texture of the jam will reduce the acceptance of panelists.

Spreadability

Spreadability is a sensory test that aims to measure the consistency and texture of jam when spread on bread. This spreadability test is usually carried out for semi-solid products such as butter, jam, margarine, and others. The scale used for this spreadability sensor is 1 (difficult) to 9 (very easy). In this study, the addition of gelatin did not affect the spreadability of chocolate jam. The spreadability of the four treatments is still in the easy to spread category because the resulting value is more than 7. According to Dipowaseso *et al*., (2018), adding the right gelling agent such as gelatin and pectin can make the gel formed not too hard and the resulting spread can be longer. Therefore, if less gelling agent is added, the spreadability of the product will be lower. Good quality jam usually has a good gel consistency and spreadability.

Meltability in the Mouth

Meltability is an analysis that uses the sense of taste to determine the texture of the product when in the mouth. The definition of meltability is how the chocolate spread melts completely in the mouth. In this study, the highest meltability was 7.86 with the addition of 0% gelatin, while the lowest value was 7.26 with the addition of 0.5% gelatin. Both values fall into the easy to melt

category. This meltability is influenced by the smoothness and stickiness of the chocolate spread. Smoothness is the level of roughness (like sand) that is felt in the mouth, while stickiness is the level of the mixture of melted chocolate with saliva sticking to the tongue and roof of the mouth (Sutrisno *et al*., 2018). According to Asriati et al., (2020), chocolate has a melting point of around 34°C, so if you put it in your mouth, the chocolate will slowly melt. The longer the chocolate is processed in the mouth, the level of hardness of the chocolate will decrease and the size of the chocolate particles will decrease. The smaller particle size will increase the surface area for heat transfer due to the breakdown of the formation of chocolate particles so that the chocolate melting process becomes more significant.

CONCLUSIONS

The conclusion that can be drawn from this research is that chocolate jam to which gelatin concentration is added has values of hardness, cohesiveness, gumminess, fracturability, and density which increase along with increasing concentration of gelatin, but the adhesiveness value decreases. Apart from that, increasing the gelatin concentration also increases the level of panelists' preference for the parameters of appearance, aroma, flavor, texture, and spreadability, in the meltability parameter, the level of ease of melting in the mouth decreases, but the scale is still categorized as easy to melt in the mouth.

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