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The Effect of Substitution of Brown Sugar with Honey on Total Sugar, Total **Calories, and Organoleptics Characteristics of Dry Meat Product (Dendeng)**

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Abstract

The purpose of this study was to determine the effect of the substitution of brown sugar with honey on *dendeng* in terms of total sugar, total calories, water holding capacity (WHC), and organoleptic. The results of this study are expected to provide information on the substitution of brown sugar with honey in *dendeng*. The main raw material used in this study is *dendeng*, with the main raw material being brown sugar, which is substituted with honey. The concentration concentration of (P0) as a control, namely 30% brown sugar, (P1) 24% brown sugar + 6% honey, (P2) 18% brown sugar + 12% honey, (P3) 12% brown sugar + 18% honey, (P4) 6% brown sugar + 24% honey and (P5) 30% honey. The

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1. Introduction

Dendeng is one of the dried meat products that is traditionally made from ground beef with brown sugar, salt, and spices, then printed as thin sheets with a thickness of approximately 4 mm and then dried ^[1]. Brown sugar as a sweetener contains high calories. People who use sugar as a sweetener frequently exceed the safe consumption dose for health, so a low-calorie and safe sweetener is required for health. Eating foods that contain high calories can cause diabetes and other chronic ^[2]. The use of sweeteners in the manufacture of *dendeng* can be achieved by using honey. Honey has a lower calorie content, so it can be used as a substitute for brown sugar as a sweetener in making *dendeng*. This is because the sweet taste of honey comes from simple carbohydrates such as fructose and glucose which can be quickly absorbed into the blood and then utilized for the energy needs of the human body ^[3]. Honey is composed of 38% fructose and 31% glucose ^[4]. The use of honey as a sweetener in food products can provide flavor, inhibit the growth of microorganisms, can suppress water content and play a role in preservation because of the content of organic acids and flavonoid compounds ^[5]. Processing of *dendeng* with the use of honey as a sweetener to replace brown sugar is expected to produce good quality *dendeng* that is safe for human health.

2. Materials and methods

2.1 Materials

The material used in this study was *dendeng* with the substitution treatment of brown sugar with honey.

2.2 Methods

The research method used is a laboratory experiment using a completely randomized design (CRD) with 6 treatments and 4 replications. The determination of the treatment in this study is based on ^[5] which has been modified with a concentration of (P0) as a control, namely 30% brown sugar, (P1) 24% brown sugar + 6% honey, (P2) 18% brown sugar + 12% honey, (P3) 12% brown sugar + 18% honey, (P4) 6% brown sugar + 24% honey and (P5) 30% honey. Data was analyzed using Analysis of Variance (ANOVA), and if a significant difference was found, it was tested using Duncan's Multiple Range Test (DMRT).







research method used was a laboratory experiment with a completely randomized design consisting of six treatments and three replications. The data was analyzed by analysis of variance (ANOVA) and continued by Duncan's Multiple Range Test Method (DMRT) if there were differences. Substitution of brown sugar with honey in making *dendeng* showed a significant difference (P<0.05) and could reduce the value of total sugar, total calories, and WHC but did not provide a significant difference (P>0.05) in organoleptic taste, aroma, texture, and color in jerky. Consumers still like dendeng substituted with honey.

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2.2.1 Making Dendeng

The making of *dendeng* refers to ^[7], which has been modified as follows. Beef (200 g) and spices are cleaned and then mashed using a food processor. The ground beef is mixed with spices (10% garlic, 2% coriander, 2.5% salt, 8.5% galangal, and 0.3% pepper), then honey is added according to the treatment, namely 6, 12, 18, 24, and 30%. After that, stir until evenly distributed until it becomes a dough. Then the dough is flattened with a glass edge so that it forms a thin sheet with a thickness of 2-3 mm. Subsequently, drying was carried out using a food dehydrator at a temperature of 60°C for 3 hours.

2.2.2 Total Sugar

The total sugar of *dendeng* refers to ^[8] as follows: 0.0 (blank); 0.2; 0.4; 0.6; 0.8; 1 ml of glucose solution into a test tube, then add water until the total volume of each reaction tube is 1 ml. 5 ml of Anthrone reagent was added quickly into each test tube, then the test tube was closed and mixed thoroughly. Put it in a 100 °C water bath for 12 minutes, then cool it quickly using running water. The solution was transferred to a cuvette, and the absorbance was read using a spectrophotometer at a wavelength of 630 nm. Make a curve of the relationship between absorbance and the amount of glucose.

2.2.3 Total Calorie

Testing the total calories of *dendeng* using a bomb calorimeter refes to ^[9]. Preparation of tools, which includes: turning on the cooler water until the temperature is reached according to the Dynamic Method at 25C, which is a temperature of 20 °C. Cleaning the sample crucible from the rest of the previous test. Weigh the sample to be measured at approximately 1 g (make sure the calorific value of the sample is not more than 40,000 J/g). Prepare a cotton thread for ignition by winding it up and attaching it to the ignition wire attached to the cover decomposition vessel. Place the crucible on the crucible holder and make sure the cotton

thread touches the sample. Regulated the pressure of oxygen entering the decomposition vessel at approximately 30 bar. Further testing with tools that include: Turn on the bomb calorimeter, then select the Dynamic Method at 25 C, and wait until the coolant temperature inside the tool reaches 20 °C (a sample dialog box appears). Fill in the information in the sample dialog box, then click OK and a Bomb will appear \uparrow . Place the decomposition vessel on the filling head of the bomb calorimeter. Click StartI and wait for 15 minutes until the sample calorific value appears (equipment testing is complete). Taken decomposition vessel until the Remove Bomb command appears. Remove the pressure in the decomposition vessel and clean the sample crucible. Turn off the tool and prepare the tool for the next test.

2.2.4 Organoleptic Characteristics

The organoleptic test of *dendeng* includes color, aroma, texture, and flavor ^[9]. Organolepticts testing uses the hedonic scoring method. The numerical scale used ranged from a scale of 1 to a scale of 5. The parameters observed were color, texture, aroma, and flavor of *dendeng* with the substitution treatment of brown sugar with honey. The color parameter shows the color of *dendeng* based on consumer preferences. Taste shows the taste of *dendeng* based on consumer preferences. Texture refers to the sensation of pressure that can be observed with the mouth or touched with the fingers. The sample was presented to a panel of five people, who were asked to fill out a questionnaire subjectively based on their preference for several parameters being tested. Each panelist was given 10 grams of *dendeng* from each treatment, packaged in plastic clips. The higher the score given by the panelists, the higher the panelist's preference for the product being tested, and vice versa.

3. Results and discussion

The average values of total sugar, total calorie, and organoleptic characteristics (color, aroma, texture, and taste) of *dendeng* are presented in Table 1.

Parameter	Treatment					
	PO	P1	P2	P3	P4	P5
Total sugar (%)	$36.57^{a} \pm 0.19$	$35.01^{b} \pm 0.32$	$33.37^{c} \pm 0.22$	33.37°± 0,.22	$27.40^{e} \pm 0.40$	$22.58^{f} \pm 0.40$
Total calorie (kal/g)	372.99 ^y ±3.61	365.84 ^y ±7.49	365.50 ^y ±3.19	363.16 ^z ±3.90	362.25 ^z ±3.35	$357.12^{z} \pm 2.34$
Color	4.27±0.70	3.53±0.92	3.80±0.77	3.60±0.99	3.67±0.72	3.73±0.41
Aroma	4.67±0.49	4.73±0.46	4.47±0.52	4.40±0.51	4.53±0.52	4.80±0.41
Texture	4.53±0.52	4.33±0.82	4.27±0.70	4.47±0.52	4.20±0.77	4.40±0.74
Flavor	2.53±0.83	3.47±0.52	3.80±0.68	3.27±0.96	4.07±0.46	3.40±0.74

Table 1: Average Value of Total Sugar, Total Calorie and Organoleptic (color, aroma, texture, and flavor) of Dendeng

3.1 Total Sugar

The results of the analysis of variance showed that the substitution of brown sugar with honey gave a significant difference (P<0.05) to the average total sugar of *dendeng*. The highest average value of total sugar in Table 1 is in P0, which is $36.57\% \pm 0.19$ with a concentration of brown sugar 30% and the lowest value is in P5, which is $22.58\% \pm 0.40$ with a concentration of honey 30 The total sugar content of *dendeng* was measured using the anthrone-sulfate method to determine the content of reducing and non-reducing sugars in a food ingredient. This is in accordance with the statement of ^[8] that the principle of the anthrone method test is that reducing sugar and non-reducing sugar will react with concentrated sulfuric acid as a strong oxidizing agent to

form furfural or its derivatives, and then the furfural will react with anthrone reagents to form furfural. blue-green complex.

The results that will see are not only glucose but also other sugars in the extract, such as sucrose. This is in accordance with the opinion of ^[10] that total sugar is a carbohydrate compound that can be in the form of monosaccharides or disaccharides (glucose, galactose, fructose, and sucrose), which functions as a sweetener and a source of energy. ^[11] added that reducing sugars are sugars or monosaccharides and disaccharides that have free and reactive hydroxy groups. Glucose (aldose) is usually bound to carbon number one (anomeric), while fructose (ketose) with its reactive hydroxy group is located at carbon number two.

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3.2 Total Calorie

The results of the analysis of variance showed that the substitution of brown sugar with honey made a significant difference (P<0.05) to the average total calories of *dendeng*. The average value of total calories in table 1 shows that the lowest average value is found in the P5 control treatment, which is 357.12 cal/100 g with the use of 30% honey concentration, and the highest average value is found in the P0 treatment, which is 372.99 cal/100 g with the use of 6% honey concentration.

The decrease in the average total calories in *dendeng* is thought to be because the honey used as a sweetener is low in calories, so the higher the honey concentration and the lower the brown sugar concentration, the lower the total calories produced. According to the ^[12], the total calories produced by honey per 100 g are 328 calories than sugar, which produces 364 calories. Cooked honey contains 41% fructose, 35% glucose, 1.9% sucrose, 1.5% dextrin, 17% water and other substances, including amino acids, as much as 3.5%. Fructose and glucose are the most prominent sugars in honey, reaching 85–95% of the total carbohydrates in honey ^[13].

3.3 Organoleptics Characteristics

3.3.1 Color

The results of the analysis of variance showed that the substitution of brown sugar with honey did not give a significant difference (P>0.05) to the organoleptic mean of *dendeng* color. This indicates that the substitution of brown sugar with honey does not affect the organoleptic value of *dendeng*. The organoleptic mean value of *dendeng* ranged from 3.53 ± 0.92 to 4.27 ± 0.70 .

The organoleptic value of the color substitution of brown sugar with honey showed an increase and a decrease in the average color organoleptic value in the treatment P0 to P5, although it did not show a significant difference. The highest color organoleptic mean value, which is 4.27, is found in treatment P0 (30% brown sugar use), which means that *dendeng* is slightly blackish brown in color, and the lowest organoleptic mean value is 3.53, found in treatment P1 (24% brown sugar + 6% honey), which defines the brown color. According to ^[14], the darker color of *dendeng* sapi is thought to be caused by grinding. It can make the tissue fibers smooth and the liquid meat containing hemoglobin will come out to the surface. The protein will react with glucose from sugar as a result. Mailard color is brown. The color of *dendeng* is influenced by the sugar content in the ingredients for making *dendeng* and the temperature used in the drying process. ^[15] stated that processed meat products in the form of *dendeng* are generally brown or blackish in color due to the Maillard reaction that takes place as long as the *dendeng* is dried.

3.3.2 Aroma

The results of the analysis of variance showed that the substitution of brown sugar with honey did not make a significant difference (P>0.05) to the organoleptic average of the aroma of *dendeng*. This indicates that the substitution of brown sugar with honey does not affect the organoleptic value of the aroma of *dendeng*. The average organoleptic value of *dendeng* aroma ranged from 4.40 ± 0.51 to 4.80 ± 0.41 .

The organoleptic value of the aroma of the substitution of

brown sugar with honey showed an increase and a decrease in the average aroma organoleptic value in treatments P0 to P5, although there was no significant difference. Based on the organoleptic aroma score, the highest score in the study was found in treatment P5 (30% honey use), which was 4.80, and the lowest average value was in treatment P3 (18% brown sugar and 12% honey), which was 4.40, which defined *dendeng* honey-scented grind. The low aroma of *dendeng* is thought to be because honey can affect the aroma of *dendeng* if given in large quantities, so that the distinctive aroma of meat in *dendeng* decreases. ^[16] explained that honey has a sugar content of 80%, so the sweet taste can affect the aroma of *dendeng* to smell like honey.

3.3.3 Texture

The results of the analysis of variance showed that the substitution of brown sugar with honey did not give a significant difference (P>0.05) to the organoleptic mean of *dendeng* texture. This indicates that the substitution of brown sugar with honey does not affect the organoleptic value of the *dendeng* texture. Table 1 shows that the mean texture of *dendeng* ranges from 4.20 to 4.53. The highest average texture organoleptic value was found in treatment P0 (addition of 30% brown sugar), which was 4.53, and the lowest average value of *dendeng* was found in treatment P2 (18% addition of brown sugar with 12% honey), which was 4.27.

The average organoleptic value of the *dendeng* texture in each treatment showed that the *dendeng* had a slightly soft texture. According to ^[17], meat tenderness can be achieved by cooking meat at a temperature range of 57-60°C, because at that temperature there is no hardening of myofibril proteins, while heating at temperatures greater than 72-74°C will cause hardening of the protein so that the meat becomes tough, whereas according to ^[18], the texture of a product produced depends on the amount of myofibrillar protein that is degraded, the degree of drying, the degree of connective tissue in the meat.

3.3.4 Flavor

The results of the analysis of variance showed that the substitution of brown sugar with honey did not make a significant difference (P>0.05) to the organoleptic mean of *dendeng* flavor. This indicates that the substitution of brown sugar with honey does not affect the organoleptic value of *dendeng* flavor.

Table 1 shows that the average taste of *dendeng* ranges from 2.53 to 4.07. The highest average value of organoleptic taste was found in treatment P4 (use of 6% brown sugar with 24% honey), which was 4.07, which was defined as *dendeng* tasting like honey, and the lowest average value of *dendeng* was found in treatment P0 (use of 30% brown sugar), which was 2.53, which is defined as *dendeng* without honey.

Taste is a determining factor for consumer acceptance of food products ^[19]. The average value of *dendeng* taste showed an increase even though it did not show any significant or non-significant differences specifically. The resulting flavor indicates that there is a combination of interactions between the components of the spices and the addition of honey used. This is due to the presence of hydroxymethylfulfural (HMF) as a flavoring agent in honey which will have an impact on the taste of *dendeng* ^[20].

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4. Conclusion

Substitution of brown sugar with honey had a significant effect (P<0.05) on total sugar and total calories, while organoleptic color, aroma, texture, and flavor had no significant effect (P>0.05). The results showed that the substitution of brown sugar with honey could reduce the value of total sugar and total calories of *dendeng*.

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