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STUDY OF THE ADDITION OF VARIOUS CONCENTRATIONS OF SUMBAWA HONEY AS A NATURAL SWEETENER ON THE ORGANOLEPTIC QUALITY AND PHYSICAL PROPERTIES OF MALAKA FRUIT JUICE (*Phyllantcus emblica*)

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ABSTRACT

Malacca fruit (Phyllanthus emblica) has a high level of antioxidant activity containing phenolic compounds and flavonoids. One of the antioxidant compositions which is quite high in malacca fruit is vitamin C. To increase the selling value, the malacca can be processed into fruit juice with honey as a sweetener supplement. The purpose of this study was to determine the differences in composition between honey with organoleptic properties of color, aroma and taste and to determine the variation of honey composition on physical properties in Malacca juice. This study uses a Completely Randomized Design (CRD) with honey composition factors, namely 0%, 5%, 10%, 15%, and 20%. The addition of honey concentrations significantly influences the sensory evaluation (hedonic test) of taste and aroma, but it does not significantly affect the texture and color. The addition of honey concentrations has a significant impact on the physical color properties of Malaka fruit juice. The best honey concentration treatment was at 15%, which produced juice with a reddish to yellowish-red color, a honey-like aroma, a slightly thick texture, and a sweet taste, making it preferred by the panelists.

1. Introduction

Malacca fruit is a fruit that comes from wild plants that can grow in tropical and subtropical areas. It has yellow appearance and sour-slightly bitter taste. Malacca fruit has not been optimally utilized, only consumed fresh without further processing, causing malacca fruit to have low economic value. Only a small part of the stem is taken to be used as a cooking spice, while most of the fruit is left alone and eventually rots on the tree. Malacca fruit is not seasonal like other fruits, so it is easy to be obtained (Khoiriyah, 2015).

Malacca fruit has quite high antioxidant activity because it contains phenolic and flavonoid compounds that are often used to treat cancer, diabetes, liver, heart disorders, and anemia. One of the antioxidant compounds that is quite high in malacca fruit is vitamin C. Every 100 grams of malacca fruit contains 600-1300 mg of vitamin C. Malacca fruit is widely used as a traditional medicine and can be processed into food products such as jam, jelly, pickles, and cooked as a flavoring agent for meat (Khan, 2009). In addition, malacca fruit also has the potential to be processed into one type of drink, one of which is fruit juice.

Fruit juice is a liquid obtained from squeezing fruit, whether filtered or not, which is not fermented and is intended for fresh drinks that can be drunk immediately. Fruit juice is a beverage product that can be drunk immediately to meet the needs of vitamins, fiber and others. This product also has a long shelf life compared to the natural form of fruit. Generally, industrial food products, such as processed fruit juice, use sweeteners to enhance the taste (Aliyu et al., 2012).

Sweeteners serve to enhance taste and aroma, improve physical and chemical properties. There are two types of sweeteners, natural sweeteners and artificial sweeteners. Artificial sweeteners are additives that are deliberately made to imitate the taste of sugar such as saccharin, cyclamate and aspartame which are widely used as synthetic sweeteners in the

manufacture of food and beverages, while natural sweeteners are sweeteners obtained from plant and animal materials (Matute et al., 2010). Plant sweeteners are sweeteners that come from plants such as sugar cane, while animal sweeteners are sweeteners that come from animals, one of which is honey produced by bees.

Honey is a sweet liquid produced by honey bees (*Apis dorsata*) and comes from various nectar sources (SNI, 2013). Honey is rich in phenolic components, ascorbic acid, tocopherol, catalase, and flavonoids (Aliyu et al., 2012). Forest honey is better known because it contains more nutrients consisting of minerals and vitamins. Forest honey has many varieties in terms of taste, color, aroma, viscosity, and content. The color of forest honey is usually cloudy brown or light brown to dark brown depending on the nectar source. Honey is beneficial for health and can be used as medicines such as preventing diabetes, cancer, strengthening the immune system, and can reduce weight and cholesterol. One of the potential honey producers is Sumbawa Island (Sakri & Faisal, 2012; Kinoo et al., 2012).

In Sumbawa, so far forest honey has only been consumed directly and used as additional nutrition for the body. The nutritional content of honey can potentially be used as a natural sweetener in making fruit juice. In a study conducted by (Babarinde et al., 2011; Hadisoesilo et al., 2011) the addition of honey as an alternative sweetener to snake fruit juice with concentrations of 5%, 10% and 15% respectively. By the organoleptic test result, the highest panelist preference score of the product taste was shown in the snake fruit juice sample with the addition of 10% honey concentration with describing taste was sweet and not bland.

Later, the research on the manufacture of malacca fruit juice with the addition of signature Sumbawa honey as a natural sweetener has never been done. Therefore, it is necessary to conduct research on snake fruit juice with the addition of various concentrations of Sumbawa honey and investigating the quality parameters by physical properties and sensory attributes.

2. Research Materials and Methods

2.1. Materials

Materials used in this research was malacca fruit and honey obtained from Lamenta Village, Empang District, Sumbawa Regency, mineral water (Aqua), granulated sugar (Gulaku) and various other ingredients. The tools used in this research include,knife, strainer, funnel, PET bottle (250 ml), spoon, analytical scale (Shimadzu ATX224), blender (Phllips HR 2116), stove, steamer, measuring cup, stopwatch, and Color Analysis Mobile Application.

2.2. Procedure

1000 g of washed Malacca fruit was cut into two parts and separated from the seeds. After being washed and cut, the fruit was steamed for 10 minutes at a temperature of 75°C to prevent browning of the fruit (blanching). Crushing the fruit for ± 5 minutes was done by adding 1000 ml of water to obtain malacca fruit mixture which will be used as raw material. Malacca fruit mix was then filtered and heated with the addition of various concentrations of honey (according to treatment) including (P0) 0% (control), (P1) 5%, (P2) 10%, (P3) 15%, (P4) 20% into the fruit juice, while stirring so that the fruit juice and honey can be homogen and no clumping occurs. In this heating process, the fruit juice was upgraded to 12 minutes heating at a temperature of 80 ° C. After the heating process, the fruit juice was filtered with a sieve twice to get good results and slightly reduce the thickness of the fruit juice and then the fruit juice wss put into bottles that have been sterilized beforehand (boiled for 15 minutes). After packaging, the fruit juice was pasteurized again to be sterile from pathogen microbes due to the packaging process.

2.3 Quality assessment

2.3.1. Sensory assesment

Organoleptic tests include color, viscosity, aroma, and taste parameters that are carried out by using the hedonic method. The samples were placed in the container. As much 30 untrained panelists from the Sumbawa community were asked to assess of color, aroma, taste and texture by filling out the form provided, the hedonic test score was expressed in range numbers from “extremely dislike” to “like very much” with scale of 1-5 (Pertiwi, 2016).

2.3.2. Physical color test (color analysis)

The study was conducted by identifying the L*, a*, b* and °Hue values obtained from the product captured photos using a Colorimeter (MSEZ User Manual) for 3 repetitions at each concentration. The the color changes in the malacca fruit juice that occurred during heating was measured. The °Hue value was obtained from the formula, °Hue = tg-1 (b/a) (Anjar & Riri, 2021).

3. Results and Discussion

3.1. Color preference level

Color is a factor that appears visually first. A nutritious, tasty, and very good textured ingredient will be more desired if it has a good appearance color and does not deviate from the ingredient it should have. Color is also an indicator of freshness, ripeness, and whether or not the processing is good. The color of a food product is the main attraction before consumers knowing and liking other properties. Consumers can also assess the quality of food ingredients quickly and easily by looking at the color (Marlina et al., 2012).

This study evaluated the preference level for the color of malacca fruit juice with the addition of varying honey concentrations. The average hedonic scores for the color parameter ranged from 3.3 to 3.7 (**Table 1**), indicating that the panelists generally rated the juice as "moderately liked." The highest average score (3.7) was observed at 20% honey concentration, while the lowest score (3.3) occurred at 5% honey concentration.

The ANOVA results for color preference revealed an F-value of 1.091 and a p-value of 0.363, which is greater than the significance level ($\alpha = 0.05$). These findings indicate that the addition of honey at different concentrations did not significantly affect the panelists' preference for the color of the malacca fruit juice. Some panelists commented that the dark coloration of the juice, caused by the addition of honey, appeared less appealing. The darkening of the juice likely resulted from the processing and heating steps, where the initially light brown juice turned darker as honey concentration increased. This dark brown appearance may have reduced its visual appeal to some panelists.

The observed color change is attributed to caramelization, a non-enzymatic browning reaction involving the degradation of sugars without the presence of amino acids. Caramelization enhances the flavor and color of foods and beverages, but it can also alter the original appearance of the product. When sugar is heated above its melting point, it undergoes chemical changes that result in darker hues (Desrosier, 2008).

3.2. Preferred level of texture (viscosity)

Viscosity refers to the sensation of thickness or consistency that can be perceived visually, by touch, or during swallowing. The assessment of viscosity aims to determine the panelists' acceptance of the product's elasticity or thickness. Observations of the effect of adding various honey concentrations on the texture of malacca fruit juice are presented in **Table 1**. The average hedonic score for the texture of malacca fruit juice with the addition of different honey concentrations ranged from 3.3 to 3.43, which corresponds to "moderately liked." The highest average scores (3.43) were observed at 5% and 15% honey concentrations, while the lowest scores (3.3) were recorded for the control (0% honey) and the 20% honey concentration.

ANOVA results for texture preference showed an F-value of 0.229 and a p-value of 0.922, both exceeding the significance level ($\alpha = 0.05$). This indicates that varying honey concentrations did not have a statistically significant effect on the texture preference of malacca fruit juice. Several panelists noted that the juice had a thick and smooth texture, which made it easy to drink and swallow. This consistency may result from the filtration and cooking processes during juice preparation, as well as the addition of honey, which contributes to the soft and thick texture.

These findings align with Winarno's (2008) statement that an increase in viscosity is influenced by the addition of honey. Higher honey concentrations typically lead to an increase in viscosity. However, in this study, the texture remained relatively stable across all honey concentrations, suggesting that the initial processing steps played a dominant role in determining the juice's final texture.

Table 1. Sensory properties of malacca fruit juice

Parameter	0% (control)	5%	10%	15%	20%
Color	3.67	3.30	3.33	3.60	3.70
Viscosity	3.30	3.43	3.40	3.43	3.30
Aroma	2.40 a	3.33 b	3.73 c	3.87 c	4.33 d
Flavor	1.70 a	2.87 b	3.43 c	3.63 c	4.27 d

Description, numbers that have letters on the right indicate significantly different treatments.

3.3. Aroma preference level

Aroma is the smell perceived by the olfactory nerves in the nasal cavity when food is introduced, and it plays a crucial role in determining consumer preferences. The aroma of food significantly influences consumer perception, as an unpleasant smell often leads to assumptions of spoilage or poor quality (Lestari, 2016). Observations on the effect of varying honey concentrations on the aroma of Malacca fruit juice are summarized in **Table 1**. The average hedonic scores for aroma ranged from 2.4 (disliked slightly) to 4.3 (liked). The highest score was observed with 20% honey addition, while the lowest was recorded for the control (0% honey). Honey's distinct and strong aroma appears to significantly enhance the aroma profile of the fruit juice.

The ANOVA test for aroma preference showed an F-value of 25.044 and a p-value of 0.000 (< 0.05), indicating a statistically significant effect of honey concentration on aroma preference. Duncan's post-hoc test further revealed that the aroma preference for the 0% honey sample significantly differed from all other samples (5%, 10%, 15%, and 20%), while no significant differences were observed between the 5% and 10% or the 10% and 15% concentrations.

Several panelists noted that the honey aroma dominated the malacca fruit juice, likely due to the strong and distinctive smell of honey, which overshadowed the fruit's natural aroma. This dominance may also result from the pasteurization process, which can reduce the natural aroma of the fruit. Hadiwijaya (2013) supports this finding, stating that honey often imparts a prominent aroma when added to food products.

3.3. Level of taste preference

Taste is one of the key sensory attributes that determine the overall quality and consumer acceptance of a product (Atmaja, 2009). Observations on the effect of honey concentrations on the taste of malacca fruit juice are detailed in **Table 1**. The average hedonic scores for taste ranged from 1.7 (disliked) to 4.27 (liked). The highest preference was recorded for the 20% honey sample, while the lowest was observed for the control (0% honey). As the honey concentration increased, the sweetness of the juice intensified, masking the sourness of Malacca fruit and enhancing its overall flavor profile.

ANOVA results showed an F-value of 35.064 and a p-value of 0.000 (< 0.05), confirming that honey concentration significantly affected taste preference. Duncan's post-hoc test indicated that the 0% honey sample significantly differed from all other concentrations (5%, 10%, 15%, and 20%), while the 10% honey sample showed no significant difference from the 15% concentration.

Panelists described the taste of Malacca fruit juice with added honey as delicious, with the sweetness derived from the natural flavor of forest honey. This aligns with Pontis et al. (2014), who found that honey not only enhances sweetness but also balances sour and other flavors, contributing to a richer taste. Muchtadi et al. (2010), further emphasized honey's role in improving the sensory acceptance of food and beverages due to its natural sweetness and flavor-enhancing properties.

3.4. Physical color

Color is one of the sensory factors that affect the acceptance of a food product because generally consumers or buyers before considering nutritional value and taste, will first be attracted by the color of the material (Holinesti, 2009). The color of a material can be measured using a colorimeter, spectrometer, or other tools specifically designed to measure color. The parameters used are the L* value to describe the brightness of the color, 0 for black and 100 for white. The a* value describes the type of green-red color, where a negative a* number indicates green and vice versa a positive a* value indicates red. The b* value for the blue-yellow color type, where a negative b* number indicates blue and vice versa a positive b* value indicates yellow (Hunterlab, 2008).

The average L value (brightness) of malacca fruit juice drinks with the addition of various concentrations of honey ranged from 18.67 to 59.5 (Fig. 1), where the highest value was obtained with the addition of honey with a concentration of 0%, while the lowest was obtained with the addition of honey with a concentration of 10%.

The results of the ANOVA test on the physical value of brightness color (L) with the addition of various concentrations of honey showed that the F value (37.344) and p-value (0.000) <α value (0.05), so it can be concluded that the addition of various concentrations of honey has a significant effect on the physical value of the L color (brightness) of malacca fruit drinks.

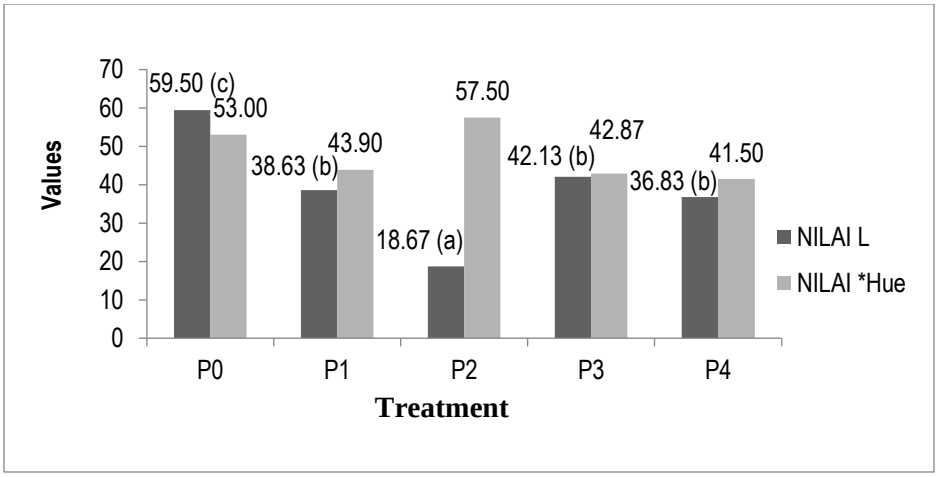

Figure 1. Graph of Average L Value and °Hue Value

Duncan's test results showed that the addition of 10% honey concentration had a significant effect on the addition of honey with concentrations of 20%, 5% and 15%. The addition of 20%, 5%, and 15% honey concentrations had a significant effect on the addition of 0% honey. This is because honey has not been added to the 0% honey concentration, only the color of the malacca fruit juice. While honey concentrations of 5%, 10%, 15%, and 20% have been added to change the color of the food from yellow to brownish. Further explained by (Muchtadi, 2010) brown color is the end result of the reaction of active aldehydes polymerized with amino groups to form a brown compound called meladonin.

Based on **Table 2**, it shows that the °Hue value ranges from 41.5 to 57.5, which means that there are samples that provide color *Red (R)* and there are samples that provide color *Yellow Red (YR)*. This is due to the possibility of color changes during the heating process caused by honey which is a factor in making malacca fruit juice.

4. Conclusion

Based on the results and discussion, it can be concluded that the addition of honey concentrations significantly influenced the sensory attributes of taste and aroma in the hedonic preference test. However, the honey concentrations did not have a significant effect on the texture and color in the sensory evaluation. In terms of physical properties, the addition of honey significantly affected the color brightness (L) and hue of Malacca fruit juice. Among the treatments, the best honey concentration was 15%, which produced fruit juice with a visually appealing reddish-yellow color, a pleasant honey aroma, a slightly thick texture, and a sweet taste. These attributes were highly preferred by the panelists.

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