

EFFECT OF COMBINATION OF CONCENTRATION OF TURMERIC EXTRACT (*Curcuma longa L.*) AND SUGAR ON WATER CURRENT AND ORGANOLEPTIC JELLY CANDY

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Abstract

Jelly candy is made from gelling agents and essences to produce a variety of flavors, a clear transparent appearance, and a chewy texture. In general, jelly candy uses gelatin as its gelling agent. Doubts about the halalness of gelatine make research into the potential of other gelling agents necessary. Carrageenan can replace gelatin as a gelling agent because of its gelling ability. This study used turmeric extract as a colorant for jelly candy. This study aimed to determine the effect of adding sugar and turmeric extract on the water content and organoleptic of turmeric jelly candy (*Curcuma longa L.*). This study used a completely randomized design with two factors: variations in sugar concentration (25%, 75%) and turmeric extract (5%, 10%, 15%). The results showed that the combination of turmeric (*C. longa*) extract concentration significantly affected water content; the greater the concentration of sugar and turmeric extract affected the color and taste of jelly candy. The concentration of carrageenan and konjac mixture that the panelists most liked was 75% sugar. Meanwhile, the concentration of turmeric extract that the panelists most liked was the addition of 10% turmeric extract.

Keywords: *Turmeric, Carrageenan, Jelly candy*

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1. Introduction

Candy is a type of confectionery that both children and adults favor. Candy that is widely circulated in the market is very diverse in shape, type, and taste, including gum (gum), lollipop, chewy candy (jelly), hard candy (hard candy), chocolate-based candy (bounty), caramel, caramel chewed nuts, nougat, and ginger candy (Yustina, dkk., 2013). According to SNI 3547-I-2008, hard candy is a type of solid-shaped snack food hard texture and does not become soft when chewed. Types of hard candy are rock candy,

candy cane, and fudge. Fudge is a candy made using a soft ball heating level (112-115°C) (Akib dkk., 2016). Jelly candy has a clear and transparent appearance and has an elastic texture with a certain elasticity. Jelly candy is a semi-wet food made from fruit juice and gelling agents with a clear and transparent appearance and a particular texture and elasticity (Koswara, 2009).

Gelling agents commonly used include gelatin, carrageenan, and agar. Jelly candies are generally made from an agar base with gelatin as a qualifier. Gelatin is a natural product obtained from the partial hydrolysis of collagen. Gelatin is a soluble protein and can act as a gelling agent.

Gelatin functions as a gelling agent and can bind water; this can be seen from the average water content, which tends to increase with the addition of gelatin. Gelatin concentration has a significant effect on the texture of jelly candy (Tiara, 2014). Carrageenan is a substance produced by seaweed of the *Rhodophyceae* class that is generally shaped like flour and functions as an emulsifier, stabilizer, thickener, and gelling agent (Monaria Tondang dkk., 2018). Adding turmeric extract to jelly candy products adds to the nutritional value of jelly candy products. Turmeric extract is one of the plants that have the potential as a traditional medicinal ingredient to prevent diseases that the community has long known. Turmeric is rich in curcuminoid compounds that can be anti-microbial, anti-oxidant, anti-fungal, and anti-inflammatory (Ferreira dkk., 2013). This plant is antineoplastic (damages ribosome formation in cancer cells or inhibits the growth of cancer cells). The parts used are rhizomes and leaves. This plant is very rich in chemical content such as tannins, curcumin, amyllum, sugar, essential oils, resin, saponins, flavonoids, and toxic proteins that can inhibit the proliferation of cancer cells (Chaerunnisa, 2018). The active compounds of curcuminoids are consumed as curcumin, demethoxycurcumin, and bisdemethoxycurcumin. Curcumin is the primary pigment in the yellow color of turmeric rhizomes. Microemulsions containing curcumin remain transparent yellow for approximately 14 days at 37 °C. Curcumin can be degraded due to changes in pH and radiation. Acidic and alkaline pH can affect curcumin levels. Similarly, UV radiation can have an impact on curcumin degradation (Cahyono dkk., 2011). The preparation of turmeric as a standardized product must pay attention to proper processing because the quality and efficacy of the product can be reduced or cause toxicity. The resulting toxicants usually come from microorganisms due to the high water content and water activity

in turmeric, causing a decrease in the quality of the spice (Kusumaningrum dkk., 2015).

Sugar can bind water to be used as a shaper of product texture. In addition, the texture is influenced by the moisture content of the product; the higher the moisture content of the candy, the lower the hardness of the candy, and the lower the moisture content of the candy, the more complex the hardness of the candy (Nurwati, 2011). Jelly candy is made from a mixture of fruit juice, gelling agents, the addition of essences to produce a variety of flavors, a clear transparent physical form, and a chewy texture like chewing gum. Gelling agents commonly used include gelatin, carrageenan, or agar-agar. According to SNI 3547-2-2008, jelly candy is a soft-textured confectionery processed by adding hydrocolloid components such as agar, gum, pectin, starch, carrageenan, gelatin or other hydrocolloids used for texture modification to produce chewy products. Jelly candy is a semi-wet food made from fruit juice and gelling agents, with a clear and transparent appearance, and has a particular texture and chewiness (Koswara, 2009). In making jelly candy, it is necessary to use other food additives such as sucrose (granulated sugar), high fructose syrup, and citric acid to give flavor and aroma so that, from a sensory point of view, jelly candy can be accepted by panelists. Jelly candy, according to SNI 3547.2-2008, has a typical taste and aroma, which does not contain foreign flavors and aromas, and has a chewy texture.

2. Research Methods

2.1 Process of Making Turmeric Extract

Turmeric is sorted, then washed and peeled. Sorting aims to remove foreign objects and separate harmful ingredients from obtaining good quality turmeric. Washing aims to remove impurities that stick to the material. Turmeric was prepared based on the treatment, then 100 ml water was added and boiled for 20 minutes at 70°C. Boiling aims to obtain turmeric extract

because heating can accelerate the extraction process. The boiled water was filtered to separate the pulp from the extract. The extract solids obtained were used to make jelly candy.

2.2 Processing Process of Jelly Candy with the Addition of Turmeric Extract

All ingredients, namely sugar (25%, 75%), water (500 ml), carrageenan (15g), turmeric extract (5%, 10%, 15%), glucose (50%), and citric acid are mixed, then boiled for 15 minutes at 80°C until boiling. After that, it is molded in a container, cooled at room temperature for ± 1 hour, thinly sliced according to taste, and dried in the sun for three days.

2.3 Sample Analysis Moisture content

Turmeric extracts jelly candy as much as 2 g in a weighing bottle with a known weight. Then dried in an oven at 105°C for 2 hours, cooled in a desiccator for 10 minutes, and weighed. Next, it was heated for 30 minutes, cooled in a desiccator for 10 minutes, and weighed again. This treatment was repeated until a constant weight was reached (difference in successive weighing ≤ 0.2 mg). The higher the temperature and the longer the heating time, the smaller the water activity value. According to Bimantara et al. 2015, states that high heating temperatures cause low water activity. Weight reduction is the amount of water evaporated from the material, with the calculation:

$$\begin{aligned} \text{Moisture content \%} \\ &= \frac{\text{initial weight} - \text{final weight}}{\text{initial weight}} \times 100\% \end{aligned}$$

Organoleptic Test

Organoleptic testing was carried out for color, aroma, taste, and overall sensory properties using the hedonic test. The hedonic test was conducted by scoring based on the panelists' liking for the product with the range of values provided. The number of panelists used was 25

people with untrained criteria. Panelists gave a score or value based on their liking for a turmeric extract jelly candy on the questionnaire provided. Organoleptic tests are highly relevant to product quality because they directly relate to consumer tastes (Fitriyono, 2014). The organoleptic test used in turmeric extract jelly candy is a hedonic test (liking test) using 25 untrained panelists conducted for three days at Universitas Yudharta Pasuruan students.

2.4 Data Analysis

Analysis of moisture content data using ANOVA Factorial analysis of variance test (Two Way Annova). The significance test used the 5% BNT test, and the organoleptic test used the Friedman test (Tenaya, 2015). To find the best treatment using the De Garmo Effectiveness Index test (Wahyuni, 2011)

3. Results and Discussion

3.1 Moisture content

Moisture content is one of the most important characteristics of food, as water can affect food's appearance, texture, and flavor. Moisture content in food also determines the freshness and durability of the food. High moisture content makes it easy for bacteria, molds, and yeasts to multiply, so changes in food ingredients will occur (Daud dkk., 2019). The moisture content in food determines the shelf life of the food. Moisture content is the amount of water in the material expressed percent of candy (Jumri dkk., 2015). The following is data on the moisture content of Jelly Candy:

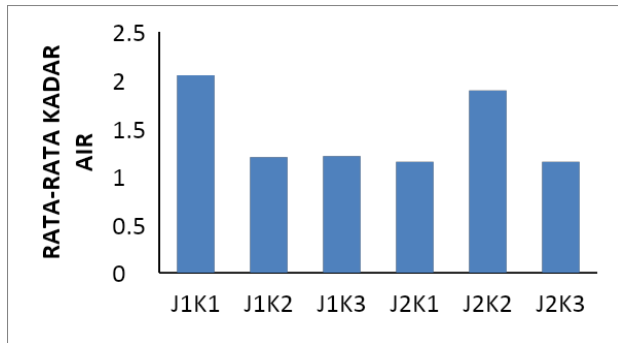


Figure 1. Moisture Content of Jelly Candy

Description:

J1K1: 25% sugar addition, 5% turmeric addition
 J1K2: 25% sugar addition, 10% turmeric addition
 J1K3: 25% sugar addition, 15% turmeric addition
 J2K1: 75% sugar addition, 5% turmeric addition
 J2K2: 75% sugar addition, 10% turmeric addition
 J2K3: 75% sugar addition, 15% turmeric addition

18 The average water content of turmeric extract jelly candy before ranged from 1.2% to 2.05%, as shown in Figure 4.5. The results of the analysis of variance showed that the highest average water content had a value of 2.05% from the treatment combination J1K1, namely the addition of 25% sugar and 5% turmeric, while the lowest value was 1.15 from the treatment combination J2K1 and J2K3, namely the addition of 75% sugar and 10% turmeric and 15% turmeric extract. The concentration of sugar in the ingredients influences jelly candy's moisture content. The proportion of turmeric extract and sugar can also affect the organoleptic value of jelly candy. Moisture content is one of the essential characteristics of food ingredients because water can affect the formation of organoleptic properties of the product. Moisture content will affect a food's appearance, texture, and flavor. Water is the most critical component in food ingredients because water affects food's appearance, texture, and flavor (Sari dkk., 2008).

3.2 Organoleptic

The organoleptic test is a test using the five senses. The body parts used in this test are the

eyes, ears, sense of taste, sense of smell, and sense of touch or hand. The ability of the sensory organs is analyzed or differentiated in providing a response or response to a sample. These abilities include recognizing, distinguishing, detecting, and expressing likes or dislikes (Negara dkk., 2016). The organoleptic test was the hedonic (favourability) test on 25 panelists. Panelists were asked for their responses regarding liking or otherwise (dislike). The levels of liking are referred to as the hedonic scale. The hedonic scale can be stretched or collapsed according to the desired scale range. The hedonic scale can also be converted into a numerical scale with quality numbers according to the level of liking. With this numerical data, parametric data analysis can be carried out (Putri, dkk., 2019).

Color

Color is the first sensory test a panelist must do because color is one of the senses the human eye can directly capture. Color is also one of the determinants of the quality of a food product. Color that is consistent with the color that should be desired will give the impression of its assessment for panelists. Color is a factor that must be considered in product development because panelists will judge a new food product first on visual appearance. Color is a visual form consumers consider (Wardhani, 2022). The organoleptic analysis conducted on 25 panelists shows that the panelists' value of the color of turmeric extracts jelly candy ranges from 2.96 to 3.6, which is between dislike and very like. The histogram of the scoring results of the panelists' level of liking for turmeric extract jelly candy is presented in Figure 2.

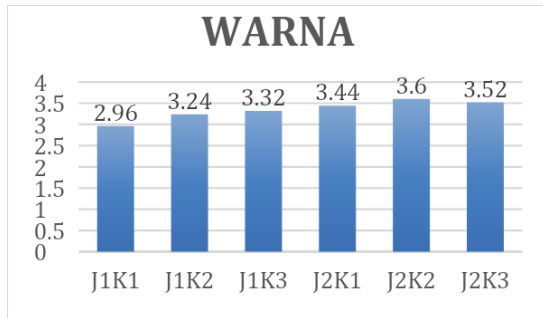


Figure 2. The average Colour value of Jelly Candy

Description:

- J1K1: 25% sugar addition, 5% turmeric addition
- J1K2: 25% sugar addition, 10% turmeric addition
- J1K3: 25% sugar addition, 15% turmeric addition
- J2K1: 75% sugar addition, 5% turmeric addition
- J2K2: 75% sugar addition, 10% turmeric addition
- J2K3: 75% sugar addition, 15% turmeric addition

The average panelist's liking score for the color of turmeric extract jelly candy had the lowest value of 2.96 from the treatment combination J1K1, namely 25% sugar percentage and 5% turmeric, while the highest value was 3.6 from the treatment combination J2K2, namely 75% sugar percentage and 10% turmeric. According to the panelists' notes, the color of the J1K1 treatment looks pale yellow, while the J2K2 treatment looks brownish yellow. The color of jelly candy is influenced by the color-forming components of turmeric and will increase and decrease with each addition of turmeric. The color produced by jelly candy comes from turmeric (curcuminoid pigments). The higher addition of turmeric will result in changes in pigment stability (Syafutri dkk., 2010).

Aroma

Aroma is a significant factor in determining consumer acceptance of a product. Before eating it, consumers usually first smell the aroma to assess whether or not the product is suitable for eating. The aroma in food is one factor that determines the delicacy of food related to the sense of smell. Aroma is one of the critical

variables because, in general, consumers' taste in food products is determined by aroma (Soekarto & Hubeis, 2000). The organoleptic analysis results conducted on 25 panelists show that the panelists' value of the aroma of turmeric extracts jelly candy ranges from 3.32 to 3.64, which ranges from immensely dislike to very like. Histogram of the average scoring results of panelists' level of liking for the aroma of turmeric extract jelly candy in Figure 3.

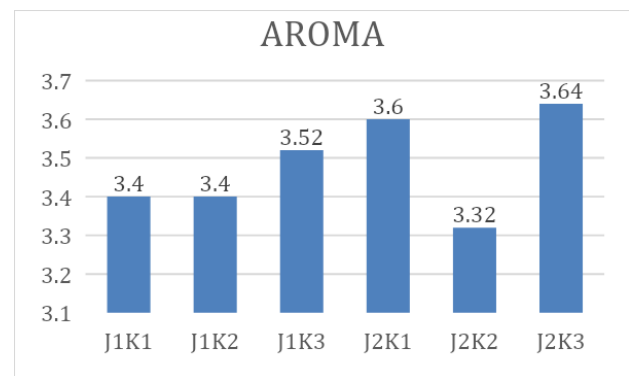


Figure 3. The average value of the Aroma of Jelly Candy

The average value of panelists' liking for the aroma of turmeric extract jelly candy had the lowest value of 3.32 from the treatment combination J2K2, namely the percentage of sugar 75% and turmeric 10%, while the highest value was 3.64 from the treatment combination J2K3, namely the percentage of sugar 75% and turmeric 15%. According to the panelists' notes in the J2K2 treatment, the aroma of the candy is not flavourful, while adding the percentage of sugar and turmeric in the J2K3 treatment can improve the aroma of the candy. The Friedman test results show that the X^2 Table value is smaller than the X Count value, which means there is a significant difference between the percentage of added sugar and the percentage of added turmeric (Syafutri dkk., 2010).

Texture

Texture is one of the crucial characteristics of food products that influence consumer

acceptance. The texture is an essential parameter in soft foods. Panelist preference for texture produces the same response as color (Putri et al., 2019). The organoleptic analysis conducted on 25 panelists shows that the value of panelists on the texture of turmeric extract jelly candy ranges from 2.4-3.44, which ranges from dislike to like. The histogram of the average scoring results of the panelists' level of liking for the texture of turmeric extract jelly candy is presented in Figure 4.

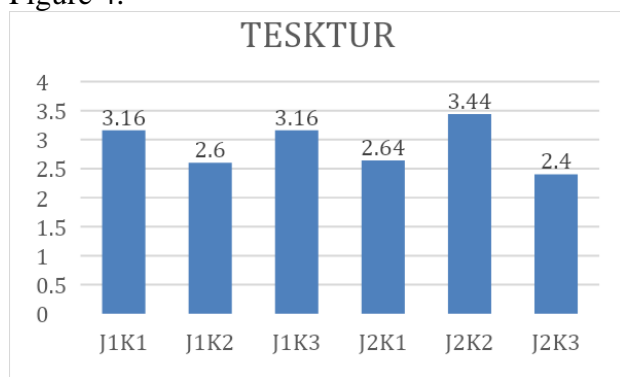


Figure 4. The average value of texture of jelly candy

The average value of panelists' liking for the texture of turmeric extract jelly candy had the lowest value of 2.4 from the treatment combination J2K3, namely the addition of 75% sugar and 15% turmeric, while the highest value was 3.44 from the treatment combination J2K2, namely the addition of 75% sugar and 10% turmeric. According to the panelists' notes in the J2K2 treatment, the texture of the candy was rather complex, while the reduction in the percentage of turmeric resulted in a chewier candy texture. In addition, the texture is influenced by the moisture content of the product; the higher the moisture content of the candy, the lower the hardness of the candy, and the lower the moisture content of the candy, the more complex the hardness of the candy (Nurwati, 2011).

Flavor

Flavor plays an essential role in determining the acceptability of food. Flavor sense is divided into four flavors: sweet, salty, bitter, and sour. Panelists' flavor acceptance is influenced by chemical compounds, temperature, concentration, and interaction with other flavor components (Winarno, 2004). The flavor is different from odor and involves more of the five senses of the tongue. The flavor is difficult to understand entirely because human tastes are diverse. Generally, food does not consist of only one group of flavors but is a combination of various integrated flavors to create a good taste of food. The flavor is one factor that influences a person's acceptance of food (Sitoayu & Trisia, 2016).

The results of an organoleptic analysis conducted on 25 panelists show that the panelists' scores on the taste of turmeric extract jelly candy ranged from 3.32 to 3.76, ranging from moderate to like. The histogram of the average scoring results of the panelists' liking for the flavor of turmeric extract jelly candy is presented in Figure 5.

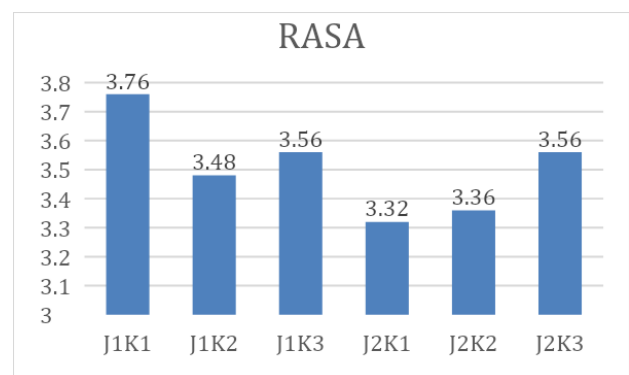


Figure 5. The average value of Candy Jelly Flavour

The average value of panelists' liking for the taste of turmeric extract jelly candy had the lowest value of 3.32 from the treatment combination J2K1, namely the addition of 75% sugar and 5% turmeric, while the highest value was 3.76 from the treatment combination J1K1,

namely the addition of 25% sugar and 5% turmeric. According to the panelists' notes, the J2K1 treatment tasted too sweet, and the taste of turmeric was not so pronounced, while the J1K1 treatment had a good taste. Other factors that also affect the taste of this jelly candy are the sweetness influenced by the addition of sucrose and glucose, the sour taste that comes from additional raw materials (turmeric), and the addition of citric acid. The presence of glucose and sucrose can improve the flavor of food ingredients. When citric acid is added, it reinforces the flavor (Winarno, 2004; Fajarwati, dkk., 2017).

Best Treatment

The best turmeric extract for jelly candy treatment was determined using the effective index method. This method uses organoleptic test parameters, including color, taste, aroma, and texture. The parameter weights can be seen in Figure 5 below.

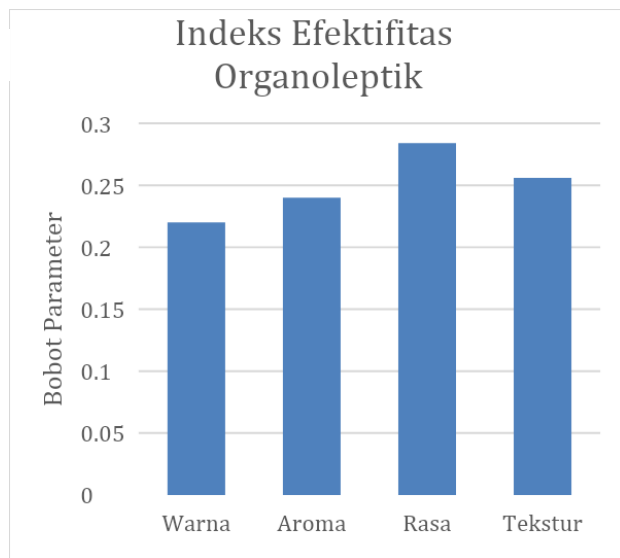


Figure 6. Effectiveness Index of Jelly Candy

The highest parameter weight is the taste parameter of 0.284, followed by the texture at 0.256, the aroma at 0.240, and the color at 0.220.

5. Conclusion

Based on this research, the following conclusions were obtained:

1. The use of different concentrations of turmeric and sugar mixture has a significant effect on the water content of jelly candy.
2. The addition of different concentrations of turmeric extract (*Curcuma longa* L) influenced the organoleptic characteristics of jelly candy on the parameters of color, taste, and texture.

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