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*RESEARCH ARTICLE*

# EFFECT OF ADDITION OF ARUMANIS MANGO (MANGIFERA INDICA) JUICE ON PHYSICOCHEMICAL CHARACTERISTICS OF JELLY CANDY FROM SAFFRON (CROCUSSATIVUS) EXTRACT

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## *Abstract*

This research aimed to determine the effect of addingarumanis mango juice to the characteristics of jelly candyfrom saffron extract. This research was designed using a completely randomized design with 5 treatments namely A(addition of 0% mango juice), B (addition of 2% mango juice), C (addition of 4% mango juice), D (addition of 6%mango juice) and E (addition of 8% mango juice) with 3 repetitions. The data obtained were analyzed statisticallyusing ANOVA (Analysis of Variance) and if they were significantly different, the were continued with the DNMRT(Duncan's News Mutiple Range Test) at 5% significance level. The results showed that the addition of mango juice tothe characteristics ofjellycandywas significantlydifferentonwatercontent, ash content,total sugar content,vitamin C, pH value and antioxidant acitvity. The best product based on physical and chemicalanalysis tests was jelly candy with the addition of 4% mango juice with hardness (78.38 N/cm2), moisturecontent (19.79 %), ash content (1.40 %), vitamin C (43.64 mg/100 g), total sugar content (57.33 %), pH value (4.90),and antioxidant activity(47.65 %).

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## Introduction:-

Candy is one of the snacks or snacks that many people like. The sweet taste and various textures make candy a delicious snack when consumed. In general, candy circulating among the public is divided into two, namely hard candy and soft candy. Where in terms of texture, hard candy has a dense texture. In terms of texture, jelly candy has an elastic texture with a certain elasticity. This candy is generally made from water or plant juice and gel-forming ingredients. According to Hasyim et al (2015), good quality jelly candy has the characteristics of having a clear and transparent appearance, a chewy and elastic texture, sweet and slightly sour, and a fresh fruit aroma. One of the factors that influences the quality of jelly candy is the gel-forming material. There are several gel-forming ingredients that can be used in making jelly candy, such as kerageenan, gum, pectin and gelatin.

One jelly candy innovation that can be developed is jelly candy from saffron extract. Currently, the spice saffron is starting to be widely discussed by the general public. This herbal spice with the Latin name Crocus sativus is usually better known for its organoleptic properties such as its unique aroma, color and taste. The distinctive bitter taste of saffron comes from a chemical called monoterpene glycoside picrocrocin and the distinctive aroma of saffron is caused by the presence of the volatile compound "aglyconesafrana". Meanwhile, the distinctive golden yellow color

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of saffron comes from the crocin content (Zeka et al., 2015). Jelly candy innovation using saffron extract as a base ingredient can be beneficial for health due to the content contained in saffron. However, despite the many benefits of the saffron spice, there are quite a few people who are less interested in consuming it, this is because the taste of saffron is slightly bitter and the typical odor of the saffron spice itself. Therefore, it is necessary to add other ingredients to improve the taste and nutritional value of saffron products.Mango fruit is an additional ingredient that can improve the taste and nutritional value of saffron products. One of the varieties is the arumanis mango. Arumanis mango fruit has specific characteristics with red-orange skin color, attractive yellow flesh, distinctive taste and aroma, and is not fibrous (Ichsan et al., 2015). In general, many people consume mangoes immediately after they are ripe because they taste sweet, fragrant, delicious and fresh. Apart from consuming it directly, mango fruit can also be processed first into fruit juice, which can be used as an addition to jelly candy from saffron extract.

Based on preliminary research conducted by researchers to make jelly candy from saffron extract with the addition of arumanis mango juice, namely 0%, 2%, 4%, 6%, 8%. The aim of using this concentration is to reduce the astringent taste of saffron extract by adding mango juice. From the preliminary results, it was found that jelly candy with the addition of 0% mango juice was used as a reference, with the taste still having the characteristic saffron and sweet taste. The addition of mango juice with 2%, 4%, 6%, and 8% produces jelly candy with a taste that still has a slight bitter taste typical of saffron and a dominant sweet taste in each treatment. Based on the explanation above, the author wants to conduct research on "The Effect of Adding Arumanis Mango (Mangifera indica) Juice on the Physicochemical Characteristics of Jelly Candy from Saffron (Crocus sativus) Extract".

## Research Method:-

**Materials and Tools**

The raw material used in this research is the stigma of saffron flowers which have been dried first. The saffron stigma was obtained from PT. Taqychan Group Indonesia. Meanwhile, the mango fruit used is fresh arumanis mango that has no bruises. Additional ingredients such as sugar, High Fructose Syrup (HFS 55%), powdered sugar, cornstarch, and gelatin. The materials used in chemical analysis are distilled water, DPPH, methanol, PP indicator, HCl, NaOH, Pb-acetate, Kl solution, sodium thiosulfate solution, H2SO4 solution, 10% K2SO4.

The tools used in this research were knives, scales, basins, blenders, spoons, plastic cups, mixers and stoves. Meanwhile, the tools used for analysis include desiccators, Erlenmeyer, measuring cups, beakers, dropper pipettes, measuring flasks, water baths, burettes, funnels, porcelain cups, spectrophotometers, thermometers, and stopwatches.

## Research Methods:-

The treatment in this research was the amount of mango juice added to make jelly candy fromsaffron extract, namely with treatments of 0%, 2%, 4%, 6% and 8%. The following are treatments for the different amounts of mango juice that will be used in this research, namely:

A = Addition of 0% mango juice
B = Addition of 2% mango juice
C = Addition of 4% mango juice
D = Addition of 6% mango juice
E = Addition of 8% mango juice

**Implementation of Research**

**Making Mango Juice (Inonuetal., 2021)**

First of all, the mangoes are washed, then the mango skin is peeled and a second wash is carried out, after that the size is reduced to make it easier to crush. After that, 100 g was weighed, then the mango was crushed using a blender with the addition of 300 mL water. After getting the mango pulp, filter it and get mango juice.

**MakingExtract Saffron**

Prepare 5 strands of saffron stigmas, then brew them with 500 ml of warm water at 40oC for 15-20 minutes. The saffron extract is said to be ready after the color of the brewing water changes to golden yellow.

**Making Jelly Candy (Nurhasanah, 2011 in Neswati, 2013 with modifications)**

Sucrose 38 g and HFS 55% 16 g dissolved with saffron extract 30 g, placed in a container and heated to a temperature of 60oC. Once dissolved, add 11 g beef gelatin and 5 ml water. Stir the ingredients slowly until they reach the desired consistency. After that, the stove heat is reduced, then add mango juice at a rate of 0%, 2%, 4%, 6%, 8% per total weight of raw materials. Stir until homogeneous. Remove the container and then put the solution in

a mold and cool at room temperature ± 1 hour then put it in the freezer ± 24 hours. Next, the jelly candy is removed from the mold and cut into pieces then coated with powdered sugar and cornstarch in a 1:1 ratio.

## Result and Discussion:-

### Raw Material Analysis

In making this jelly candy, the raw materials used are saffron(Crocus sativus) extract and mango (Mangifera indica) juice. The analysis carried out on each raw material is Vitamin C levels, pH value, and antioxidant activity. The analytical values for saffron extract and mango juice can be seen in Table 2.

**Table 2:-** Values of Vitamin C Levels, pH and Antioxidant Activity in Saffron Extracts.

| Parameter Analysis | Saffron Extracts ± SD | Mango Juice ± SD |
|---|---|---|
| Vitamin C(mg/100g) | 25.11±0.81 | 30.27±1.86 |
| pH | 6.07±006 | 4.33±0.06 |
| Antioxidant activity(%) | 51.67±372 | 58.43±3.24 |

Based on the raw material analysis in Table 2, it is known that the vitamin C content of mango juice is 30.37 mg/100 g. The results of this study are slightly lower than research by Santoso et al (2017), which stated that the vitamin C level in mango was 57.2 mg/100 g. This decrease in vitamin C levels is thought to be because fresh mangoes have been processed first into mango juice, and is thought to be due to differences in the type of mango fruit used. Meanwhile, the vitamin C content in saffron extract, the analysis results were found to be 25.11 mg/100 g

The results of the pH analysis of mango juice were 4.33. The results obtained were higher than research by Choiron and Yuwono (2018), the pH value of sweet arum mango as raw material for fruit juice was 3.50. This difference in pH value is thought to be due to the freshness of the mango fruit. The pH value is a value that provides information regarding the degree of acidity of a material. The pH value obtained for the saffron extract was 6.07.

Based on the results of the analysis of antioxidant activity in mango juice, a value of 58.43% was obtained. This result is different from that obtained in the research of Mulangsri et al (2017), namely 64.64%. According to Suwardike et al (2018), the antioxidant content in mangoes varies depending on the variety and part of the plant. In saffron extract, the antioxidant activity analysis value obtained was 51.67%.

### Physical Analysis of Jelly Candy

### Hardness Test

According to Mahardika et al (2014), hardness is an important criterion for various types of candy. In Table 3 the hardness values of jelly candy for each treatment are presented.

**Table 3:-** Hardness Value of Saffron Extract Jelly Candy plus Mango Juice.

| Treatment | Hardness Value (N/cm2) (Average ±SD) |
|---|---|
| E( Addition of 8 % mango juice) | 76.46±0.75 |
| D(Addition of 6 % mango juice) | 77.68±2.67 |
| C(Addition of 4% mango juice) | 78.38±0.82 |
| B(Addition of 2% mango juice) | 79.65±1.34 |
| A(Addition of 0% mango juice) | 80.02±4.92 |
| CV :3.34% | |

Based on Table 3, the hardness value of jelly candy for each treatment was obtained. The average hardness value obtained ranged from 80.02 – 76.46. The highest average value was in treatment A where jelly candy was added with 0% mango juice. The lowest average value was in treatment E where jelly candy was added with 8% mango juice.

The research results showed that the more mango juice added, the lower the hardness value of the jelly candy produced. This decrease in hardness value is thought to be because the addition of mango juice will increase the water content of the jelly candy produced, thereby affecting the texture of the jelly candy. This is in line with the opinion of Apriani (2019) who states that one of the hardness factors of a product is also influenced by water content. The more water content a product has, the softer the texture of the product.

Soekarto (1990) in Mahardika (2014) states that hardness is the property of a solid food object or product in terms of its resistance to breaking due to compressive forces that are not deforming. Changes in hardness to some extent can be an indicator of the suitability of the jelly candy. The hardness value of jelly candy is related to the chewy, soft or hard nature of the jelly candy product produced. According to Apriani (2019), the greater the hardness value indicates the harder the jelly candy and vice versa, if the hardness value is smaller it indicates the softer the jelly candy.

**Chemical Analysis of Jelly Candy**

**Water Content**

Based on Table 4, it can be seen that the variance results show that the addition of mango juice has a significant effect at the 5% level.

**Table 4:-** Moisture Content of Saffron Extract Jelly Candy plus Mango Juice.

| Treatment | Water Content Value (%) (Average±SD) | | | |
|---|---|---|---|---|
| A(Adding mango juice 0%) | 17.54±0.49 a | | | |
| B(Adding mango juice 2%) | 18.86±0.38 | b | | |
| C(Adding mango juice 4%) | 19.79±0.30 | | c | |
| D(Adding mango juice 6%) | 20.68±0.33 | | | d |
| E (Adding mango juice 8%) | 21.27±0.18 | | | d |
| CV: 1.80% | | | | |

Note: numbers on the same route followed by different lowercase letters are significantly different according to the DNMRT level of 5%.

The average value of water content obtained ranged from 17.54 to 21.27%. The highest water content value was in treatment E jelly candy (8% mango juice added) and the lowest water content value was treatment A jelly candy (0% mango juice added). Based on the water content values obtained, it is also known that the more mango juice added, the higher the water content of the jelly candy. This is thought to be due to the highwater content in mango juice. This is also in line with the opinion of Pracaya (2008) who states that mango fruit has a high water content, namely 86.10%. The water content obtained in this research is known to exceed the quality standard limit for jelly candy in SNI 3547.02-2008, namely a maximum of 20%. Based on the analysis results, it is known that the jelly candies treated A, B, and C meet SNI, where the water content value obtained is <20%. The jelly candies treated D and E do not meet SNI, where the water content value obtained is >20%.

Daud et al (2019) stated in their research that water content is a very important parameter in chemical tests in the food industry which is useful for determining the quality and resistance of food to damage that may occur. The higher the water content of a food item, the greater the possibility of damage both due to internal biological activity (metabolism) and the entry of pathogenic microorganisms (Daud et al, 2019).

**Ash Content**

The average value of ash content for jelly candy for each treatment is presented in Table 5.

**Table 5:-** Ash Content Of Saffron Extract Jelly Candy Plus Mango Juice.

| Treatment | Ash Content Value (%) (Average ±SD) | | | |
|---|---|---|---|---|
| A (Adding mango juice 0%) | 0.98±0.14 a | | | |
| B(Adding mango juice 2%) | 1.15±0.07 | ab | | |
| C(Adding mango juice 4%) | 1.40±0.15 | | bc | |
| DAdding mango juice 6%) | 1.62±0.27 | | | cd |
| E (Adding mango juice 8%) | 1.83±0.11 | | | d |
| CV: 18.42% | | | | |

Note: numbers on the same route followed by different lowercase letters are significantly different according to the DNMRT level of 5%.

Ash content is the mineral elements remaining after combustion until it is carbon free (Hamsah, 2013). This analysis aims to determine the ash content in jelly candy using the gravimetric method (dry ashing). The principle of this method is that the ash in food is determined by weighing the remaining minerals as a result of burning organic material at a temperature of around 550$^{o}$C (Yenrina, 2015).

Based on Table 8, it is found that the ash content value in jelly candy ranges from 0.98 – 1.83%. The results of variance analysis show that the percentage of added mango juice has a significant effect at the 5% level. The highest ash content was found in treatment E (addition of 8% mango juice) and the lowest ash content was found in treatment A (addition of 0% mango juice). These results show that the higher the addition of mango juice to jelly candy, the higher the ash content value. This increase is due to the ash content in mango juice. The ash content in mango fruit is 0.40% (Ramadhan et al., 2015). Determining the ash content is closely related to the mineral content contained in a food (Sudarmadji et al., 1997 in Ramadhan et al., 2015). Some of the mineral content in mangoes such as iron (Fe), copper (Cu), potassium (K), phosphorus (P), zinc (Zn), calcium (Ca), manganese (MnO), and selenium (Se). The mineral content is thought to influence the ash content of jelly candy.

**Vitamin C levels**

Vitamin C levels in jelly candy range from 37.08 – 50.68 mg/100g. The results of variance analysis show that the percentage of added mango juice has a significant effect at the 5% level on the vitamin C content of the jelly candy produced. The vitamin C content values for jelly candy for each treatment can be seen in Table 6.

**Table 6:-** Vitamin C Levels of Saffron Extract Jelly Candy plus Mango Juice.

| Treatment | Vitamin C Value (mg/100 g) (Average ±SD) |
|---|---|
| A(Adding mango juice 0%) | 37.07±0.40 a |
| B(Adding mango juice 2%) | 40.59±1.46 b |
| C(Adding mango juice 4%) | 43.64±0.70 c |
| D(Adding mango juice 6%) | 47.40±1.07 d |
| E (Adding mango juice 8%) | 50.68±1.21 e |
| CV: 2.38% | |

Note: numbers on the same route followed by different lowercase letters are significantly different according to the DNMRT level of 5%.

Based on Table 6, it can be seen that the highest levels of vitamin C were found in jelly candy treated E (addition of 8% mango juice), namely 50.68 mg/100 g. The lowest levels of vitamin C were found in jelly candy in treatment A (addition of 0% mango juice), namely 37.07 mg/100 g. The results of the analysis of vitamin C levels show that the higher the percentage

By adding mango juice, the higher the level of vitamin C in the jelly candy product produced. This increase in vitamin C levels is due to the high levels of vitamin C in mango juice, namely 30.27 mg/100 g, so it affects the vitamin C levels of jelly candy. These results are also in line with research (Nianti et al., 2018) which states that the more lemon peel powder you add, the more vitamin C content will increase.

High levels of vitamin C in raw materials are also susceptible to damage. Umu et al (2010) stated that the decrease in vitamin C levels could be reduced due to damage to fruit cells during peeling and chemical reactions occurring. To minimize excessive reduction in vitamin C, this can be done by reducing the heating temperature and not peeling the skin of the fruit for too long (Nianti et al., 2018).

**Total Sugar Content**

Based on the results of analysis of variance, it shows that the addition of mango juice in making jelly candy has a significant effect at the α=5% level on the total sugar content of the jelly candy produced. The total sugar content value of jelly candy for each treatment is presented in Table 7.

**Table 7:-** Total Sugar Content of Saffron Extract Jelly Candy plus Mango Juice.

| Treatment | Total Sugar Content Value (%) (Average ±SD) |
|---|---|
| AAdding mango juice 0%) | 50.93±0.92 a |
| B(Adding mango juice 2%) | 54.03±0.67 a b |
| C(Adding mango juice 4%) | 57.33±1.83 bc |
| D(Adding mango juice 6%) | 59.36±1.95 c |
| E (Adding mango juice 8%) | 61.43±5.09 c |
| CV : 4.63% | |

Note: numbers on the same route followed by different lowercase letters are significantly different according to the DNMRT level of 5%.

Based on Table 7, it can be seen that the average value of the total sugar content of jelly candy with the addition of mango juice is around 50.93– 61.43%. The highest average value was obtained in treatment E (addition of 8% mango juice) with a value of 61.43%. Meanwhile, the lowest average value was treatment A (addition of 0% mango juice) with a value of 50.93%. Research resultshowed that the higher the percentage of mango juice added, the higher the total sugar content of the jelly candy produced. This increase is due to the sugar content in mango juice. This is in line with the opinion of Pracaya (2005) which states that mangoes contain simple sugars, namely sucrose, glucose and fructose. This sugar provides a sweet taste and energy that the body can immediately use.Winarno (2004) in Purwaningtyas et al. (2017) stated that total sugar is a combination of non-reducing sugar and reducing sugar. According to the 1994 Indonesian National Standard (SNI) regarding quality requirements for jelly candy, the total sugar content is at least 20%. This shows that jelly candy with the addition of 0%, 2%, 4%, 6% and 8% mango juice meets the quality requirements for total sugar content set by SNI.

**pH value**

The degree of acidity (pH) is one of the parameters that determines the quality of jelly candy. The results of the analysis of the pH value of jelly candy can be seen in Table 8.

**Table 8:-** pH Value of Saffron Extract Jelly Candy plus Mango Juice.

| Treatment | pH Value (Average ±SD) | | | |
|---|---|---|---|---|
| E(Adding mango juice8%) | 4.60±0.10 a | | | |
| D(Adding mango juice6%) | 4.73±0.05 | a b | | |
| C(Adding mango juice 4%) | 4.90±0.17 | | bc | |
| B(Adding mango juice2%) | 5.13±0.21 | | | cd |
| A (Adding mango juice0%) | 5.56±0.05 | | | e |
| CV: 2.69 % | | | | |

Note: numbers on the same route followed by different lowercase letters are significantly different according to the DNMRT level of 5%.

Based on Table 8, it can be seen that the addition of mango juice has a significant effect at the α=5% level on the pH value of the jelly candy produced. The pH value of each treatment ranged from 4.60 – 5.56. The highest pH value was in treatment A (addition of 0% mango juice) with a value of 5.56. Meanwhile, the lowest pH value was in treatment E (addition of 8% mango juice) with a value of 4.60. The results of the pH value analysis show that the higher the percentage of added mango juice, the lower the pH value of the jelly candygenerated. This is due to the low pH value of the raw material for mango juice, namely 4.33. The research results showed that all treatments were classified as acidic conditions because the pH value was below 7 (neutral).

According to Less and Jackson (1983) in Maryani et al. (2010), that the optimal pH in making jelly candy is in the range between pH 4 –6. The pH value of the product (5.57 – 4.6) is in the range of the pH value of jelly candy according to Less and Jackson (1983) in Maryani et al. (2010). A pH value that is low enough can inhibit microbial growth during storage (Maryani et al., 2010).

**Antioxidant Activity**

Antioxidants are compounds that have a molecular structure that can provide electrons to free radical molecules and can break the chain reaction of free radicals (Kumalaningsih, 2006). The antioxidant activity values of jelly candy are presented in Table 9.

**Table 9:-** Antioxidant Activity of Saffron Extract Jelly Candy Plus Mango Juice .

| Treatment | Antioxidant Activity Value (%) (Average ±SD) | | | |
|---|---|---|---|---|
| A(Adding mango juice 0%) | 43.24±0.50a | | | |
| B(Adding mango juice 2%) | 45.92±0.71 | ab | | |
| C(Adding mango juice 4%) | 47.65±0.51 | | c | |
| D(Adding mango juice 6%) | 49.13±0.95 | | | d |
| E (Adding mango juice 8%) | 51.81±0.62 | | | e |

| CV: 1.42 % |
|---|

Note: numbers on the same route followed by different lowercase letters are significantly different according to the DNMRT level of 5%.

Based on the results of variance analysis, it shows that the addition of mango juice in making jelly candy has a significant effect at the α=5% level on the antioxidant activity of the jelly candy produced. The average antioxidant activity value of jelly candy ranged from 43.24 – 51.81% at a concentration of 1000 ppm. The highest average value was in treatment E (addition of 8% mango juice) with a value of 51.81%. Meanwhile, the lowest average value was in treatment A (addition of 0% mango juice) with a value of 43.24%.

Based on Table 9, it can be seen that the higher the percentage of mango juice added to the jelly candy, the higher the antioxidant activity value produced. This increase in antioxidant activity value is due to the antioxidant activity of mango juice which is quite high, namely 58.43%. The phenol content in mangoes is thought to also play an important role in the antioxidant content. This is in line with the opinion of Hardiana and Rudiyansyah, (2012), who stated that phenol group compounds play a role in antioxidant activity, the greater the content of phenol group compounds, the greater the antioxidant activity. According to Elzaawely and Tawata (2010) in Suwardike et al., (2018), there are 8 types of phenolic compounds found in mango fruit, namely benzoic acid, pyrogallol, p-hydroxy benzoic acid, vanillic acid, syringic acid, ferulic acid, ethyl gallate and gallic acid.

## Conclusion:-

Based on the research that has been carried out, it can be concluded that the addition of arumanis mango juice to the physicochemical characteristics of jelly candy has a significant effect on water content, ash content, total sugar content, vitamin C, pH value and antioxidant activity. The best treatment for jelly candy products based on physical and chemical analysis is treatment C with the addition of 4% mango juice. The test results obtained were hardness (78.38 N/cm2), water content (19.79%), ash content (1.40%), vitamin C levels (43.64 mg/100 g), total sugar content (57 .33 %), pH value (4.90)and antioxidant activity (47.65%).

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