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"Utilization of White Ginger (*Zingiber Officinalee Rosc*) as Natural Food Ingredients,"

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ABSTRACT

This study aims to explore the processing of candied ginger and observe the effect of adding citric acid and storage time to candied ginger produced. The treatment applied in the manufacture of candied ginger is the interaction of the addition of citric acid and storage time on the quality of candied ginger. Parameters observed for candied ginger produced include: Water content, reducing sugar content. Total acid, as well as organoleptic tests on the value of taste, color and texture value. The experimental design used was a completely randomized design (CRD). The results showed that the addition of citric acid greatly affected the water content, reducing sugar content and total acidity of candied ginger. In the treatment interaction, the more addition of citric acid and the longer the storage, the water content, total acid and texture increased, on the other hand the reduced sugar content, taste and color produced decreased. In organoleptic testing, the most preferred taste of candied ginger was the addition of 1% citric acid and a storage time of 0 days (3.60). The most preferred color was the addition of 1.5% citric acid and 0 days of storage (4.08) while the most preferred texture value was the addition of 2% citric acid and 6 days of storage with a panelist assessment score of 3, 88 (Like). As a conclusion that Ginger can be used as candied fruit with a concentration according to the concentration with the value of the level of preference according to the needs of each with the addition of citric acid according to the needs of the organoleptic values that are expected to be carried out.

Keywords : *Candied Ginger, Citric Acid, Storage Time.*

I. INTRODUCTION

Ginger, is a rhizome plant that is very popular as a spice and medicinal ingredient. The rhizome is in the form of fingers that bulge in the middle segments. The dominant spicy taste is caused by a ketone compound called zingeron. Ginger belongs to the Zingiberaceae family. Fresh ginger has a stronger taste when compared to powdered ginger, the content of gingerol which is good for health is also still widely found in the benefits of fresh ginger. To take advantage of fresh ginger, you can mix ginger with dishes such as processed seafood dishes, salad toppings, and mix your smoothies or juices, dr. Tania Safitri, 2020.

Ginger has a very large opportunity to be developed in Indonesia because it is supported by the climate, soil conditions and geographical location that are suitable for cultivating this plant, including environmental and land conditions in Sorogaten and Kaliberot hamlets. The prospect and potential for ginger production is quite high, for example, elephant ginger can reach 25 tons/hectare, even with intensive technology, the production can reach 60 tons/hectare (Galeriukm, 2009 in Astriani.dkk. 2013).

Ginger (*Zingiber Officinale Rosc*) is one of the agricultural commodities in the form of spice plants that have high social and economic value. Ginger products have become one of the export commodities, and are even included in the top nine spices traded in the world.

The forms of ginger products traded in the world market include fresh ginger, salted ginger, dried ginger, ginger oil, ginger powder, and ginger spread. Besides, ginger is needed as a raw material for the food and beverage industry as well as medicine (Rukmana Rahmat, 2001). Furthermore, Rukmana Rahmat (2001), said that within the country, the use of ginger is very varied, among others, used as medicinal plants, kitchen spices, or processed into various foods or drinks. The development of ginger processing technology is very important in the following efforts :

1. Diversification (diversification) of food.
2. Expansion of entrepreneurship and employment opportunities.
3. Increasing community income and welfare.

4. Agro-industry growth at household scale.
5. Achieving added value and improving environmental quality.

Ginger processing will provide a relatively high economic value and benefits according to what we want, besides that it can also diversify ginger production into various processed products from one form of food to another. Candied ginger is usually served as a snack. There are various types of ginger that can be found in the market but to get candied ginger with good results, it is better to make it from small white ginger because the fiber is soft.

Citric acid is a weak organic acid found in the leaves and fruits of plants of the genus Citrus. This compound is a good and natural preservative, besides being used as a sour taste enhancer in foods and soft drinks (Lies Suprati, 2006).

II. RESEARCH METHOD

2.1. Materials and Tools.

The materials used in this study were 3 kg of small white ginger, 6 kg of granulated sugar, 450 grams of citric acid and 6 liters of clean water while the materials for chemical analysis were H2SO4, 5% phenol solution, concentrated sulfuric acid, CaCO3, Pb acetate, Sodium Oxalate and 80% alcohol.

The tools used are a skewer, basin, bucket, knife, pan, plastic while the tools for analysis are spectrophotometer, pipette, water heater, refractometer, stove, analytical scale, cup, 600ml beaker, waring blender and whatman 2 filter paper.

2.2. Research Treatment.

This research was conducted in 2 (two) stages consisting of :

1. Concentration of citric acid (K).

K1 = 1% Citric Acid Concentration
K2 = 1.5% Citric Acid Concentration
K3 = 2% Citric Acid Concentration.

2. Storage time (L)

L1 = Storage Time 0 days
L2 = Storage Time 3 days
L3 = Storage Time 6 days.

2.3. Experimental Design.

The experimental design used in this study was a completely randomized design (CRD) with a factorial pattern. The mathematical model of the experimental design used is as follows (Gasperz, 1994):

$$Y_{ijk} = \mu + \alpha_i + \beta_j + (\alpha\beta)_{ij} + \epsilon_{ijk}$$

Where :

Y_{ijk} = Observation value in the k-th experimental unit that received the treatment combination ij (level I from factor K and level j from factor L).
μ = population mean (true average).
α_i = Effect of citric acid concentration treatment of K factor.
β_j = Effect of storage time treatment of L . factor
$(\alpha\beta)_{ij}$ = Effect of Interaction level - i factor K and level - j factor L.
ϵ_{ijk} = The random effect of the kth experimental unit that gets the treatment combination ij.

2.4. The Procedure for Making Candied Ginger.

The manufacture of candied ginger is carried out through the following stages of activity:

a. Choose Ginger Rhizome that is not too old.
b. Peel the skin of the ginger rhizome until clean.
c. Soak the ginger rhizome in cold water for 12 hours
d. Boil the ginger rhizome for 20 minutes until it becomes slightly soft, remove and drain.
e. The ginger rhizome is pierced with a fork or stick until soft.
f. Soak the ginger rhizome again in cold water for 12 hours, then drain.
g. Cook granulated sugar in water until it becomes a sugar solution, then remove and cool.
h. Enter the ginger rhizome into the sugar solution, and soak for 12 hours (one night).
i. Remove the ginger rhizome from the sugar solution, then drain.
j. Boil the sugar solution again until thick and pour it on the ginger rhizome in succession.
k. Finally do the cooling to get dried candied ginger.

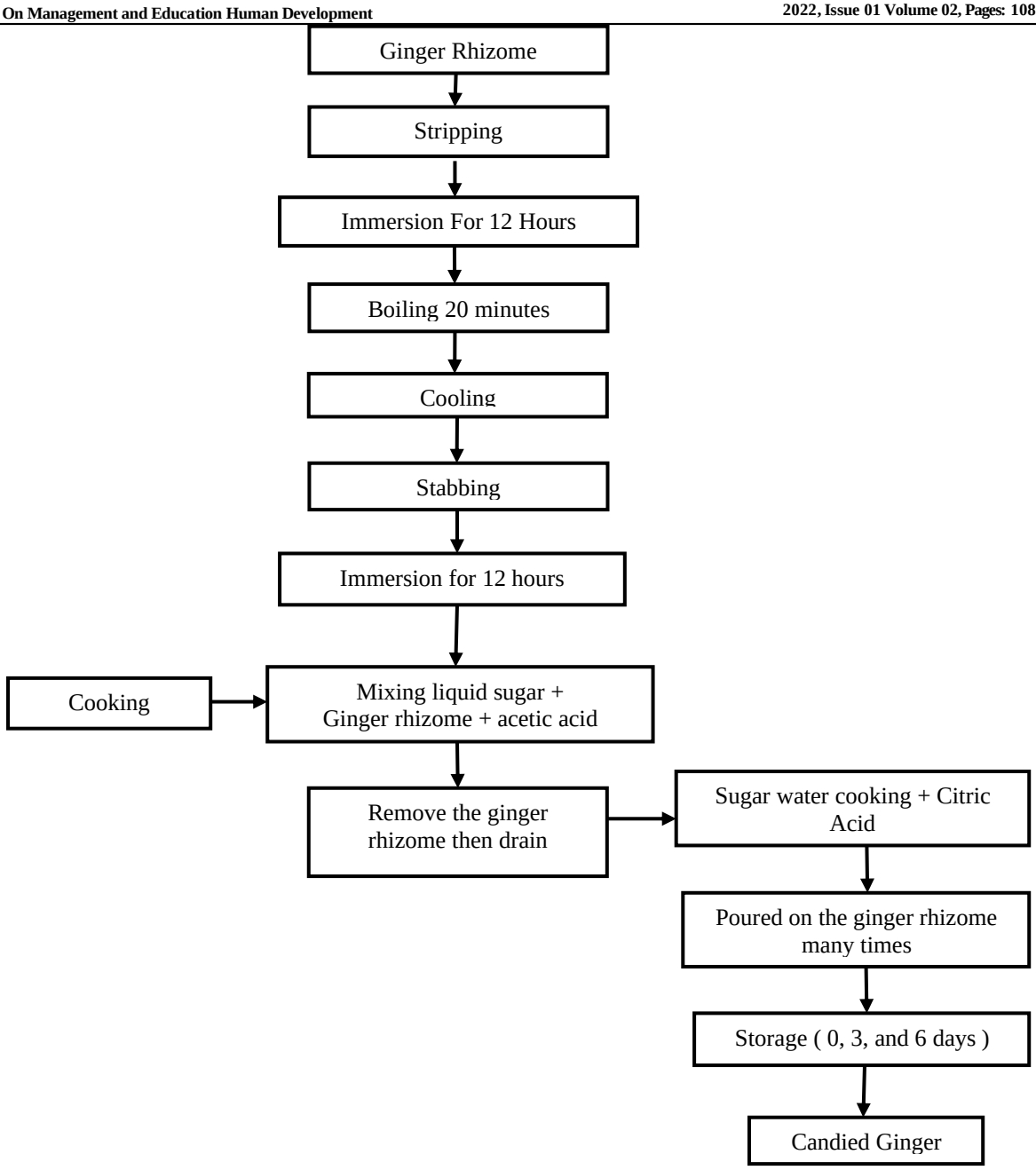

Figure 1. The Process of Making Candied Ginger

2.5. Observation

Observations made in this study were water content, reducing sugar content, total acid and organoleptic tests on the value of taste, color, and texture.

1. Water Content.

According to Sudarmadji, 1989. The water content can be determined by: the sample is weighed as much as 2 grams and then put into a porcelain dish whose weight is known and then dried in an oven at a temperature of 100 ^{o}C – 102 ^{o}C for 3-5 hours until a constant weight is obtained, after that the drying is stopped and the porcelain dish is removed from the oven and then put into a desiccator to be cooled and then weighed. The water content is calculated as a percent by the formula:

$$\text{Water Content} = \frac{A - B}{B} \text{ X } 100\ \%$$

Where :

A = Initial weight of the sample (gr)

B = Final Weight of the sample (gr)

2. Reducing Sugar Levels.

In the determination of total sugar (Sudharmadji., et al. 1984) the method used is the phenol method where the sample must be a clear liquid (filter if there is a precipitate). Initially, the sample in liquid form was made alkaline

with the addition of CaCO3 so that the acid contained in the sample did not hydrolyze the sugar present during heating which was needed to inactivate the sugar hydrolyzing enzymes.

To remove pigments, colored compounds and colloidal compounds, the sample is added with alkaline pb-acetate. Excess pb-acetate can be removed by adding sodium oxalate. If the sample is solid, it is necessary to carry out extraction using 80% alcohol to extract the sugar present in the sample. Most sugars are sensitive to high concentrations of alcohol. Therefore alcohol needs to be removed by low heating.

The sample is taken (20 – 30 grams), add 80% alcohol in a ratio of 1: 1 or 1: 2, Crush the sample using a waring blender until all the sugar is extracted and then transfer it, then all are crushed into a beaker quantitatively, filter the sample using a cotton swab, place the filtrate in a beaker, the remaining solids on the cotton are washed with 80% alcohol until all the sugar is dissolved in the filtrate (PH is measured if it is acidic), add CaCO3 until it is quite alkaline, heat it on a water heater at 100ºC for 30 minutes. Filter again with whatman filter paper no. 2 and then put into a 600 ml beaker after that it is transferred into a measuring cup using a dropper, adjust the volume of the solution to a certain volume with water, shake so that mixed evenly then the solution is ready to use where the total sugar is entered into the spectrophotometer and then read the absorbance. Determine the total sugar concentration in the sample, if needed, the solution can be diluted sufficiently if it will be used the next day, then this solution must be stored in the refrigerator for a certain time (not too long, because the sample will be damaged).

3. Total Acid.

Determination of total acid was carried out by titration, as much as 10 grams of the material was crushed in a waring blender, entered into a 250 ml volumetric flask and then diluted by adding distilled water to the mark, then filtered with filter paper. 25 ml of filtrate was titrated with 0.1 N NaOH solution which had been standardized with potassium hydrogen plate using 0.1% phenolphthalein indicator. The results obtained were calculated as ml of 0.1 N NaOH per 100 grams of material.

4. Organoleptic Test.

Organoleptic tests can be in the form of testing the taste, color, and texture based on the panelists' preference level using the Hedonic scale (Rampengan V, Pontoh.J, Sembel D.T., 2005). Materials were presented to 15 panelists at random by giving a certain code, then the panelists were asked to give an assessment of each example based on criteria from very dislike (score 1) to very like (score 5). The assessment of taste and color is also the same. Meanwhile, the texture assessment is based on the criteria from very hard (score 1) to very soft (score 5).

III. RESULTS AND DISCUSSION

3.1. Water Content.

The water content of candied ginger in all treatment combinations ranged from 28.78% - 34.91%. The lowest value of water content of candied ginger was seen in the administration of 1.0% citric acid and 0 days of storage time. While the highest value was seen in the treatment of 1.5% citric acid and 6 days of storage time.

The results of analysis of variance showed that the addition of citric asthma treatment and storage time treatment and the interaction of the two treatments had a very significant effect on the water content of candied ginger produced.

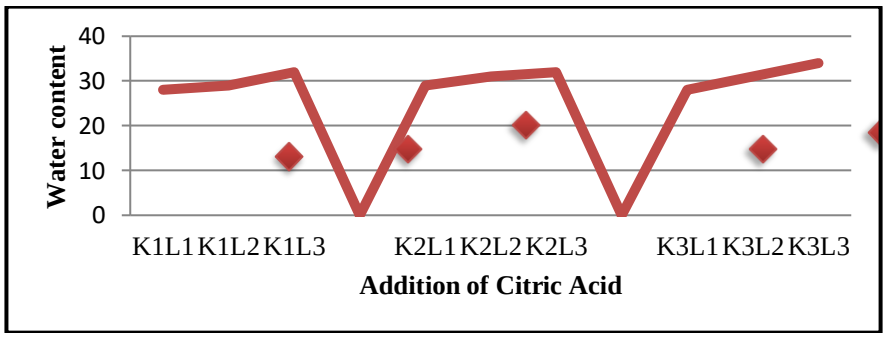

Figure 2. The interaction of the addition of citric acid and storage time on the water content of candied ginger

Figure 2. Shows that the more the concentration of citric acid and the longer the storage time, the water content of candied ginger increases. This is due to the long storage so that the fermentation process occurs, as stated by Winarno (2004) that foodstuffs that contain sugar and are stored for a long time will undergo a fermentation process which will result in an increase in the water content of these foodstuffs.

In addition, giving lime during immersion can cause calcium to react with the carboxyl group of fruit pectin, because calcium has a valence of two, so there will be a bond between the carboxyl so that there is an enlargement of the tissue. The larger the fruit tissue, the more water will evaporate when drying (Anonymous, 1992).

3.2. Reducing Sugar Levels.

In the manufacture of candied foodstuffs, especially ginger, the important properties are sweetness, solubility in water, color and texture. Therefore, the quality of sweets can be determined by the physical and chemical properties of foodstuffs (Aspandi Muchidin, 1984).

The value of the reducing sugar content of candied ginger on average ranged from 34.44% - 55.14%. The lowest average value of reducing sugar content of each candied ginger was seen in the treatment of 2.0% citric acid concentration and 6 days of storage. The results of the analysis showed that the concentration of citric acid and storage time and the interaction of the two treatments had a very significant effect on the reducing sugar content of candied ginger.

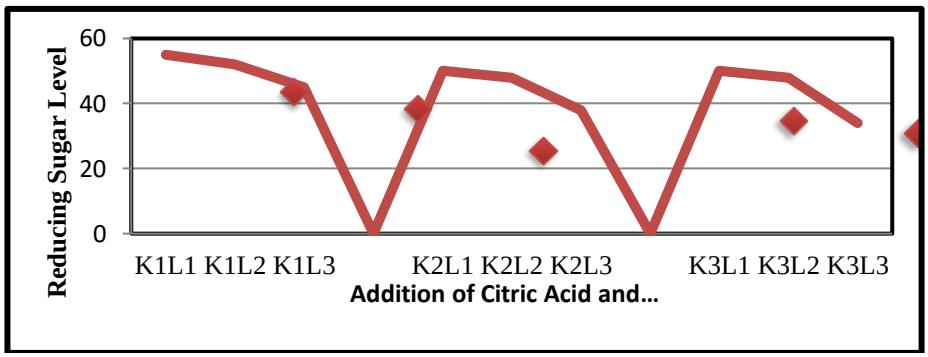

Figure 3. The interaction of the addition of citric acid and storage time on the reducing sugar content of candied ginger.

The results of the BNJ test showed that the concentration of 1% citric acid was very significantly different from the concentrations of 1.5% and 2% citric acid. The redfuction sugar content of candied ginger has a tendency to change when there is a decrease in the concentration of citric acid, where if the fruit has low acid or pectin levels, it requires a long boiling (Apandi, 1984).

Figure 3 shows a change in the reducing sugar content of candied ginger. Where the higher the concentration of citric acid given, the reducing sugar content decreases. This is presumably due to the hydrolysis process so that the fruit substrate that contains high acid will affect the balance of the existing sugar content and make the pectin stability so that the toughness of the fruit tissue decreases which is exchanged by the structure of the sugar content of candied (Desroiser, 1988).

3.3. Total Acid.

The lowest total acid content was found in the K1 L1 treatment (1% citric acid concentration and 0 days storage time) of 7.75% and the highest was found in the K3 L3 treatment (2% citric acid concentration and 6 days storage time) of 8.60%.

Analysis of the variance of the total candied ginger acid showed that the addition of citric acid and storage time and the interaction of the two treatments had a very significant effect on the total candied ginger acid.

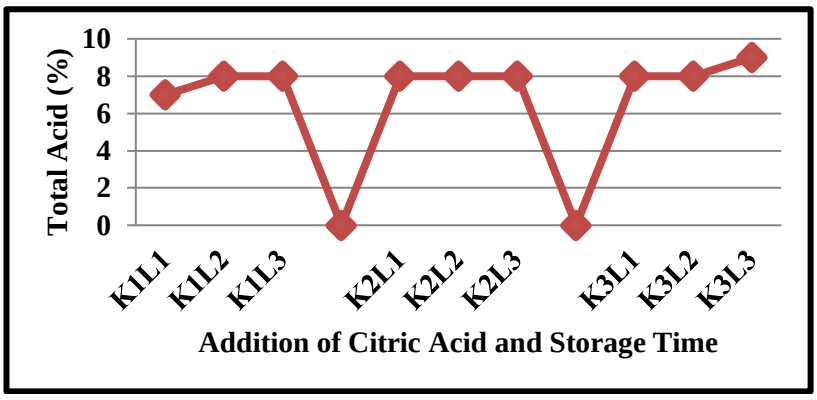

Figure 4. The interaction of the addition of citric acid and storage time on the total acid of candied ginger.

From the BNJ test, it can be seen that the higher the addition of citric acid and the longer the storage time, the increase in total acid is very significant.Figure 4 shows the highest value obtained in the treatment with the addition of 2% citric acid and 6 days of storage. while the lowest was obtained by the addition of 1% citric acid and 0 days of storage. According to Ponting., et al (1996), during the process of storing the product in the form of acid will increase the total acid content.

3.4. Organoleptic Test.

1.Taste

Taste is one of the factors that affect a person's acceptance of a food. The taste of food can be recognized and distinguished by taste buds located on the papillae, which are the orange-red spots on the tongue (Winarno, F.G., 1989). As for the addition of flavor to candied ginger, it is suspected that it is related to the concentration of citric acid with 50% sugar added to candied so that the addition causes a sweet taste in candied ginger.

The value of the panelists' response to the sweetness of each treatment was between 2.0 to 4.2, meaning that the panelists' preference level was between moderately like and very like. The panelists' response value was the highest or the preferred treatment for the taste value in the treatment with 0 days storage time and 1% citric acid concentration, where the sweetness was moderate and not too sweet when compared to concentrations of 1.5% and 2% citric acid.

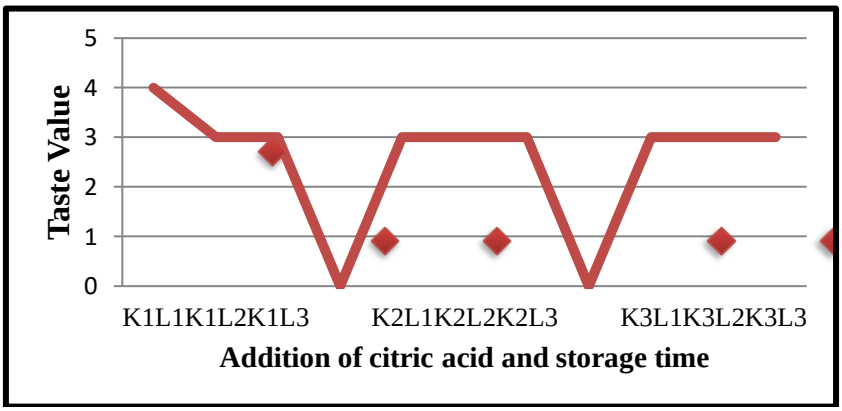

Figure 5. The interaction of the addition of citric acid and storage time on the taste value of candied ginger.

The analysis of variance showed that the treatment of citric acid concentration and storage time and the interaction of the two treatments had a very significant effect. This means that the addition of citric acid affects the taste value of candied ginger produced. Where citric acid can affect the taste. Besides that, it can also create acid which can reduce sweetness and improve the colloidal properties of foods containing pectin in addition to helping the extraction of pectin and pigments. The results of this study are supported by the opinion of Winarno F.G., et al (1980).

Furthermore, it is also suspected that the high concentration of citric acid given will cause the fruit to become sour so it will taste like oranges because citric acid is also present in high concentrations of fruit juice and allows it to live in cells that depend on carbon compounds for energy sources. In addition, there are some citrons from the sugar solution (Desroiser, 1988).

2. Color

Determination of the quality of food ingredients in general is very dependent on several factors including taste, color, texture and nutritional value of the material. But before that other factors need to be considered, spiritually the color factor appears first sometimes very decisive (Desroiser, 1988).

The color of a food ingredient is the main factor because it affects the appearance so that it can affect consumer acceptance of the resulting product. The variance shows that the treatment of citric acid concentration and storage time has a significant effect on the color of candied ginger.

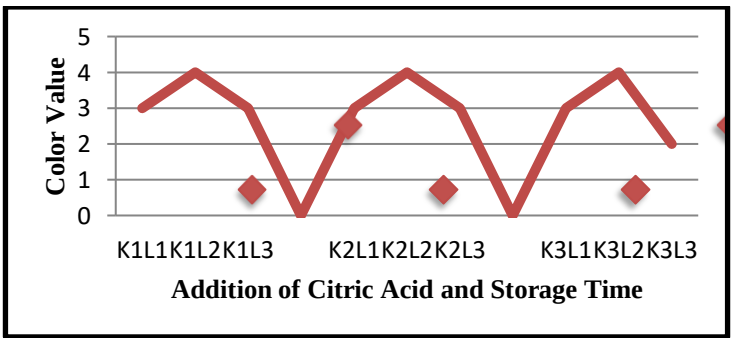

Figure 6. The interaction of the addition of citric acid and storage time on the color of candied ginger

The results of the analysis of the value of the panelists' response to the color value of candied ginger produced on average ranged from 2.12 to 4.08, this means that the panelists' level of preference for candied ginger is between rather like and like. The highest average value is in the treatment of 1.0% citric acid concentration with a storage time

of 3 days which is 4.08 (like), while the lowest value was in the treatment of 2% citric acid concentration and 6 days of storage, which was 2.12 (somewhat like). Seeing this difference means that the lower the concentration of citric acid, the more preferred the color of candied ginger, or vice versa, the higher the citric acid and the longer the storage, the less favorable the color of candied ginger.

3. Texture

Of all the treatments that were tested on the panelists, it turned out that the texture of candied ginger on the treatment of citric acid concentration and storage time had a significant effect on the texture of candied ginger. The results of the analysis ranged from 2.85 to 3.88, this means that the results of the analysis of the texture value of candied ginger show a bit hard to a bit soft.

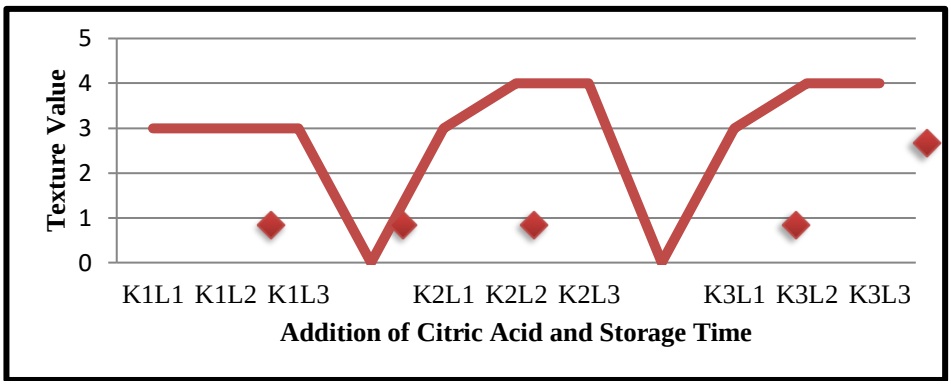

Figure 7. The interaction of the addition of citric acid and storage time on the texture of candied ginger.

The results of the variance showed that the treatment of citric acid concentration and storage time had a very significant effect on the texture of candied ginger, while the interaction of the two treatments did not have a very significant effect. This is because the concentration of citric acid is very important because it affects the appearance of candied ginger. Purnomo Hari (1995) stated that a group of physical properties caused by structural elements of food that can be felt by experiments related to the flow of food under pressure that is measured objectively is texture. Therefore, the treatment of food must be softened, if we want to maintain it optimally as a nutrient.

IV. CONCLUSION

The conclusions that can be drawn from this research are as follows:

1. Ginger fruit is a type of cooking spice plant whose rhizome can be made into candied ginger.
2. The addition of citric acid greatly affects the water content, reducing sugar content and total acid.
3. In the treatment interaction, the more addition of citric acid and the longer the storage, the water content, total acid and texture increased, on the other hand the reduced sugar content, taste and color produced decreased.
4. At the level of preference of the panelists to the taste value, which is the most preferred in the treatment of adding 1% citric acid and storage time of 0 days, the color value is most preferred in the treatment of adding 1.5% citric acid and storage time of 0 days and the texture value of candied ginger The most preferred treatment was the addition of 2% citric acid and 6 days of storage.

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