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Effect of Cooking Temperature on Quality of Jelly Candy Made from Guava Leaves (*Psidium guajava* L.)

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Abstract: Guava leaves contained bioactive component like flavonoid had not been used optimally, so it is important to process the guava leaves to be a new product. Stability of the flavanoid is influenced by temperature. This study was carried out to make jelly candy from guava leaves as the raw material, using variation of the cooking temperature at 50, 60 and 70°C. The result showed that the temperature of cooking had a statistically significant effect on the moisture content, total phenols and IC_{50} but had no significant effect on the ash content, Aw, reducing sugars, sucrose, total plate count and total mold/yeast. Based on sensory evaluation it can be concluded that the use of cooking temperature 60°C is the best product.

Key word: Cooking temperature, guava leaves, jelly candy

INTRODUCTION

Fruit is part of the guava plants commonly consumed. In addition to fruit, guava leaves also have used as herbal tea, capsule fillers or processed through the boiling process. Cuellar *et al.* (1984) cit Garcia (2003), reported that based on phytochemical analysis showed guava leaves contain tannins, phenols, triterpenes, saponins and essential oils. Yuliani *et al.* (2014) showed that guava leaves contain 11.04-12.66% tannin and 0.98-1.03% quercetin, it was depend on the type. According to Sudarsono *et al.* (2002), guava leaves contained flavonid, tannin (17,4%), fenolat (575.3 mg/g) and essential oils. Besides that guava leaves have a pharmacological effect as an anti-inflammatory, antidiarrheal, analgesic, antibacterial, antidiabetic, antihypertensive and platelet enhancer.

It had been reported that the mixing level of ethanol and water as extractor compound had no statistically significant effect on antioxidant activity of dried guava leaves (Rivai *et al.*, 2009). Tannins are one of the compounds that have antioxidant activity and are quite a lot in the guava leaves. Ferawaty (2014) showed drying temperature had effected on the level of tannin of "Mahkota dewa" (*Phaleria macrocarpa*), getting higher the temperature that were 25, 45, 65, 85 and 105°C, become lower the level of tannin that were 1.928, 1.722, 1.448, 1.104 and 0.830%, respectively.

If viewed of the phytochemical content and the benefits of the guava leaves, it would be better if the guava leaves more optimally utilized. Therefore we need an innovation to process guava leaves into another form that is more convenient and practical to consume as well as preferred by the consumer. One of them is to make jelly candy using guava leaves as raw material.

According to SNI (2008), jelly candy is a soft-texture candy that is processed by the addition of hydrocolloids like gelatin, gum, pectin, agar, starch, carrageenan and other, to modify the texture to produce a product that is chewy.

In the making of jelly candy, cooking temperature is a factor that determines the characteristics and chemical constituents of jelly candy. In this study we want to show the effect of cooking temperature on quality of jelly candy made from guava leaves.

MATERIALS AND METHODS

Material and equipment: The main ingredient in the making jelly candy was guava leaf extract. It was also needed materials for chemical analysis. The tools used consist of jelly candy making equipment and chemical analysis tools.

Guava leaves extract: Guava leaf extract made by boiling the leaves in water in the ratio 1:7 at a temperature 40°C for 4 h.

Making of candy jelly: We use trial and error method to get formula of Jelly. Jelly candy made from a mixture of guava leaf extract, sugar, gelatin and citric acid. The treatment used in this study is cooking at temperature 50, 60 and 70°C.

Observation: Data were collected consist of sensory evaluation, chemical and microbiological analysis.

Sensory evaluation: Parameters tested were the preference on color, flavor, taste and texture of jelly candy by using 20 panelists.

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Chemical analysis: The analysis performed included: (1) Determination of moisture content using a moisture analyzer KERN DLB, (2) Determination of aw is done by using a series Labmaster aw (Novasina), (3) Determination of the ash content by burning the sample in furnace (Buchi) at a temperature of 550°C, (4) Determination of reducing sugar using titrimetric method (ISO 3547.2-2008), (5) Determination of sucrose using titrimetric method (ISO 3547.2-2008), (6) Determination of the total polyphenols using polyphenol-folin ciocateu method (Modified Strycharz and Shetty, 2002) and (7) Determination of antioxidant activity using IC_{50} DPPH (2,2-diphenil-1-picrylhydrazyl) (Huang *et al.*, 2005).

Microbiological analysis: The analysis includes the total plate count and determination of the amount of mold/yeast. Determination of total plate count using PCA (Plate Count Agar) media, while the determination of the amount of mold/yeast using PDA (Potato Dextrose Agar) media. Both the analysis and the method of casting the total colony count with SPC (Standard Plate Count) (Fardiaz, 1993).

Design and statistical analysis: This study was designed using a complete randomized design with 3 treatment and 3 replications. Data were analyzed statistically using ANOVA and if significantly different, followed by Duncan's New Multiple Range Test at 5% significance level.

The model for the response is:

$$Y_i,j = \mu + T_i + \text{random error}$$

where

1: $Y_{i,j}$ being any observation for which X_1 = I (I and j denote the level of the factor (cooking temperature: 50, 60 and 70°C) and the replication (3 times) within the level of the factor, respectively)

2: μ (or mu) is the general location parameter

3: T_i is the effect of having treatment level I

RESULTS AND DISCUSSION

Sensory evaluation of jelly candy: The results showed that there was influence of cooking temperature (50, 60 and 70°C) on the jelly candy color, the higher the temperature, resulting darker of jelly candy color produced (Fig. 1).

From the result of sensory evaluation conducted on 20 people, the percentage of panelist who expressed like and really like on the color, flavor, taste and texture of the jelly candy can be seen in Fig. 2. From this figure it can be seen that using the cooking temperature 60°C produces jelly that was the most preferred by the panelists which was a percentage of panelists who expressed like and really like on color (90%), flavor (65%), taste (85%) and the texture (90%).

Chemical analysis: Table 1 show the moisture content, aw, ash content, reducing sugar, sucrose, total phenol and IC_{50} of jelly candy. Moisture content of jelly candy ranged from 14.12±0.13% to 15.15±0.12%. The highest moisture content contained in the jelly candy with cooking temperature of 50°C that is the A product and the lowest moisture content contained in the jelly candy with cooking temperature 70°C is the C product. The higher cooking temperature resulting the lower of moisture content of the product, it is caused by the higher of the cooking temperature the more water able evaporated.

Aw value of jelly candy range from 0.74±0.01% to 0.77±0.02%. There was not statistically significant difference among the treatments, but as viewed from its value showed there is a difference. The lowest value of Aw was B product and A product has the highest Aw value. It can occur because of differences in cooking temperature. According to Kusnandar (2010), the presence of water in the food can be expressed as moisture content and water activity. Moisture content shows the absolute amount of water contained in food as a component of food, however the water activity shows how water plays a role or activity value of jelly candy at the 5% significance level ($p = 0.165$).

Ash content of the jelly candy ranged from 0.17±0.09% to 0.24±0.03%. There was no statistically significant difference between the treatment of the ash content at 5% level ($p = 0.385$). Reducing sugar ranged from 1.67±0.12% to 1.90±0.11%. There was no statistically significant difference between the treatment on the reducing sugar of the jelly candy at 5% level ($p = 0.351$). The sucrose ranged from 25.25±0.36% to 25.49±0.41%. Cooking temperature had no statistically significant effect on sucrose at 5% level ($p = 0.725$).

The cooking temperature had statistically significant effect on the total phenol and antioxidant activity (IC_{50}) of jelly candy ($p<0.05$). The higher cooking temperature, resulting the higher total phenol and IC_{50} that were 32.02±2.08, 36.58±0.28 and 37.52±0.78%, respectively for total phenols and 1.06±0.18, 0.99±0.07 and 1.49±0.06%, respectively for IC_{50} (Table 1). The highest IC_{50} is 0.99±0.07% at 60°C cooking temperature equivalent to 9937 mg/mL. This value indicates a weak antioxidant activity, it was related with Pragdimurti *et al.* (2013). According to Pragdimurti *et al.* (2013), antioxidant activity is weak, if it has IC50 > 150mg/mL. Madrau *et al.* (2009) demonstrated that there was no statistically significant effect on antioxidant activity in *pelese* Apricot that were drying in different temperature (fresh, 55 and 75°C). One of the compounds has antioxidant activity in guava leaves is polyphenol. Pholyphenolic compound react with free radicals such as DPPH by donating a hydrogen atom to form a more radical phenoxyl relatively stable (Mokgope, 2006). The presence of the polyphenol content in guava candy comes from guava leaves containing tannins and flavonoids (Geidam *et al.*, 2007).

Table 1: Chemical analysis of jelly candy

Treatment (Cooking temperature)	Moisture content (%)	Aw	Ash content (%)	Reducing sugar (%)	Sucrose (%)	Total phenols (%)	IC_{50} (%)
A (50°C)	15.15 ± 0.12^b	0.77 ± 0.02^a	0.24 ± 0.03^a	1.67 ± 0.12^a	25.49 ± 0.41^a	32.02 ± 2.08^a	1.06 ± 0.18^a
B (60°C)	14.47 ± 0.36^a	0.74 ± 0.01^a	0.17 ± 0.09^a	1.86 ± 0.29^a	25.29 ± 0.37^a	36.58 ± 0.28^b	0.99 ± 0.07^a
C (70°C)	14.12 ± 0.13^a	0.74 ± 0.02^a	0.19 ± 0.02^a	1.90 ± 0.11^a	25.25 ± 0.36^a	37.52 ± 0.78^b	1.49 ± 0.06^b
P	0.004	0.165	0.385	0.351	0.725	0.004	0.004

Number was followed by the same superscript have not significantly different at α = 5%

Table 2: Microbiological analysis on the jelly candy

Treatment (Cooking temperature)	Total plate count colony/g	Total yeast colony/g
A (50°C)	$3.70 \times 10^3\pm0.50^a$	$5.0 \times 10^1\pm1.00^a$
B (60°C)	$3.67 \times 10^3\pm0.51^a$	$4.3 \times 10^1\pm2.31^a$
C (70°C)	$3.70 \times 10^3\pm0.56^a$	$4.7 \times 10^1\pm1.53^a$
P	0.996	0.893

Number was followed by the same superscript have not significantly different at α = 5%

Fig. 1: Jelly candy of guava leaves with 3 level of cooking temperature. (A = 50°C, B = 60°C and C = 70°C)

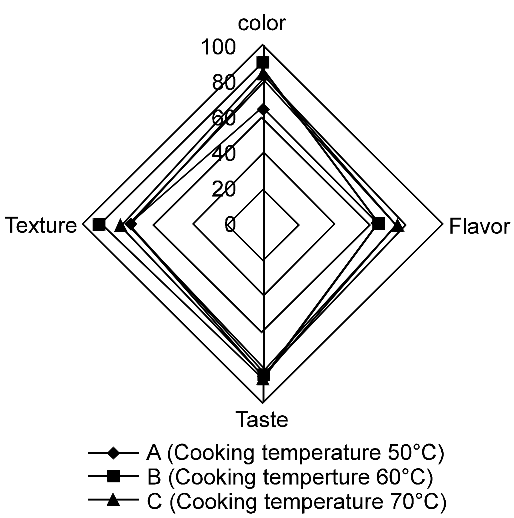

Fig. 2: Graph radar of sensory evaluation of jelly candy

Microbiological analysis in jelly candy: It had been analyzed total plate count and total yeast of jelly candy made from leaves (Table 2). Total plate count testing purposes is to determine how much of the total microbes present in the product. Total plate count of jelly candy guava leaves ranged from 3.67×10^3 colony/g to 3.7×10^3 colony/g.

The results of variance showed that the average value of total plate count on jelly candy with cooking temperature treatment was not significantly different at the 5% significance level (p>0.996). Water in food affect the growth of microbes, including microbial spoilage and pathogenic. Food with larger water content is generally easier to contaminated by microbes that are more at risk in terms of food safety (Kusnandar, 2010). These results indicate that the cooking at temperature of 50°C had higher moisture content than cooking at temperature of 60 and 70°C. But it seems that the water content has no relation with total plate count and mold. Colony total of yeast was count with SPC (Standard Plate Count), ranged from $4.3 \times 10^1\pm2.31$ colony/g to $5 \times 10^1\pm1.00$ colony/g. Table 2 show that there is no statistically significant effect of the cooking temperature on the total yeast (p = 0.893) at 5% significance level.

The value of total plate count and the yeast is too low. It assumes that was related with concentration of sugar (65%). Besides guava leaves extract have inhibitory activity on growth of *S. aureus*, *S. fecalis*, *E. coli*, *Salmonella typhi* and *Klebisella pneumonice* (Geidam, 2007).

Conclusion: Cooking temperature of jelly candy processing had significant effect on moisture content, total phenol and IC_{50} and had no significant effect on ash content, Aw, reducing sugar, sucrose, total plate count and total yeast. By using sensory evaluation, cooking temperature 60°C, was the best product.

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