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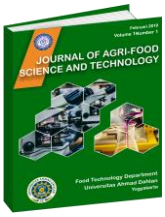

The Effect of Soaking Time and Size of Fruit Pieces on Pineapple Infused Tea Characteristic

Arvi Yashinta Andeswari, Nabila Hidayatuz Zahro, Reza Widyasaputra*, Mohammad Prasanto Bimantio, Adi Ruswanto

Department of Agricultural Product Technology, Faculty of Agricultural Technology, Institute of Agriculture Stiper, Indonesia

Corresponding Email: rezaws@instiperjogja.ac.id

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ABSTRACT

Fruit-infused tea become one of the exciting innovations in recent years. Fruit addition could improve the freshness and richness of tea drinks. Pineapple has good potency when used in the making of fruit-infused tea. The soaking time and size of fruit pieces were essential to determine because there is a solid-liquid extraction process in making pineapple-infused tea. This research aimed to assess the effect of soaking time and the size of fruit pieces on the characteristics of pineapple-infused tea. This research used Complete Block Design (CBD) with two factors: (A) soaking time and (B) size of fruit pieces. Factor A consisted of 3 levels: A1 = 3 hours; A2 = 6 hours; A3 = 9 hours. Factor B consisted of 3 levels: B1 = 0.5×0.5×0.5 cm; B2 = 1×1×1 cm; B3 = 1.5×1.5×1.5 cm. The treatment was replicated two times. The analysis was antioxidant activity, vitamin C, pH, total flavonoid, and tannin content. The result showed a significant difference in soaking time on tannin content, vitamin C, pH parameters, and the size of fruit pieces on pH parameters. The best result was obtained in 1×1×1 cm of fruit pieces and 3 hours soaking time with 13.20 ± 0.01% vitamin C, 17.28 ± 0.83% tannin content, 0.107 ± 0.018 % flavonoid content, 92.56 ± 1.99 % antioxidant activity and 4.95 ± 0.03 pH value. This research provides data about the difference between soaking time and the size of fruit pieces to the pineapple-infused tea characteristic.

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1. INTRODUCTION

Tea is one of the refreshing beverages that has long been known and promoted in Indonesia. Tea is a healthy and refreshing beverage with highly beneficial polyphenols, catechins, caffeine, and essential oils (Liu et al., 2023). Tea also contains vitamins C, A, and B (Koláčková et al., 2020; Ratnani & Malik, 2022). One of the types of tea that is becoming a trend in society, especially among young people, is green tea. Green tea is known to have a

high content of polyphenols, even higher than black tea, which is why green tea is believed to enhance the immune system and improve body organ functions (Pradhan & Dubey, 2021). Green tea drinks can also be combined with fruit infusions to become fruit-infused tea. However, there is a lack of study in fruit-infused tea, so it is interesting to study. Almost similar research on fruit-infused tea is research on fruit tea. Fruit tea is a drink processed by mixing tea brewing water with fruit juices and then put into a glass bottle as its packaging (Zieniewska, 2020).

One type of fruit that can be used as an ingredient for infused tea is pineapple. Pineapple is a trendy tropical and subtropical fruit known as a fruit with high vitamin C and polyphenols (George et al., 2016; Yeoh & Ali, 2017). One hundred grams of pineapple fruit, there are 52.0 kcal of energy, 13.7 grams of carbohydrates, 0.54 grams of protein, 150 mg of potassium, 130 IU of vitamin A, and 24 mg of vitamin C (Mohd et al., 2020; Putri, 2015). Pineapple also contains minerals and fibers that are good for the digestive system, maintaining ideal body weight and providing balanced nutrition (Hossain et al., 2015). The production of pineapple-infused tea can be used as a significant innovation to increase the antioxidant content of both ingredients. An analysis of the size of the fruit slices and the proper time of immersion of fruit should be done because, in the process of making pineapple-infused tea, there is a solid-liquid extraction process where there is contact between two phases, which causes the solution to diffuse from the solid phase to the liquid phase. Before the liquid-solid extraction occurs, it is necessary to undertake a preliminary treatment of the reduction of the solid size to be extracted, which will result in the rupture of the cell wall, and this can make the solution easier to extract (Sridhar et al., 2021). The main contribution of this study was to provide information about the effect of the difference in soaking time and size of pineapple fruit on the antioxidant, tannin, flavonoid, vitamin C, and pH characteristic of pineapple infused tea.

2. MATERIALS AND METHODS

2.1. Materials

The primary materials used in this study were honey pineapple fruit var. queen from Pemalang, Tong Tji brand green tea, and mineral water. The chemicals used were distilled water, amylum 1%, iodine standard 0.01 N, methanol, DPPH (1,1-diphenyl-2-picryl hydrazyl), folin-denis solution, saturated Na_2CO_3, tannin acid, quercetin, ethanol, $AlCl_3$ 5%, pH buffer. Tools used in this study were a tea strainer, knife, funnel, cutting board, ruler, glass teapot, erlenmeyer flask, measuring glass, pipette, beaker glass, and pH meter.

2.2. Research Methods

The research design used was a Completed Block Design (CBD) with 2 factors. The first factor (A) was the soaking time, and the second factor (B) was the size of the pineapple fruit pieces.

A1 = 3 hours B1 = (0.5×0.5×0.5) cm
A2 = 6 hours B2 = (1×1×1) cm
A3 = 9 hours B3 = (1.5×1.5×1.5) cm

From these two factors, 3×3 = 9 treatment combinations were obtained. Each treatment was repeated 2 times, which was then expressed as a block so that 3×3×2 = 18 experimental units were obtained. This research was conducted at the Faculty of Agricultural Technology Laboratory, Institute of Agriculture Stiper. This research was conducted for 2 months, from February to March 2023.

This research was performed in three stages. First, pineapple fruit and green tea solution are prepared. The pineapple fruit was peeled and cleaned. Then the pineapple was cut into cubes with varying sizes: B1: (0.5×0.5×0.5) cm, B2: (1×1×1) cm, B3: (1.5×1.5×1.5) cm. The green tea was brewed with 200 mL boiling water for 15 minutes. In the second stage, 100 grams

of pineapple pieces were added to the 200 mL green tea solution. Then the pineapple pieces were soaked at room temperature for A1: 3 hours, A2: 6 hours, A3: 9 hours. The infused tea was filtered from pineapple pieces using a tea filter. The third stage analyzed pH, antioxidant activity, tannin, flavonoid, and vitamin C content. The statistical analysis was conducted by Analysis of Variance (α = 5%) and continued with the Duncan Multiple Range Test (α = 5%) for the significant result.

3. RESULT AND DISCUSSION

Antioxidants are electron-giving compounds that work by donating an electron to oxidant compounds so that the activity of the oxidant compound can be inhibited (Mahmoudi et al., 2021; Zeb, 2021). Antioxidants stabilize free radicals by complementing free radicals' electron deficiency and inhibiting the free radical formation chain reaction. Primary data from the analysis of the antioxidant activity of pineapple-infused tea can be seen in Figure 1.

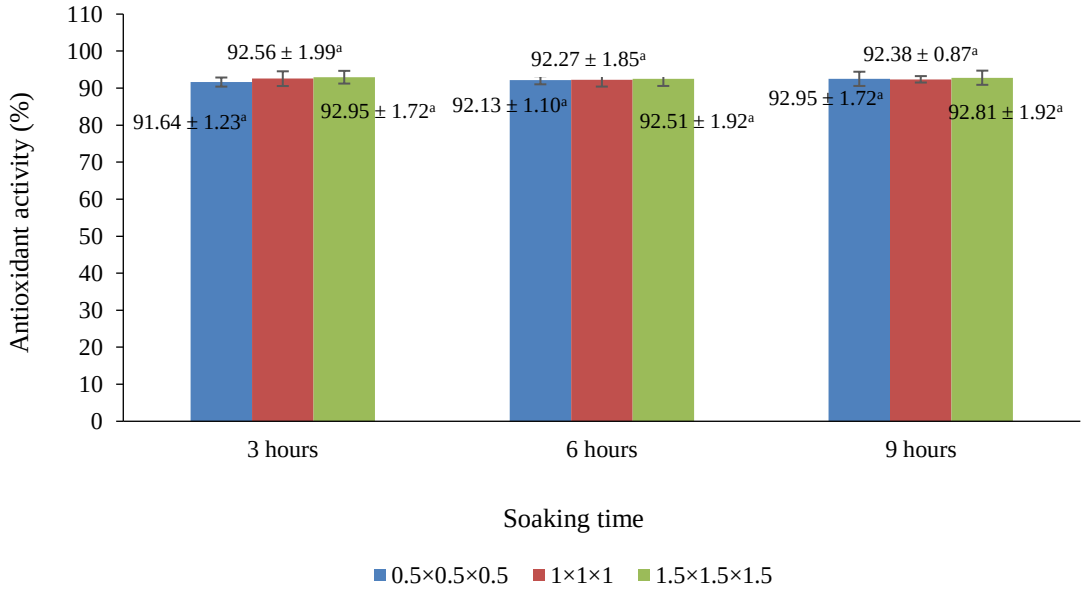

Figure 1. Antioxidant activity of pineapple infused tea.

Analysis of variance (ANOVA) showed that the size of fruit pieces and the length of soaking had no significant effect on antioxidant activity. The interaction between both factors also had no significant effect on antioxidant activity. This happened because the antioxidant content in tea dominates the antioxidant content in pineapple, so adding pineapple did not have a major effect in increasing the antioxidant content in green tea. The scavenging effect of DPPH free radicals increases with increasing concentration up to a certain concentration and then decreases with the addition of a large concentration (Siallagan et al., 2023). The fruit size did not significantly affect antioxidant activity because the size of the pineapple pieces was still too big. The smaller the size of the fruit pieces, the surface area of the substance will increase to accelerate its solubility. The smaller the size of the fruit pieces, the more pores are formed, and the more the amount of antioxidant content is absorbed (Rodríguez De Luna et al., 2020).

Tannins are active secondary metabolite compounds that are known to have several properties, including as astringents, anti-diarrhea, anti-bacterial, and antioxidants (Fitriani et al., 2021; Khodaie et al., 2023; Setyorini & Antarlina, 2022). Tannins are very complex organic substance components. Tannins consist of phenolic compounds, which are compounds that are difficult to separate and difficult to crystallize, precipitate proteins from their solutions, and are compounded with these proteins (Cano et al., 2020; Nascimento et al., 2021). Primary data

analysis of pineapple-infused tea tannin content can be seen in Figure 2.

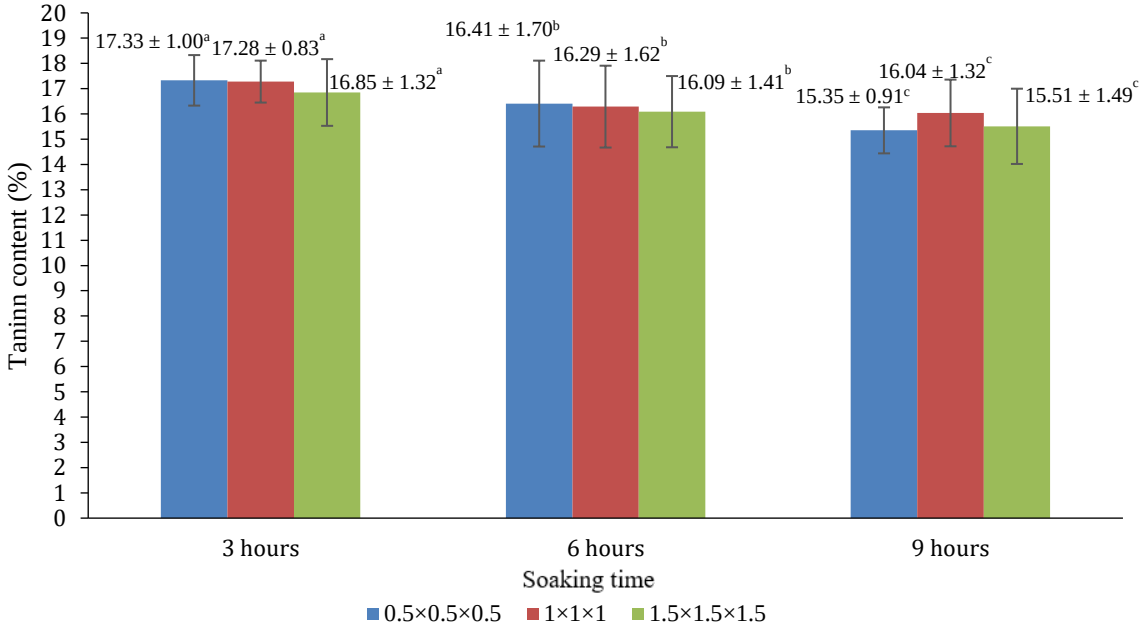

Figure 2. The tannin content of pineapple infused tea.

The soaking time factor gave significant results from the research obtained, as for the size factor of fruit pieces and the interaction between the two factors, which had no significant effect. The longer the soaking time, the lower the tannin content. The tannins contained in this drink came from adding green tea (Zhang et al., 2020), so when the pineapple soaking process occurred, the tea did not undergo an extraction process. The extraction process only occurs when the tea is brewed and separated from the pulp before adding the pineapple.

Flavonoids are colored pigments found in plants. Anthocyanins are constituents of blue, violet, and red colors, and flavonols as constituents of dim yellow, chalcones, and aurones are constituents of bright yellow (Faustina et al., 2022; Khoo et al., 2017). The primary data analysis of flavonoid levels of pineapple-infused tea can be seen in Figure 3.

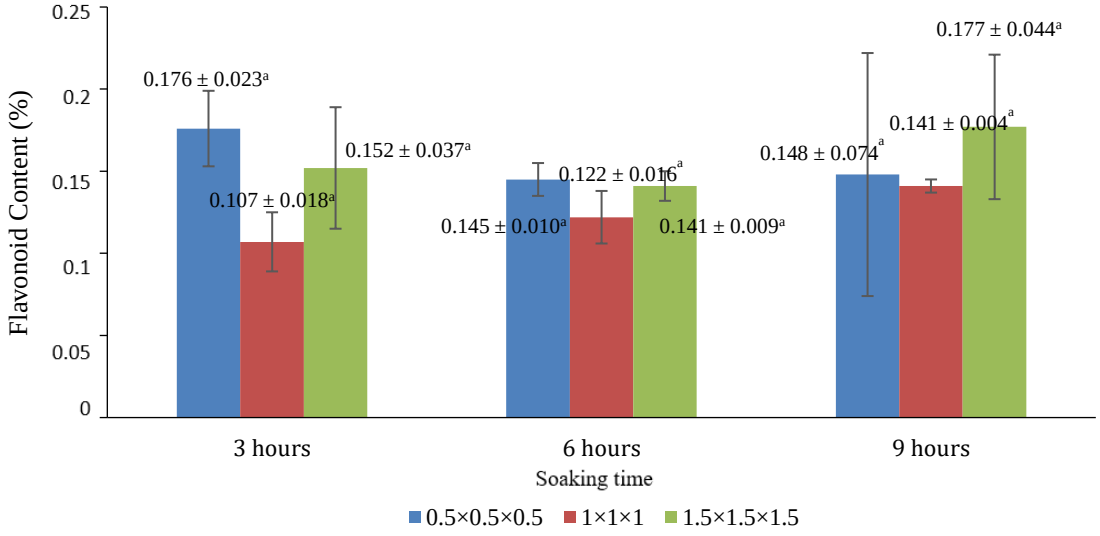

Figure 3. Flavanoid content of pineapple infused tea.

The results showed that the factor of soaking time and fruit size did not significantly affect the flavonoid content. The interaction of the two factors also showed results that had no significant effect on flavonoid levels. This result was related to the analysis of antioxidant activity because flavonoids have antioxidant abilities that can prevent free radicals (Arifin & Ibrahim, 2018; Sharma et al., 2016). The results obtained are in line with antioxidants, the occurrence of results that have no significant effect on the size of the fruit pieces and the length of soaking is the size of the pineapple fruit pieces that are too large, so that smaller pineapple fruit pieces are needed, because the smaller the particle size, the surface area of the substance will increase so that it can accelerate the solubility of a substance (Slámová et al., 2020).

Vitamin C is an important water-soluble antioxidant compound in human plasma and is known to influence the body's immune system, which can support various cell functions (Dosedˇ et al., 2021; Khadim & Al-Fartusie, 2021). Vitamin C neutralizes reactive oxidant compounds and can regenerate important antioxidant compounds in membranes and cells, such as glutathione and vitamin E (Berutu et al., 2019; Foyer et al., 2020). The primary data analysis of pineapple-infused tea vitamin C content can be seen in Figure 4.

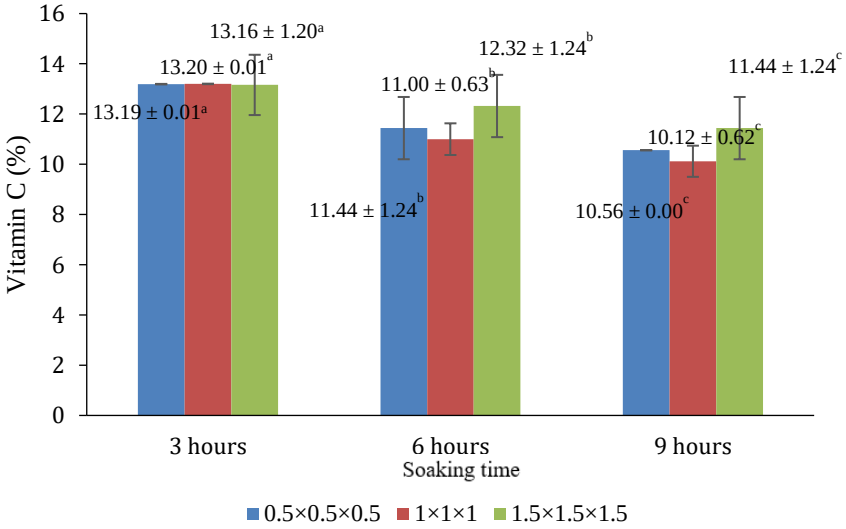

Figure 4. Vitamin C of pineapple infused tea.

The results obtained showed that the soaking time factor had a significant effect on the vitamin C content of the product. At the same time, the size of the fruit pieces and the interaction between the 2 factors had no significant effect on vitamin C levels. Soaking time had a significant effect on vitamin C content. Figure 4 shows that the longer the soaking, the lower the vitamin C content. The highest vitamin C content was found in the 3-hour soaking time. The decrease in vitamin C levels was thought to occur due to ascorbic acid degradation during soaking. The longer the soaking time, the level of degradation increased (Hailemariam & Wudineh, 2020; Renard et al., 2023).

The size of the fruit pieces did not give significant results because the size of the pineapple fruit pieces was too large, so it needed a smaller size of fruit pieces because the smaller size of the fruit pieces was able to increase the extracted vitamin C levels in pineapple infused tea. This happens because the smaller the pieces of material, the more it expands the surface of the material to increase the contact between small pieces of fruit with solvents and cause the solvent to break down the cell walls of the material easily.

The pH measurement analysis is carried out to determine changes in the acidity level of a product. Changes in the pH value of pineapple-infused tea can be seen in Figure 5. The fruit soaking time factor significantly affects the pH value analysis based on the results obtained. The fruit size factor and the interaction of the two factors significantly affect the pH

value. The results showed that the larger the size of the fruit pieces, the larger the size of the fruit pieces, the greater the pH value obtained. This indicates that the size of the surface area of the material affects the pH value of the product. As for the length of soaking, there was a significant decrease in pH in the variation of soaking time with a fruit piece size of 0.5 cm. While soaking with fruit sizes of 1 cm and 1.5 cm, there was an increase in pH at the 6-hour soaking time. Longer soaking time decreased the pH value (Ivakdalam & Rehena, 2020).

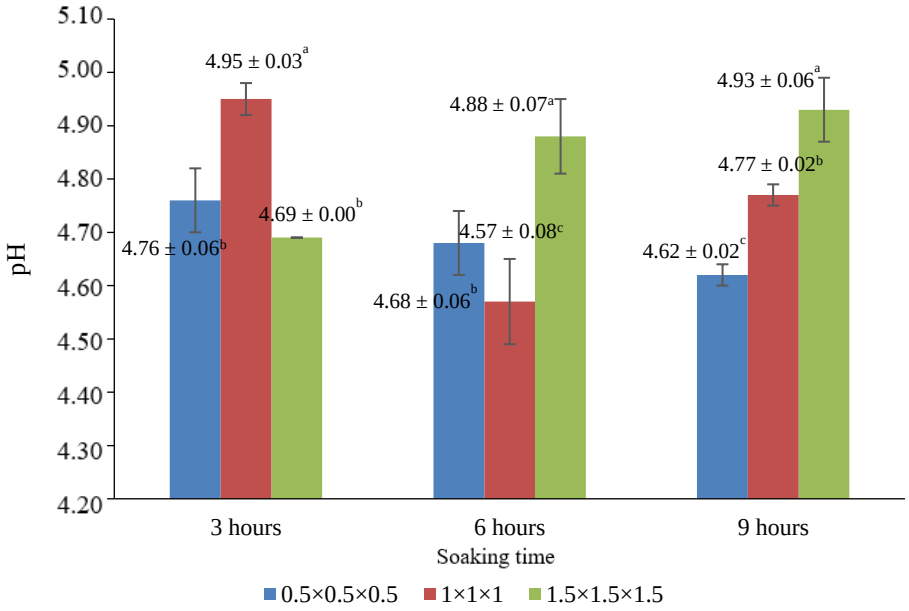

Figure 5. pH of pineapple infused tea.

4. CONCLUSIONS

The result of this research showed that there was a significant difference in soaking time on tannin content, vitamin C, and pH parameters. There was a significant difference in the size of fruit pieces regarding pH parameters. There was no significant difference between the two factors regarding antioxidant activity parameters. The best result was obtained in 1×1×1 cm of pineapple cutting size and 3 hours soaking time with 13.20 ± 0.01% vitamin C, 17.28 ± 0.83% tannin content, 0.107 ± 0.018% flavonoid content, 92.56 ± 1.99% antioxidant activity and 4.95 ± 0.03 pH value.

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