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Effects of Turmeric Addition on the Physicochemical Characteristics and Preference Levels of Lemon-Date Infused Water

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ABSTRACT

Infused water is a beverage prepared by soaking ingredients to allow flavor and nutrients to dissolve in water. Turmeric (*Curcuma domestica*), lemon (*Citrus limon*), and dates (*Phoenix dactylifera*) have advantages as antioxidants. This study aimed to examine the effect of soaking time and turmeric addition on the physicochemical characteristics, as well as preference levels of infused water made with lemon and dates. A 2-factorial Completely Randomized Design was employed, considering soaking durations of 4; 6; and 8 hours, and turmeric additions of 5; 10; and 15 g. The results showed that soaking time and turmeric addition significantly influenced the vitamin C content, antioxidant activity, turbidity, and color of the infused water. The best-infused water combination was obtained with an 8-hour soaking time and 5 g of turmeric addition, yielding a vitamin C content of 7.74 mg/100 g, an antioxidant activity of 8.22%RSA, pH of 3.76, and turbidity of 21.65 FTU.

Keywords: infused water; lemon; turmeric; antioxidant activity

ABSTRAK

Infused water adalah minuman yang dibuat dengan cara merendam bahan-bahan yang memungkinkan rasa dan nutrisinya larut dalam air. Kunyit (*Curcuma domestica*), lemon (*Citrus limon*), dan kurma (*Phoenix dactylifera*) memiliki keunggulan sebagai pangan sumber antioksidan. Penelitian ini bertujuan untuk mengetahui pengaruh lama perendaman dan penambahan kunyit terhadap karakteristik fisikokimia, serta tingkat kesukaan terhadap *infused water* yang dibuat dengan bahan lemon dan kurma. Penelitian ini menggunakan Rancangan Acak Lengkap 2 faktorial dengan lama perendaman 4; 6; dan 8 jam, serta penambahan kunyit 5; 10; dan 15 g. Hasil penelitian menunjukkan bahwa lama perendaman dan penambahan kunyit berpengaruh signifikan terhadap kandungan vitamin C, aktivitas antioksidan, tingkat kekeruhan, dan warna infused water. Kombinasi infused water terbaik diperoleh dengan lama perendaman 8 jam dan penambahan kunyit sebanyak 5 g, menghasilkan kandungan vitamin C sebesar 7,74 mg/100 g, aktivitas antioksidan 8,22% RSA, pH 3,76, dan kekeruhan 21,65 FTU.

Kata kunci: infused water; lemon; kunyit; aktivitas antioksidan

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INTRODUCTION

To ensure optimal health, one to two and a half liters of drinking water is needed by the body daily as an essential nutrient. Adequate consumption of good-quality mineral water is crucial for maintaining proper body function, aiding digestion, and regulating metabolism and body balance (Asmadi et al., 2011). In 2008, The Indonesian Hydration Regional Study (THIRST) reported that 46.1% of 1200 respondents living in six different regions in Indonesia experienced mild dehydration. Among the respondents, adolescents exhibited a higher prevalence of dehydration (49.5%) compared to adults (42.5%). This condition can be attributed to limited knowledge about the importance of water for the body. To increase the consumption of mineral water in less interested individuals, infused water with a distinctive taste and aroma can be used as an alternative liquid source (Harifah et al., 2017).

Infused water is a natural beverage consisting of mineral water combined with fresh fruit slices characterized by a sour flavor, without any added sweeteners or ice cubes, to maintain the acid-base balance of the body. This can be prepared using one or several types of fruits, vegetables, and spices. Moreover, it serves as a refreshing and healthy source of hydration, boosting immunity with the fresh and invigorating taste possessed (Sinaga, 2019).

Lemons are a fruit known to be rich in vitamin C and antioxidant content, providing several health benefits to the human body. They contain approximately 3.7% citric acid and 40-50 mg/100 g of vitamin C (Kristanto, 2013). When used as an ingredient in infused water, lemons contribute anticarcinogenic properties through limonoids, help balance pH levels, and aid in detoxifying the body (Sulianta, 2016).

In Islamic health practices, infused water has long been recognized. Prophet Muhammad used to drink date-soaked water called "nabeez" (Muzaifa et al., 2019). Dates possess various nutritional components, including 277 kcal energy, 74.97 g carbohydrates, 1.81 g protein, 149 IU vitamin A, 15 mcg folic acid, 696 mg potassium, 54 mg magnesium, 64 mg calcium, and 89 mg beta carotene (Anonim, 2018). Their addition to infused water provides natural sweetness and balances the bitter taste of lemon.

Turmeric is a plant commonly found in Indonesia, containing curcumin and essential oil. Furthermore, its rhizomes have an average curcumin content of 10.92% (Sundari, 2016). Curcuminoids, the primary antioxidant compounds in turmeric, impart a yellow color to the rhizomes (Pujimulyani, 2007) and offer beneficial properties such as anticholesterol, antitumor, anti-inflammatory, and anti-cancer effects (Winarti and Nurdjanah, 2005). In addition to turmeric, white saffron made into powder has antioxidant activity so it can be used as an antidiabetic (Pujimulyani et al., 2018), anticholesterol (Pujimulyani et al., 2020) and antiaging (Pujimulyani et al., 2019).

The study conducted by Putri (2017) on the effect of soaking time and the addition of dates on vitamin C levels in lemon-mint leaf-infused water showed a vitamin C content of 0.024 mg/ml, during 4 hours of soaking, which increased to 0.047 mg/ml between 6 and 12 hours. Additionally, Wahyuningsih et al. (2018) reported that soaking herbs for 12 hours yielded the highest antioxidant activity compared to 6 and 9 hours (Anindya, 2020).

Dates contain antioxidant compounds such as phenolics and flavonoids, which help protect the body's cells from damage caused by free radicals (Yasin et al., 2015). They also contain beneficial fiber for digestive health. The vitamin content in dates includes B-complex vitamins such as thiamine, riboflavin, niacin, and vitamin B6, which are essential for energy metabolism and nervous system function. Dates also contain various minerals, including potassium, which supports heart health and muscle function, and magnesium, which is crucial for bone health and energy metabolism. The iron content in dates also aids in red blood cell production (Younas et al., 2020).

Infused water with dates and lemon added with turmeric has been researched because all three ingredients contain antioxidants. By combining them, it is hoped to produce a refreshing-infused

water beverage that serves as a functional drink.

During the preparation of infused water, it is important to consider various factors affecting the extraction process, such as particle size, soaking time, and solvent temperature (Soebagio et al., 2014). Therefore, this study aims to examine the relationship between soaking time and turmeric addition in lemon and date-infused water, specifically focusing on the characteristics and preference levels of their resulting combination.

MATERIALS AND METHOD

Materials

The main ingredients applied in this study were mineral water, lemon, Sukari dates, and turmeric, respectively obtained from Indowarung Sedayu, Nanda Fruit Stall Sedayu, Alif Frozen Food Gamping, and Gamping Market. Furthermore, chemicals used for analysis included distilled water, 0.1 N iodine solution, 1% amylum indicator, ethanol, and *2,2-diphenyl-1- picrylhydrazyl* (DPPH).

The tools used comprised a knife, cutting board, glass jar, spoon, measuring cup, digital scale, aluminum foil, and showcase. Those employed for analysis purposes were Pyrex beaker glass, pH meter (HI 2210), 125 ml Erlenmeyer (Pyrex), volume pipette, drop pipette, Pyrex test tube, funnel, 10 ml burette with 0.05 ml accuracy, turbidimeter (HI 93703), vortex mixer (Type 37600), colorimeter, and UV-Vis spectrophotometer (Shimadzu UV mini 1240).

Methods

The preparation of infused water began by thoroughly washing the lemons and turmeric until clean. The lemons were longitudinally sliced into 0.7 cm pieces, weighing approximately 20 g. The dates were separated from the seeds and they weighed around 10 g. Turmeric was peeled, sliced into 0.5 cm thickness, and weighed 5, 10, and 15 g. The slices of these three materials were put into a glass jar, and 250 ml of mineral water was added. The jar was tightly sealed and placed in a showcase at a temperature of 10°C for soaking durations of 4, 6, and 8 hours.

Analysis of Physical Properties

The analysis of physical properties included turbidity tests performed using the Hanna Inst - HI 93703 turbidimeter and colorimetry.

a. Turbidity Analysis (Omar and MatJafri, 2009)

   Turbidity analysis is conducted using a turbidimeter. The general principle of the turbidimeter is that when light hits a particle, some of it is transmitted and some is reflected. Therefore, the transmitted light is used as the basis for measurement (Omar and MatJafri, 2009).

b. Color Analysis (Yuwono and Susanto, 1998)

   The sample is placed in a clear plastic container in a colorimeter. The color reader is turned on. The reading buttons are set to L*, a*, b*, then the target button is pressed. The reading results are recorded.

Analysis of Chemical Properties

The analysis of chemical properties encompassed the determination of vitamin C content, antioxidant activity, and acidity (pH) through iodimetry, DPPH, and AOAC methods, respectively.

a. Vitamin C Content (AOAC, 1995)

   The analysis of vitamin C content is conducted using the iodometric method. The procedure involves taking 5-25 ml of the sample with a pipette and transferring it into a 125 ml Erlenmeyer flask. Then, add 2 ml of 1% starch solution and 20 ml of distilled water. Subsequently, titrate with a 0.01 N standard iodine solution. 1 ml of 0.01 N iodine solution corresponds to 0.88 mg of ascorbic acid.

The formula to calculate the vitamin C content is as follows:

$$\% \text{ Vitamin C} = \frac{(Volume\ of\ iodine\ titration\ x\ 0.88\ x\ FP)}{(mg\ of\ sample)}\ x\ 100$$

b. Antioxidant activity (Xu and Chang, 2007)

The antioxidant activity analysis is conducted using the DPPH method. The procedure involves taking 1 ml of the sample and adding 3 ml of 0.1 mM DPPH solution. Vortex for 1 minute, then incubate at room temperature in the dark for 30 minutes. The absorbance is measured at λ 517 nm. A blank (control) is prepared using ethanol instead of the sample. The radical scavenging activity is expressed as a percentage (%) RSA = % Radical Scavenging Activity.

$$\% \text{ RSA} = 1 - \left(\frac{\text{Abs.sampel}}{\text{Abs.kontrol}}\right) \times 100\%$$

c. Acidity Analysis (AOAC, 1995)

pH measurement is conducted using a pH meter. The pH meter instrument is first standardized with buffer solutions for pH 4 and pH 7. Measurement is carried out by immersing the pH meter electrode into 50 ml of the sample.

Preference Levels

The preference levels of the infused water were examined using the hedonic scale test method with 25 semi-trained panelists. Values of the scale included 1 = very like, 2 = prefer, 3 = like, 4 = slightly dislike, 5 = dislike, and 6 = very dislike.

Experimental Design

A completely randomized design (CRD) was employed in this study, with two replications, considering the soaking time (4; 6; and 8 hours) and turmeric addition (5; 10; and 15 g) as the involved factors. The obtained data were subjected to Analysis of Variance (ANOVA) and the Duncan Multiple Range Test (DMRT) at a 95% confidence level.

RESULTS AND DISCUSSION

Turbidity Level

Table 1 shows the results of the turbidity level analysis of lemon and date-infused water with variations in both the soaking time and the amount of added turmeric.

Table 1. Turbidity level (FTU) of infused water

Soaking Time (hours)	Addition of Turmeric (g)		
	5	10	15
4	21.53±0.09[a]	33.44±0.02[cd]	34.90±0.07[e]
6	22.62±0.04[b]	33.12±0.15[c]	40.05±0.07[f]
8	21.65±0.47[a]	33.69±0.04[d]	40.72±0.21[g]

Note: Numbers followed by different notations in the same column indicate significant differences at the 5% significance level.

The ANOVA results indicated significant differences between the turbidity values of the infused water produced based on the variation in soaking time and turmeric addition. The lowest turbidity recorded was 21.53 FTU during 4 hours of soaking with 5 g of turmeric, while the highest value of 40.72 FTU was observed after 8 hours and 15 g addition. The increase in turbidity was attributed to the continuous soaking process, which led to the dissolution of various solids in the water. Rohmah and Anton (2008) explained that solids such as salts, minerals, cations, anions, and other solids substances could elevate water turbidity and limit light penetration into the water.

Color

Table 2 shows the physical analysis results of L*, a*, and b* values representing the color of the infused water.

L* (*Lightness*) values

The L* value indicates the brightness of the product generated. The ANOVA results revealed significant differences in the L* values (ranging from 34.14 to 35.75) of the infused water produced based on soaking time and turmeric addition. In acidic conditions, curcumin imparts a bright yellow color, while at neutral or alkaline pH, a brownish-yellow is developed (Andarwulan and Faradilla, 2012). Pujimulyani et al. (2010) reported that treatments involving citric acid soaking and steam blanching affected the color of lempuyang by inactivating polyphenol oxidase enzymes responsible for browning reactions, leading to the bright coloration of the infused water obtained.

Table 2. L*, a*, and b* values of the infused water

Soaking time (hours)	Addition of turmeric (g)	L*	a*	b*
4	5	34.78±0.19b	0.37±0.02^{ab}	3.18±0.12^{b}
	10	34.77±0.15^{b}	0.34±0.01^{ab}	3.61±0.04^{d}
	15	34.14±0.08^{a}	0.71±0.06^{cd}	3.39±0.05^{c}
6	5	35.65±0.16^{ef}	0.29±0.04^{a}	2.75±0.05^{a}
	10	35.75±0.05^{f}	0.36±0.09^{ab}	3.61±0.12^{d}
	15	34.98±0.17^{bc}	0.75±0.00^{d}	3.86±0.02^{e}
8	5	35.43±0.06^{de}	0.75±000^{d}	2.74±0.05^{a}
	10	35.33±0.14^{d}	0.62±0.01^{c}	3.84±0.08^{e}
	15	35.16±0.04^{cd}	0.80±0.02^{d}	4.05±0.02^{f}

Note: Numbers followed by different notations in the same column indicate significant differences at the 5% significance level.

a* (*Redness*) values

The a* value represents the degree of redness in the product. Positive a* values indicate the dominant red color of the ingredients, while negative is for the dominant green. The ANOVA results showed significant differences (P<0.05) in the a* values (ranging from 0.29 to 0.80) of the infused water produced based on soaking time and turmeric addition, thereby suggesting the effect of these parameters. The lowest a* value of 0.29 was obtained during 6 hours of soaking with 5 g of turmeric, while the highest at 0.80 was observed after 8 hours and 15 g addition. The color of the infused water is attributed to curcuminoids, which are responsible for the yellow-orange appearance of turmeric (Andarwulan and Faradilla, 2012). Prolonged soaking enhances the dissolution of curcumin in water due to being soluble in polar solvents.

b* (*Yellowness*) values

The b* value represents the degree of yellowness in a material. Positive b* values indicate a dominant yellow color, while negative is for dominant blue. Based on the test results, the b* value of infused water ranged from 2.74 to 4.05. The lowest b* value of 2.74 was observed during 8 hours of soaking with 5 g of turmeric, while the highest at 4.05 was recorded after 8 hours and 15 g addition. This suggested that the composition of added turmeric could intensify the yellowness level in the infused water. The yellow color is attributed to curcumin, a pigment in turmeric that belongs to the curcuminoid group. Curcuminoids are phenolic compounds comprising curcumin, demethoxycurcumin, and bisdemethoxycurcumin (Sari et al., 2013).

Vitamin C

Table 4 shows the analysis results of the vitamin C content of lemon and date-infused water with different soaking times and turmeric additions.

Table 3. Vitamin C levels (mg/100 g) in infused water

Soaking time (hours)	Addition of turmeric (g)		
	5	10	15
4	7.09±0.07^{a}	7.21±0.24^{a}	7.49±0.49^{ab}
6	7.09±0.07^{a}	7.30±0.22^{a}	8.14±0.07^{bcd}
8	7.74±0.49^{abc}	8.39±0.26^{cd}	8.51±0.04^{d}

Note: Numbers followed by different notations in the same column indicate significant differences at the 5% significance level.

The ANOVA results indicated significant effects (P<0.05) of soaking time and turmeric addition on the vitamin C content of the infused water produced. The highest recorded content was 8.51 mg/100 g during 8 hours of soaking with 15 g of turmeric, while the lowest at 7.09 mg/100 g was observed after 4 hours and 5 g addition. This showed that the levels of vitamin C released from the ingredients depended on an optimal duration. Vitamin C had water-soluble properties (Almatsier, 2005), and prolonged soaking enabled more contact between the material and the solvent, thereby yielding higher content (Kartika and Fithri, 2015). The levels discovered in this study could be attributed to the higher content found in lemons compared to dates and turmeric. Normally, lemons comprise 3.7% citric acid and approximately 40-50 mg/100 g of vitamin C (Kristanto, 2013), while dates have 0.7-0.9 mg/100 g which is relatively low (Parvin et al., 2015), and turmeric contains 0.660 mg/100 g (Sujana et al., 2020). Aulya (2020) further reported that lemon-infused water soaked

for 12 hours without the addition of red ginger slices exhibited the lowest vitamin C content of 8.65 mg/g, while 12 hours soaking and red ginger addition yielded the highest value at 22.69 mg/g.

Antioxidants

The results of the antioxidant activity analysis of lemon and date-infused water with different soaking durations and turmeric additions are presented in Table 4.

Table 4. Antioxidant activity (%RSA) of infused water

Soaking time (hours)	Addition of turmeric (g)		
	5	10	15
4	7.14±0.25^{a}	8.48±0.38^{bc}	9.15±0.18^{c}
6	7.27±0.56^{a}	9.19±0.12^{c}	10.08±0.37^{d}
8	8.22±0.49^{b}	10.08±0.12^{d}	11.51±0.12^{e}

Note: Numbers followed by different notations in the same column indicate significant differences at the 5% significance level.

The ANOVA results showed that the interaction between soaking time and turmeric addition had a significant effect ($P<0.05$) on the antioxidant activity of lemon and date-infused water. The lowest antioxidant activity of 7.14% RSA was recorded from 4 hours of soaking and 5 g turmeric addition, while the highest at 11.51 %RSA was obtained with 8 hours of soaking and 15 g turmeric. The soaking time influenced the antioxidant activity by allowing the extraction of antioxidant compounds from the ingredients into the water used. This was evidenced by the increased antioxidant activity observed with an 8-hour soaking time.

The addition of turmeric also influenced the antioxidant activity due to the presence of antioxidants, such as curcumin, in turmeric. Infused water flavored with white turmeric and citric acid exhibited significantly higher antioxidant activity compared to fresh white turmeric (Pujimulyani et al., 2010). Candied fruit made from white saffron, another name for turmeric, had an antioxidant content of 42.93% RSA (Pujimulyani and Wazyka, 2009). Curcumin has antioxidant properties and can inhibit stable free radicals (1,1-diphenyl-2-picryhydrazyl) (Purba and Martosupono, 2009). Lemon fruit comprises antioxidant compounds, including phenolics and flavonoids (Anagnostopoulou et al., 2006), while dates contain flavonoid polyphenol compounds with antioxidant properties (Hamad et al., 2015).

Other studies showed variations in antioxidant content among different infused waters. Ginger-infused water comprised an antioxidant content of 21.66%, higher than the infused water of pineapple (13.50%) and cucumber (17.16%). Lime-infused water exhibited increasing antioxidant activity (82.34%) up to 12 hours of soaking but decreased to 78.59% at 5 hours of soaking due to changes in phytochemical compounds. The antioxidant activity was closely related to the soluble phytochemical compound content, which initially increased but decreased after a 12-hour immersion period.

Degree of Acidity (pH)

The pH analysis results of lemon and date-infused water with different soaking times and turmeric additions are presented in Table 5.

Table 1. Degree of acidity (pH) of infused water

Soaking time (hours)	Addition of turmeric (g)		
	5	10	15
4	4.00±0.20^{b}	3.96±0.01^{b}	3.94±0.22^{b}
6	3.82±0.09^{ab}	3.81±0.06^{ab}	3.80±0.06^{ab}
8	3.76±0.18^{ab}	3.66±0.16^{ab}	3.57±0.10^{a}

Note: Numbers followed by different notations in the same column indicate significant differences at the 5% significance level.

A pH value below 7 indicated an acidic environment, while above 7 denoted alkaline (Dwiloka et al., 2021). The ANOVA results showed no significant effect ($P<0.05$) of soaking time and turmeric addition on the pH of the infused water, but the treatments caused a decrease in the pH. The highest recorded pH was 4.00 during 4 hours of soaking with 5 g of turmeric, while the lowest value of 3.57 was observed after 8 hours

and 15 g addition. These values were influenced by the high content of organic acids, such as ascorbic acid and citric acid, present in the infused water (Gonzalez-Molina et al., 2010). According to Wijayanti et al. (2016), the decrease in pH value could be attributed to the acidity of turmeric. Both turmeric and the acid added to the solution release H+ ions, leading to increased acidity and decreased pH

Analysis of Preference Levels

The analysis results of preference levels of lemon and date-infused water with variations in soaking time and turmeric addition are presented in Table 6.

Table 6. Preference levels of infused water

Soaking time (hours)	Addition of turmeric (g)	Parameters				
		Color	Taste	Scent	Turbidity	Overall
4	5	2.84±0.89^{a}	3.08±0.81^{abc}	3.04±0.84^{ab}	2.84±0.95^{a}	2.92±0.81^{ab}
	10	3.44±0.82^{bc}	2.96±1.02^{abc}	3.28±1.02^{bc}	3.40±0.70^{a}	3.32±0.90^{abc}
	15	3.56±0.87^{c}	2.64±0.95^{a}	2.68±0.90^{a}	3.08±0.90^{a}	2.84±0.80^{a}
6	5	2.92±0.95^{ab}	3.04±1.02^{abc}	3.24±0.87^{bc}	3.08±1.22^{a}	3.28±0.84^{abc}
	10	3.16±0.68^{abc}	3.28±0.89^{bc}	3.60±0.70^{c}	3.20±0.57^{a}	3.40±0.70^{bc}
	15	3.56±0.87^{c}	3.00±0.91^{abc}	3.24±0.83^{bc}	3.12±0.83^{a}	3.32±0.90^{abc}
8	5	3.00±1.00^{ab}	3.52±1.00^{c}	3.72±0.93^{c}	3.16±0.98^{a}	3.64±0.81^{c}
	10	3.20±0.76^{abc}	3.28±0.29^{bc}	3.24±0.83^{bc}	3.16±0.85^{a}	3.40±0.64^{bc}
	15	3.64±0.86^{c}	2.80±1.08^{ab}	3.20±0.86^{bc}	3.28±0.79^{a}	3.40±0.76^{bc}

Note: Numbers followed by different notations in the same column indicate significant differences at the 5% significance level.

Color

The ANOVA results showed that soaking time and turmeric addition had a significant effect on the color preference level of infused water. The overall color values ranged from 2.84 (dislike) to 3.64 (somewhat like). The greatest value was observed in infused water with 8 hours of soaking and the addition of 15 g turmeric, indicating a preference for a more intense yellow color achieved by using a higher turmeric composition. The yellow color in turmeric was produced from a compound called curcumin (Jaruga et al., 1998 and Pan et al., 1999).

Taste

No significant difference was found in the level of flavor preference for infused water. The flavor parameter values ranged from 2.64 to 3.52. Panelists tended to prefer infused water with lower turmeric composition, as the flavor was less pronounced. This observation was due to the effect of turmeric addition, with the curcumin component contributing to a bitter taste and stronger flavor. Turmeric rhizome had a distinctive aromatic odor, slightly bitter taste, and mild spiciness, which could become stronger over time (Directorate General of POM, 2000). Additionally, the bitter taste and distinctive aroma were attributed to its curcumin content. (Winarto, 2004).

Aroma

A significant difference was detected in the favorability level of the infused water aroma. The total aroma values ranged from 2.68 (somewhat like) to 3.72 (like). Turmeric contains natural phenolic compounds including curcuminoids and sesquiterpenoids, as well as essential oils. Furthermore, its distinctive aroma was attributed to the turmerone, aturmerone, and zingiberene present in sesquiterpenoids (Kumar et al., 2017).

Turbidity

The variations in soaking time and turmeric addition were found to not significantly affect ($P<0.05$) the level of preference for infused water

turbidity. The total turbidity values ranged from 2.84 (dislike) to 3.40 (somewhat like). Panelists tended to prefer infused water with low turbidity levels achieved within 4 hours of soaking. Turbidity in infused water was caused by suspended or colloidal particles, and soaking could affect the chemical properties of the water due to the nutritional content of the soaked fruits (Romain, 2014).

Overall

The overall preference testing of lemon and date-infused water aimed to assess the responses of panelists to the product (Machmud et al, 2012). Based on Table 8, the infused water produced during 4 hours of soaking and 15 g turmeric addition was the least preferred, with a score of 2.84 (meaning rather like). Meanwhile, the most preferred, rated 3.64 (like), was obtained after 8 hours and 5 g addition. The addition of turmeric had an impact on the preference of panelists concerning taste, aroma, color, and turbidity. A less pronounced turmeric taste was generally preferred, as the flavor was determined by the curcumin content present. The aroma perceived was influenced by sesquiterpenoid compounds, which produced the distinctive turmeric aroma (Kumar et al., 2017). A fresh and distinctive aroma observed could be attributed to the Limone found in lemons. Moreover, clear or slightly cloudy infused water was preferred, with a bright yellow color achieved through curcumin and beta-carotene compounds in lemon fruit.

CONCLUSION

In conclusion, the study revealed that variations in soaking time and the addition of turmeric in lemon and date-infused water significantly influenced the vitamin C content, antioxidant activity, turbidity, and color, but did not affect acidity (pH). The manufacturing process, which involved different soaking durations and amounts of turmeric, impacted preference levels for aroma, color, and overall parameters, except for taste and turbidity. The most preferred infused water was produced with an 8-hour soaking time and 5 grams of turmeric added, showing a vitamin C content of 7.74 mg/100 g, antioxidant activity of 8.57% RSA, pH of 3.76, and turbidity of 21.65 FTU. This method is recommended for industrial manufacturing processes.

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