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QUALITY CHARACTERISTICS OF HERBAL TEA WITH DIFFERENT RATIOS OF PANDAN (*Pandanus amaryllifolius*) and STEVIA (*Stevia rebaudiana*) LEAVES

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ABSTRACT

The primary objective of this study was to evaluate the effect of varying ratios of pandan leaves (*Pandanus amaryllifolius*) and stevia leaves (*Stevia rebaudiana*) on the chemical and sensory characteristics of herbal tea, identifying the optimal formulation relative to SNI 3945:2016 standards. Unlike traditional tea derived from *Camellia sinensis*, herbal infusions utilize diverse plant materials valued for their therapeutic properties. Pandan leaves, in particular, contain essential bioactive compounds—including polyphenols, alkaloids, saponins, tannins, and flavonoids—that provide significant antimicrobial and antioxidant benefits. The experiment was conducted using a completely randomized design with four treatments and four replications. The treatments consisted of different ratios of pandan to stevia leaves: 60:40 (PS1), 65:35 (PS2), 70:30 (PS3), and 75:25 (PS4). The observed parameters included moisture content, ash content, antioxidant activity, total polyphenols, and sensory evaluation (color, aroma, taste, and overall acceptance). Data were analyzed using analysis of variance (ANOVA) followed by Duncan's multiple range test (DMRT) at a 5% significance level. The results showed that the ratio of pandan and stevia leaves significantly affected moisture content, ash content, antioxidant activity, total polyphenols, and sensory attributes. The best treatment was PS1 (60:40), which exhibited 6.35% moisture content, 7.08% ash content, antioxidant activity of 21.75 ppm, and total polyphenols of 84.34 mg GAE/g. Sensory evaluation indicated that the product had a characteristic pandan aroma, slightly bitter taste, and slightly greenish color, with acceptable overall preference by panelists.

Keywords: herbal tea, pandan leaves, quality characteristics, stevia leaves

INTRODUCTION

Tea is commonly produced from young leaves of *Camellia sinensis* and processed into various types such as black, green, and oolong tea. Due to advancements in beverage processing, herbal teas have gained increasing attention as alternative beverages with potential health benefits. Herbal teas are defined as beverages prepared from plant materials other than Camellia sinensis, including stems, roots, flowers, leaves, seeds, and peels of fruits and vegetables. These beverages are widely consumed due to their ease of preparation, rapid solubility in hot water, and naturally caffeine-free properties (Wong et al, 2022). Pandan leaves (*Pandanus amaryllifolius*) are one of the plant materials commonly used in herbal tea production. This plant is widely available in Indonesia and is known to contain various bioactive compounds beneficial to health. In addition, pandan leaves are traditionally used as flavoring and coloring agents in food products. They contain several bioactive compounds, including natural pigments, tannins, saponins, polyphenols, and alkaloids (Faras et al., 2014).

According to the study by Pamungkas et al. (2017), the DPPH assay was used to investigate the antioxidant activity of a 96% ethanol extract of pandan leaves, and the results showed an IC_{50} value of 39.7

ppm. Pandan leaf herbal tea has poor sensory qualities, such as a bitter taste. According to a study by Angraiyati & Hamzah (2017), fragrant pandan leaf herbal tea has a bitter taste when brewed and is not favored by panelists; therefore, additional ingredients are needed to enrich the tea with beneficial chemical compounds and improve its taste. Stevia leaves are a nutrient-dense natural additive to pandan leaf herbal tea that can enhance its flavor.

Stevia leaf sugar is less than one-third as sweet as sucrose. The glycosides stevioside and rebaudioside A are responsible for its high sweetness content (Buchori, 2007). According to research Elviana et al. (2024), the most effective formulation, with a polyphenol concentration of 30.00 mg GAE/g and an average antioxidant activity of 35.77%, is a blend of 70% *kecombrang* flower tea bags, 30% stevia leaves, and 0.5% cinnamon. The panel tasters preferred this brownish-colored tea due to its cinnamon-like aroma (not too strong) and sweet taste. Based on this description, a study titled "Quality Characteristics of Herbal Tea with Variations in the Ratio of Fragrant Pandan Leaves (*Pandanus amarylliofolius*) and Stevia Leaves" was conducted. The purpose of this study was to analyze the effect of the ratio of *pandan wangi* leaves and stevia leaves on the chemical and sensory quality characteristics of herbal tea and to determine the best treatment combination that meets the quality standards in accordance with SNI 3945 of 2016 regarding green tea.

METHODS

Materials

The main material used in this study was dark green pandan leaves, approximately 30 cm in length, selected from the third and fourth nodes from the base of the plant, obtained from the Jalan Manyar Sakti area in Pekanbaru. Additionally, stevia leaf powder was used, obtained through an e-commerce platform at the Beorganik Official Shop. Mineral water was used to prepare the tea. The following substances were used in the analysis: distilled water, 70% ethanol, 7.5% sodium carbonate, Folin-Ciocalteu reagent, gallic acid, 1,1-diphenyl-2-picrylhydrazine solution, and 95% alcohol.

The equipment used in this study consists of the following items: beakers, Erlenmeyer flasks, 100-ml volumetric flasks, desiccators, a furnace, porcelain dishes, forceps, measuring cups, an analytical balance, a UV-Vis spectrophotometer (Shimadzu), and various types of pipettes and micropipettes. Other tools used include a digital scale, a stove, a pot, a baking pan, a blender, a knife, a tray, a spoon, a 60-mesh sieve, gloves, jars, plastic cups, a basin, glasses, tea strainers, stopwatches, aluminum foil, labeling paper, sensory evaluation forms, a testing booth, office supplies, and photography equipment for documentation.

Research Methodology

The experimental design used in this study was a completely randomized design (CRD), with a total of sixteen experimental units, including four treatments and four replicates. Elviana et al. (2024) were cited as a reference in this study, whose concentrations were modified, with the following variations in the ratio of pandan leaves to stevia leaves:

PS1 = Fragrant pandan leaves 60% (w/w) and stevia leaves 40% (w/w)
PS2 = Fragrant pandan leaves 65% (w/w) and stevia leaves 35% (w/w)
PS3 = Fragrant pandan leaves 70% (w/w) and stevia leaves 30% (w/w)
PS4 = Fragrant pandan leaves 75% (w/w) and stevia leaves 25% (w/w)

Sensory evaluation, including color, aroma, taste, and overall assessment, were among the criteria examined in this study, along with antioxidant activity, polyphenol concentration, ash content, and moisture content.

Research Implementation

Production of pandan leaf powder

The preparation of fragrant pandan leaf powder was based on a modified version of the method described by Angraiyati & Hamzah (2017). The selected fragrant pandan leaves must be approximately 30 cm long, dark green in color, and harvested from the third and fourth nodes from the base of the plant. After rinsing under running water, the fragrant pandan leaves were left to dry for ten minutes. The pandan leaves are then cut into pieces approximately 0.1 cm in size using a knife. The sliced pandan leaves are placed randomly on a tray. The leaves are left to wilt for 18 hours at room temperature (±27°C). Drying in an oven for 150 minutes at 50°C produces dried pandan leaves. After drying, the pandan leaves are blended and then passed through a 60-mesh sieve to extract the pandan juice.

Preparation of pandan leaf and stevia leaf herbal tea

The preparation of aromatic pandan leaf and stevia leaf herbal tea refers to the modified method described in by Sadimantara et al. (2018). Take 2 g each of aromatic pandan leaf powder and stevia leaf powder according to the specified amounts. Mix the aromatic pandan leaf powder and stevia leaf powder using a spoon to produce the aromatic pandan leaf and stevia leaf herbal tea.

Data Analysis

Analysis of variance (ANOVA) was used to statistically analyze the data obtained using IBM SPSS Statistics version 25. Additional tests were conducted by applying Duncan's multiple range test (DMRT) at the 5% level when the calculated F-value was greater than or equal to the critical F-value.

RESULTS AND DISCUSSION

Moisture Content

The moisture content of herbal tea was found to be significantly influenced ($P<0.05$) by the ratio of pandan leaves to stevia leaves (based on the research results). Table 1 shows the moisture content of the herbal tea.

Table 1. Average moisture and ash content values of herbal tea made from fragrant pandan leaves and stevia leaves

Treatment	Moisture Content (%) ± SD	Ash content (%) ± SD
PS1 = fragrant pandan leaves:stevia leaves (60:40)	$6.35^{a} \pm 0.13$	$7.08^{c} \pm 0.02$
PS2 = fragrant pandan leaves:stevia leaves (65:35)	$6.82^{b} \pm 0.32$	$6.94^{c} \pm 0.17$
PS3 = fragrant pandan leaves:stevia leaves (70:30)	$7.15^{c} \pm 0.05$	$6.47^{b} \pm 0.27$
PS4 = fragrant pandan leaves:stevia leaves (75:25)	$7.55^{d} \pm 0.11$	$6.10^{a} \pm 0.03$

Note: Numbers followed by different letters in the same column indicate a statistically significant difference ($P<0.05$).

The moisture content of the herbal tea ranged from 6.35% to 7.55% (Table 1), showing significant differences across treatments. It was observed that a higher concentration of stevia resulted in lower moisture content. This trend is likely attributed to the lower initial moisture content of raw stevia leaves (6.14%) compared to pandan leaves (6.28%).

The lower moisture content in treatments with higher stevia concentrations is consistent with the lower initial moisture levels of raw stevia leaves. This aligns with findings by Risal (2023), where materials with higher intrinsic moisture, such as rosella flowers (8.15%), yielded higher final moisture content compared to drier materials like avocado leaves (4.33%). Furthermore, the reduction in moisture may be influenced by the presence of volatile compounds in aromatic plants like pandan. According to Xie et al. (2023), these

compounds evaporate alongside water during drying, further reducing the material's mass. Regardless of the treatment, the moisture content of the pandan-stevia herbal tea remained below 8%, thus fulfilling the SNI 3945:2016 quality standard for green tea.

Ash Content

A substantial effect ($P<0.05$) of the pandan leaf and stevia ratio on the ash content of herbal tea was observed in the analysis results. Table 1 shows the ash concentration of the herbal tea. Herbal tea made using pandan leaves and stevia has an ash content ranging from 6.10% to 7.08%, as shown in Table 1. Treatment PS1, which used pandan leaves and stevia to make herbal tea, had the highest ash content, although the difference was not statistically significant compared to treatment PS2.

In contrast to the other treatments, treatment PS4 had the lowest ash content in the herbal tea. The ash content in the herbal tea increased as the concentration of stevia leaves increased and the percentage of pandan leaves decreased. This occurred due to the influence of the ingredients in the herbal tea. There is 4.14 percent ash in pandan leaves and 5.18 percent ash in stevia leaves, according to a study of raw materials. According Marlina & Widiyastuti (2018), phosphorus, iron, calcium, potassium, and magnesium are some of the minerals found in stevia leaves. The mineral content of a food ingredient is proportional to its ash concentration. According to the study by Yamin et al. (2017), the ash content of a material is directly proportional to its inorganic mineral content.

The ash content of white ginger tea bags with a 4% addition of stevia leaves is 7.62%, according to a study by Sinuhaji et al. (2023). This is higher than the ash content of white ginger tea bags without stevia leaves, which is 7.32%. Elviana et al. (2024) found that a treatment consisting of 70% kecombrang flowers and 30% stevia leaf tea bags had ash content ranging from 7.10% to 8.20%, with the ash percentage increasing as the concentration of stevia leaves increased. All treatments produced herbal tea with ash content of 8% or less for pandan and stevia leaves, which is considered green tea quality according to SNI 3945:2016.

Antioxidant Activity

The DPPH assay was used to determine antioxidant activity, which was then expressed as the IC_{50} value, representing the inhibitory concentration. Based on analysis of variance, the antioxidant activity of the herbal tea was significantly influenced ($P<0.05$) by the ratio of pandan leaves to stevia leaves. Table 2 shows the mean IC_{50} values of the herbal tea.

Table 2. Average antioxidant activity values of herbal tea made from fragrant pandan leaves and stevia leaves

Treatment	Antioxidant Activity IC_{50} (ppm) ± SD
PS1 = fragrant pandan leaves:stevia leaves (60:40)	$21.98^{a} \pm 0.90$
PS2 = fragrant pandan leaves:stevia leaves (65:35)	$23.72^{b} \pm 0.35$
PS3 = fragrant pandan leaves:stevia leaves (70:30)	$24.31^{bc} \pm 0.56$
PS4 = fragrant pandan leaves:stevia leaves (75:25)	$24.95^{c} \pm 0.37$

Note: Numbers followed by different letters in the same column indicate a statistically significant difference ($P<0.05$).

Table 2 shows that herbal tea made from pandan leaves and stevia has antioxidant activity ranging from 21.98 to 24.95 ppm. The PS3-treated pandan leaf and stevia leaf herbal tea exhibited significantly different antioxidant activity compared to the PS1-treated tea, but no significant difference compared to the PS2- and PS4-treated teas. While the PS3 and PS4 treatments had the lowest antioxidant activity, the PS1 treatment had the highest antioxidant activity. Antioxidant activity increased as the concentration of

stevia leaves increased and the content of pandan leaves decreased. This is because stevia leaves contain more antioxidant compounds than pandan leaves. The strong antioxidant activity characterizes the findings of this study.

According to a study Wulansari (2018), a very strong antioxidant is defined as having an IC_{50} value of less than 50 ppm, a strong antioxidant as having an IC_{50} value between 50 and 100 ppm, a moderate antioxidant as having an IC_{50} value between 100 and 250 ppm, and an inactive antioxidant as having an IC_{50} greater than 500 ppm. The antioxidant activity in this study was higher than that reported by Hashary et al. (2023), in which pandan leaf ethanol extract exhibited very high antioxidant activity (27.65 ppm).

The use of fragrant pandan leaves and stevia leaves in this study resulted in increased activity in the herbal tea. This is due to interrelated chemical factors and reaction mechanisms. According to Tristanto et al. (2017), antioxidant glycosides, alkaloids, tannins, saponins, phenols, steroids, triterpenoids, and flavonoids are some of the phytochemical components found in stevia leaf powder. Alkaloids, flavonoids, saponins, tannins, and polyphenols are some of the chemical components found in pandan leaves (Margaretta et al., 2011) that possess antioxidant properties.

Research results by Anggorowati et al. (2016) and indicate that an increase in antioxidant activity is due to the fact that the antioxidant effect of a substance increases when it contains a significant concentration of phenolic compounds, including flavonoids and phenolic acids. Total phenols and flavonoids are positively correlated with antioxidant activity, as stated by Prabandari (2015). Antioxidant activity increases with an increase in total phenols and flavonoids.

Polyphenol Content

Polyphenolic antioxidants are a type of phenolic derivative. The polyphenol content of the herbal tea produced was significantly influenced ($P<0.05$) by the ratio of pandan leaves to stevia leaves. As shown in Table 3, the herbal tea generally had an average polyphenol content.

Table 3. Average polyphenol content of herbal tea made from fragrant pandan leaves and stevia leaves

Treatment	Polyphenol Content	
	mg GAE/g ± SD	%
PS1 = fragrant pandan leaves:stevia leaves (60:40)	$84.34^{d} \pm 0.71$	8.43^{d}
PS2 = fragrant pandan leaves:stevia leaves (65:35)	$73.55^{c} \pm 0.64$	7.35^{c}
PS3 = fragrant pandan leaves:stevia leaves (70:30)	$61.90^{b} \pm 0.65$	6.19^{b}
PS4 = fragrant pandan leaves:stevia leaves (75:25)	$53.64^{a} \pm 0.52$	5.36^{a}

Note: Numbers followed by different letters in the same column indicate a statistically significant difference ($P<0.05$).

The polyphenol content of the herbal tea made from pandan and stevia leaves ranged from 53.64 to 84.34 mg GAE/g, or 5.36 to 8.43%, as shown in Table 3. The polyphenol content of the pandan and stevia leaf herbal tea differed substantially across all treatments, according to the data. Treatment PS1, with 84.34 mg GAE/g (8.43%), had the highest polyphenol content, while treatment PS4, with 53.64 mg GAE/g (5.36%), had the lowest polyphenol content. Polyphenol content was directly proportional to the concentration ratio of stevia leaves and pandan leaves. The composition of the raw materials influences this.

Stevia leaves have a higher polyphenol content compared to pandan leaves; therefore, the polyphenol content increases with higher concentrations. The phenolic content of stevia leaf extract is 61.500 mg GAE/g (Shukla et al., 2009). The total phenolic content of herbal tea made with corn silk increases with the amount of stevia leaves (Ahmad et al., 2019).

According to Wahyudi et al. (2019), the polyphenol content in tea enhances the product's quality, thereby extending its shelf life because polyphenolic compounds possess antioxidant properties that

prevent food spoilage caused by oxidation in tea. Although polyphenols are antioxidants, Dhianawaty & Ruslin (2015) state that polyphenols are not heat-resistant if exposed to high temperatures for an extended period. This study found that treatments PS1, PS2, PS3, and PS4 did not contain sufficient polyphenols to meet SNI requirements, which stipulate that tea must have a minimum polyphenol content of 15%.

Sensory Evaluation

The sensory evaluation of pandan leaf and stevia leaf herbal teas consisted of two types of assessment: descriptive and hedonic. Descriptive sensory evaluation aimed to identify the characteristics of pandan leaf and stevia leaf herbal teas, while hedonic sensory evaluation aimed to determine the panelists' preference for the resulting pandan leaf and stevia leaf herbal teas. Color, aroma, taste, and overall impression are part of the sensory evaluation process. Table 4 shows the average descriptive results of the sensory evaluation of pandan leaf and stevia leaf herbal teas. Table 5 shows the average results of the hedonic evaluation.

Table 4. Descriptive average sensory ratings of herbal tea made from pandan leaves and stevia leaves

Treatment	Color	Aroma	Taste
PS1 = Fragrant pandan leaves : Stevia leaves (60:40)	4.40^{b}	3.87^{c}	3.90^{c}
PS2 = Fragrant pandan leaves : Stevia leaves (65:35)	3.90^{a}	3.50^{b}	3.63^{bc}
PS3 = Fragrant pandan leaves : Stevia leaves (70:30)	3.77^{a}	2.37^{a}	3.43^{ab}
PS4 = Fragrant pandan leaves : Stevia leaves (75:25)	3.60^{a}	2.17^{a}	3.13^{a}

Note: Numbers followed by different letters in the same column indicate significant differences (P<0.05).
Descriptive scores: Color: 1. Very green, 2. Green, 3. Slightly green, 4. Slightly yellowish green, 5. Yellowish. Aroma: 1. Very pandan leaf-like aroma, 2. Pandan leaf-like aroma, 3. Slightly pandan leaf-like aroma, 4. Pandan leaf and stevia-like aroma, 5. Slightly pandan leaf and stevia-like aroma. Taste: 1. Very sweet, 2. Sweet, 3. Slightly sweet, 4. Sweet with a slight bitterness, 5. Bitter.

Table 5. Average hedonic sensory ratings of herbal tea made from pandan leaves and stevia leaves

Treatment	Color	Aroma	Taste	Overall
PS1 = Fragrant pandan leaves : Stevia leaves (60:40)	4.00^{c}	3.81^{c}	4.03^{c}	4.36^{c}
PS2 = Fragrant pandan leaves : Stevia leaves (65:35)	3.87^{b}	3.60^{b}	3.84^{b}	3.95^{b}
PS3 = Fragrant pandan leaves : Stevia leaves (70:30)	3.60^{a}	3.49^{ab}	3.47^{a}	3.46^{a}
PS4 = Fragrant pandan leaves : Stevia leaves (75:25)	3.50^{a}	3.36^{a}	3.36^{a}	3.39^{a}

Note: Numbers followed by different letters in the same column indicate significant differences (P<0.05).
Hedonic score: 1. Strongly dislike, 2. Dislike, 3. Somewhat like, 4. Like, 5. Strongly like.

Herbal tea made with pandan leaves and stevia had an average color evaluation score ranging from 3.60 to 4.40, indicating a slightly yellowish-green color, as shown in Table 4. The PS1 treatment differed significantly and had a much higher color evaluation score compared to the PS2, PS3, and PS4 treatments. Herbal tea produces a more yellowish-green color when more stevia leaves are added and fewer pandan leaves are added. This is because the color of the finished herbal tea is influenced by the drying process.

The green color found in pandan leaves is produced by a natural pigment known as chlorophyll (Roihanah, 2014). According to Angraiyati & Hamzah (2017), when pandan leaves are heated, the chlorophyll becomes unstable and changes color from green to brown, destroying the previously bright green color. The conclude that stevia leaves impart a yellowish-brown color to the beverage when added in increasing amounts. It is clear from this study that the PS1 treatment differs from the others. The color results of the herbal tea can be seen in Figure 1. This tea was made with aromatic pandan leaves and stevia leaves.

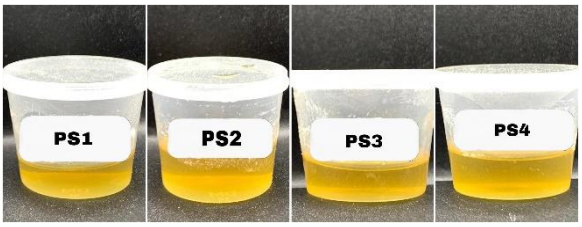

Figure 1. Color of herbal tea made from fragrant pandan leaves and stevia leaves across all treatments

Table 5 shows that the panelists' preference ratings ranged from 3.50 to 4.00, indicating "liked." The color was generally acceptable to the panelists. The highest-rated treatment was PS1, while the lowest was PS4, which differed significantly from PS1 and PS2 but not significantly from PS3. The herbal tea most preferred by the panelists was the one with a lower proportion of pandan leaves and a higher concentration of stevia leaves. This is because the panelists preferred herbal tea with a higher stevia leaf ratio, as it produced a brew with a brighter or more yellowish color. Referring to the study by Maharani et al. (2022), *binahong* leaf herbal drinks with a higher stevia leaf ratio increased the panelists' preference for the resulting tea color.

The data in Table 4 represent the average scores for descriptive aroma evaluation, ranging from 2.17 to 3.87 and covering a spectrum from pandan leaf aroma to stevia aroma. The PS4 treatment had the lowest score and differed significantly from PS1 and PS2, while PS3 did not differ significantly from PS4. PS1 had the highest score. Herbal tea infused with aromatic pandan leaves has a lighter aroma, while herbal tea infused with stevia leaves has a stronger aroma. This is because the herbal tea uses fragrant pandan leaves and stevia leaves as its main ingredients. Referring to Langit et al. (2018), it is stated that phenolic content is one of the sources of aroma in food products. The aroma of these compounds can diminish as a result of drying, as it reduces the overall phenolic content.

According to a study by Putri & Kawiji (2015), pandan leaves contain phenolic compounds such as ferulic acid, p-coumaric acid, flavonoids (quercetin and kaempferol), and tannins. According to Shivanna et al. (2013), dicaffeoylquinic acid, caffeic acid, quercetin 3-O-xyloside, apigenin-7-glucoside, 3,4-dimethoxycinnamic acid, luteolin 7-O-rutinoside, and stevia leaves contain the highest levels of phenolic components. According to the study Maharani et al. (2022), it indicates that the aromatic components of stevia leaves are enhanced with increasing concentration, leading to a stronger aroma.

The panelists' ratings for pandan leaf and stevia leaf herbal teas ranged from 3.36 to 3.81 on the hedonic sensory evaluation aroma scale (Table 5), indicating a fairly favorable response. PS3 differed significantly from PS4, and PS4 was the lowest-rated treatment, while PS1 and PS2 did not differ significantly from PS3.

PS1 was the highest-rated treatment. This is because the panelists preferred the volatile molecules that create the characteristic aroma of herbal tea from its raw materials. Elok & Khaerunnisya (2018) found that pandan leaves contain a number of volatile chemicals, including alcohols, aromatics, carboxylic acids, aldehydes, esters, and hydrocarbons. The panelists' favorite herbal corn silk tea, as reported by Ahmad et al. (2019), is the corn silk tea containing 25% stevia leaves. This treatment has a lighter aroma, which is good because it does not overpower the other ingredients.

The descriptive mean ratings for the taste of herbal tea made with pandan leaves and stevia ranged from 3.13 to 3.90 (slightly sweet to sweet), as shown in Table 4. The PS1 treatment at the highest level differed significantly from PS3 and PS4, but did not differ significantly from PS2. The resulting sweetness is proportional to the ratio of pandan leaf to stevia leaf concentrations. This is because stevia leaves contain natural sweeteners known as diterpene glycoside molecules, including stevioside and rebaudioside. However, when stevia concentration is high, as in the PS1 treatment, a slightly bitter taste or a distinct tea

flavor may accompany the sweetness. Research conducted by Ahmad et al. (2019) indicates that tea beverages can have a bitter taste when the concentration of stevia leaves is increased. The stevioside component is the cause, as it imparts a distinct bitter taste to the tea beverage. According to Raini & Isnawati (2011), found that the active chemical compounds in stevia—which include 5 to 10% stevioside and 2 to 4% rebaudioside—are responsible for the sweet taste. These compounds are 200–300 times sweeter than sucrose.

Table 5, which presents the results of the hedonic sensory evaluation of taste, shows that the panelists' liking scores for the pandan and stevia herbal blend ranged from 3.36 to 4.03, indicating that the product was rated as somewhat liked to liked. The highest-rated treatments were PS1 and PS4, which differed significantly from PS1 and PS2 but not significantly from PS3. As the concentration of pandan wangi decreases and the amount of stevia used in the herbal tea increases, the resulting herbal tea becomes more tolerable to the panelists. This is because the resulting herbal tea has a stronger flavor than the tea preferred by the panelists. According to the study by Siringoringo et al. (2023), the panelists rated the gotu kola leaf tea with a 35% addition of stevia leaves as the most acceptable result.

Based on Table 5, the overall hedonic scores for the herbal tea made with pandan leaves and stevia ranged from 3.39 to 4.36, indicating a level of preference ranging from somewhat liked to liked. Treatment PS3 differed significantly from PS1 and PS2, but did not differ significantly from PS4. PS1 was the highest-rated treatment, while PS4 was the lowest-rated. The herbal tea was better accepted by the panelists when the pandan leaf content was lower and the stevia leaf concentration was higher.

Sensory results regarding color, aroma, and taste influenced the panelists' overall preference for the produced herbal tea. The most prominent factor influencing the panelists' overall evaluation was the tea's taste; a tea that was too bitter resulted in lower preference among panelists, so they generally preferred herbal tea with a sweet yet slightly bitter taste. Research by Maharani et al. (2022) found that at a drying temperature of 55°C and a binahong leaf:stevia leaf composition of 62.50%:37.50%, the herbal beverage made from these leaves yielded the best results. Compared to other treatments, the panelists preferred this formulation.

CONCLUSION

The ratio of pandan and stevia leaves significantly affected the moisture content, ash content, antioxidant activity (IC_{50}), polyphenol levels, and sensory attributes of the herbal tea. Treatment PS1 (60% pandan and 40% stevia) was determined as the optimal formulation, as it met the SNI 3945:2016 quality standards for green tea while maintaining high antioxidant properties and panelist acceptance. This study suggests that the pandan-stevia blend has significant potential as a functional herbal beverage.

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