Consumer Sensory Perception of Jamu Gendong: The Traditional Javanese Herbal Drink

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Abstract. "Jamu gendong" is a traditional herbal drink from Indonesia that offers various health benefits, such as boosting immunity, detoxification, disease prevention, and many more. While there are many variances of jamu gendong, the scope of this current study was limited to observed 5 herbal drinks, inlcuding "beras kencur", "cabe puyang", "kunyit asam", "pahitan", and "sinom" from several producers in Malang City. This study was aimed to map the sensory profiles of "jamu gendong" and further to investigate consumer preferences on "jamu gendong" particularly among Indonesian young generation. Involving 110 untrained panelists, the study shown that "sinom" and "kunyit asam" were preferred with the highest overall acceptance scores (p-value<0.05). Both "jamu" was sensorially dominated by sour taste and sour aftertaste. In general, the panelists disliked the bitter properties of jamu gendong as "pahitan" with the highest bitter taste (p-value<0.05) was also related to the lowest acceptance level (p-value<0.05). The fact that "pahitan" was the least preferred jamu also related to its lowest total dissolved solids and thickness intensity, as well as the highest bitter taste, astringent mouth-feel and astringent mouth-after-feel (p-value<0.05).

1 Introduction

Jamu is a traditional Indonesian herbal drink made from natural ingredients, known for its various health benefits. Historical records suggest that jamu first appeared during the Mataram Kingdom era, around 1300 years ago, derived from ancient Chinese herbal medicine believed to promote health. The natural ingredients used in jamu make it a popular alternative medicine with minimal side effects [1]. The health benefits of consuming jamu include appetite stimulation, improved blood circulation, enhanced digestion, antibiotic properties, among others, depending on the type of jamu. According to the Indonesian Ministry of Health Regulation No. 3 of 2010 on the Standardization of Jamu, it is recognized as a traditional Indonesian medicine. In the old spelling, "djamoe" is an abbreviation of the words "djampi" and "oesodo" (husada), where "djampi" means prayer or remedy, and "oesodo" means health [2]. One of the well-known types of jamu in Indonesia is jamu gendong, which is traditionally brewed from leaves, roots, and other plant parts in fresh

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condition and sold by vendors carrying it around. There are at least ten varieties of jamu gendong still widely produced, including beras kencur, kunyit asam, sinom, pahitan, cabe puyang, kudu laos, kunci suruh, temulawak, uyu-uyup, and sari rapet [3]

Amidst the changing times and technological advancements, the tradition of consuming jamu remains prevalent among the majority of Indonesians. According to a report by the Health Research and Development Agency, in 2010, over 50%, specifically 95.60% of Indonesia's population, continued to consume jamu, albeit not all types [4]. However, there was a decline in jamu consumers in 2019, with only 59.12% of the population consuming it, 95.6% of whom used jamu for medicinal purposes [5]. During the Covid-19 pandemic in 2021, the consumption of jamu in Indonesia increased to 73.68% [6]. Several factors influence the public's preference for consuming jamu, including intrinsic factors (appearance, taste, aroma, etc.), extrinsic factors (environment, product promotion, variety, season), biological factors (gender, age), personal factors, economic factors, educational factors, and cultural factors [7]. Another study revealed that sensory attributes of jamu play a significant role in consumer preference, with the aroma of spices and sweet taste being the most favored attributes, while sour, bitter flavors, drinking sensations, aftertaste, and color did not significantly impact consumer assessments [8].

This current study was focused on young generation perception of jamu. Understanding sensory perception among younger generations is crucial for several reasons. As younger consumers increasingly influence market trends, their preferences and perceptions can significantly impact the acceptance and commercialization of traditional drinks. The sensory attributes of beverages, including taste, aroma, and mouthfeel, play a pivotal role in consumer acceptance and enjoyment, which is particularly relevant for traditional beverages that may not align with contemporary tastes. Research indicates that younger consumers often have different sensory preferences compared to older generations, influenced by globalization and exposure to diverse food cultures. This shift underscores the importance of understanding how younger generations perceive traditional beverages like jamu, which may require adaptation to meet their sensory expectations.

Moreover, studies have shown that sensory attributes significantly influence the acceptance of beverages among younger consumers. For example, a study on Taiwanese specialty teas found that young consumers prioritized attributes such as aroma and mouthfeel over traditional sensory evaluations emphasized by experts [9]. This suggests that traditional beverages must be marketed and developed with an understanding of the sensory preferences of younger consumers to enhance their appeal. Similarly, the sensory analysis of moringa beverages highlighted that specific sensory perceptions were critical drivers of liking among consumers, indicating that sensory attributes must be aligned with consumer expectations to foster acceptance [10].

The integration of sensory analysis into the study of traditional beverages can also provide insights into how these products can be modernized without losing their cultural significance. For instance, the application of sensory wheels in tea marketing has been suggested to bridge the gap between consumer perceptions and expert evaluations, potentially attracting younger consumers to traditional beverages [11]. This approach can be beneficial for jamu, as it may help identify key sensory attributes that resonate with younger audiences, thereby enhancing its marketability.

Sensory evaluation is a crucial process in product research and development, enabling a systematic understanding of a product's sensory characteristics. Several methods can be used, including affective tests, discriminative tests, and descriptive tests. Descriptive methods, such as the Rate-All-That-Apply (RATA) method, are particularly important in the food and beverage industry for identifying consumer preferences, understanding product differences, and developing formulations that meet market expectations. The RATA method is an objective quantitative technique designed to capture consumer or panelist perceptions in assessing and determining the intensity of a product's sensory attributes. This method is an advancement over the previous Check-All-That-Apply (CATA) method, which is qualitative and does not quantify sensory intensity. The sensory attributes assessed using the RATA method are also more varied, resulting in a higher significance in product discrimination. In this study, sensory evaluation of jamu gendong was conducted using the RATA method and hedonic testing to determine preference levels for the sensory attributes of jamu. Additionally, chemical evaluations were performed, including total sugar content tested with the anthrone-sulphate method, total acid using acid-base titration, and total soluble solids using a Brix refractometer.

2 Method

2.1 Equipment and Materials

The equipment used in this study includes sample cups, burettes, stands, dropper pipettes, graduated pipettes, graduated cylinders, volumetric flasks, Erlenmeyer flasks, an ATAGO hand refractometer, a vortex mixer, a shaker water bath set at 90°C, a SHIMADZU UV-Vis spectrophotometer, sieves, test tubes, centrifuge tubes, falcon tubes, separating funnels, beakers, an analytical balance, glass spatulas, and aluminum foil.

The main materials required for the study include samples of pahitan, kunyit asam, and beras kencur jamu, produced by jamu gendong producers in Malang City. The chemicals used for testing include 0.1 N HCl, 1% phenolphthalein (PP) indicator, 0.1 N NaOH solution, distilled water (aquades), standard glucose solution, anthrone reagent, calcium carbonate ($CaCO_3$), sulfuric acid (H_2SO_4), sodium oxalate (Na-oxalate), and lead acetate (Pb-acetate).

2.2 Research Methodology

The experimental design of this study follows a Completely Randomized Design (CRD) consisting of two factors: Factor I = type of jamu (beras kencur, cabe puyang, kunyit asam, pahitan, and sinom) and Factor II = producer. The data were analyzed using ANOVA (Analysis of Variance) followed by Tukey's post hoc test at a 95% confidence level. The observed parameters include the intensity of sensory attributes, preference levels, total sugar content, total acid content, and total soluble solids.

2.3 Rate-All-That-Apply (RATA) and Hedonic Testing

The sensory and hedonic testing of jamu gendong was conducted at the Sensory and Applied Food Science Laboratory using the Rate-All-That-Apply (RATA) method, involving general or untrained panelists. The panelists were selected from university students (18-22 y.o) and comprised of Javanese (70%), Sundanese (15%), Madurese (5%), Betawi (5%) and any other ethnic groups in Indonesia (5%). All the subjects involved in this study has confirmed that they at least experienced in consuming jamu gendong. The samples tested included beras kencur, cabe puyang, kunyit asam, pahitan, and sinom each from three different producers (Producers A, B, C). Panelists were given the opportunity to rate the intensity of taste, aroma, color, and texture of each jamu sample.

For the sensory attribute intensity, the scoring system was as follows: a score of "1" indicated that the attribute was not noticeable, a score of "2" indicated that the attribute was slightly noticeable, a score of "3" indicated that the attribute was noticeable, a score of "4" indicated that the attribute was very noticeable, and a score of "5" indicated that the attribute was extremely noticeable.

In the hedonic test, the scoring system for overall liking was: a score of "1" indicated that the attribute was very disliked, a score of "2" indicated that the attribute was disliked, a score of "3" indicated that the attribute was moderately liked, a score of "4" indicated that the attribute was liked, and a score of "5" indicated that the attribute was very liked. This comprehensive evaluation helps to understand both the objective sensory characteristics and the subjective preferences of the panelists, which are essential for improving and marketing jamu products.

2.4 Total Sugar Test Using Anthrone-Sulfate Method

The total sugar content in the samples was determined using the anthrone-sulfate method, which measures the amount of reducing sugars. The process began with the preparation of a standard curve using a test tube containing 1 mL of a standard glucose solution (200 mg anhydrous glucose in 1 L of distilled water) and 5 mL of anthrone reagent. The addition of the anthrone reagent was performed under a fume hood due to the acidic nature of the reagent. The test tube was then covered with aluminum foil, vortexed, and heated in a water bath for 12 minutes. After heating, the standard solution was cooled and its absorbance was measured using a UV-Vis spectrophotometer at a maximum wavelength of 630 nm for 1 hour (Optical Time, OT). The absorbance readings were taken at the maximum wavelength obtained.

For the sample total sugar measurement, 1 mL of the sample solution was taken in a test tube, followed by the addition of 5 mL anthrone reagent. The test tube was then covered, vortexed, and heated for 12 minutes. After heating, the sample was cooled and its absorbance was measured using a UV-Vis spectrophotometer at the maximum wavelength until it reached OT. The absorbance was read to determine the total sugar content in the sample.

2.5 Total Titratable Adicidity Test

The total acid test uses the acid-base titration method. The titration testing stage begins with the standardization of NaOH by preparing 25 mL of 0.1 N HCl solution, then adding 2 drops of phenolphthalein (PP) indicator, and subsequently titrating it with NaOH. The purpose of standardization is to ensure the accuracy of the NaOH concentration to be used as the titrant. This standardization is repeated three times for accurate results. Once the correct NaOH concentration is obtained, 10 mL of the herbal medicine sample is diluted in 250 mL of distilled water. Take 50 mL of the solution, add 2 drops of PP indicator, and titrate with 0.1 N NaOH until the solution color changes to a constant pink. Record the volume of NaOH used, then calculate the total acid in the sample using the following formula.

2.6 Total Dissolved Solid Test

The total dissolved solids test is conducted to determine the concentration of sugar solution in the sample using a refractometer. Before measuring the sample, the refractometer is calibrated with distilled water. One drop of the herbal medicine sample is placed on the refractometer prism. During the test, the refractometer is directed towards a light source, and the boundary line between blue and white indicates the degree Brix or the total sugar content.

3 Results And Discussion

3.1 Total Sugar

Table 1 shows that Jamu Sinom has the highest sugar content, at 8.07%, followed by Jamu Cabe Puyang with a sugar content of 6.31%. This is due to the different sugar concentrations used in the preparation process of the herbal drinks. The higher the sugar concentration used, the higher the total sugar content.

Based on Table 1, the highest total sugar is produced in sinom herbal medicine. In the preparation of herbal medicine (jamu gendong), sugar is one of the additional ingredients used as a sweetener. The most commonly used sweetener in the preparation of traditional drinks, in this case jamu, is palm sugar, specifically red sugar [12]. The high sugar content in sinom indicates that the concentration of red sugar used in its production is also higher compared to other herbal medicines.

Table 1. Chemical Content Profile of Various Types of Jamu

Types of Jamu	Total Sugar (%)	Total Acid (%)	Total Dissolved Solids (°Brix)
Beras Kencur	0.74 ± 0.45^b	2.76 ± 0.97^a	6.40 ± 2.86^a
Cabe Puyang	6.31 ± 2.43^a	1.29 ± 0.15^b	6.44 ± 2.89^a
Kunyit Asam	0.45 ± 0.23^b	3.69 ± 1.20^a	5.37 ± 1.50^a
Pahitan	0.07 ± 0.09^b	1.19 ± 0.30^b	1.00 ± 0.00^b
Sinom	8.07 ± 2.90^a	1.25 ± 0.12^b	6.71 ± 2.69^a

*different superscript within the same column indicates significant different at confidence level of 95%

3.2 Total Acid

Based on the total sugar test results shown in **Table 1**, it is known that Jamu Kunyit Asam has the highest acid content, at 3.69%. The acid content in herbal drinks is influenced by the use of tamarind as a base or additional ingredient to give the herbal drink its flavor. The high acid content is due to the increased concentration of tamarind added to the herbal drink. The dominant chemical compound responsible for the sour taste is tartaric acid, which is found at 16% in tamarind fruit [13].

3.3 Total Dissolved Solids

Table 1 shows that the highest total dissolved solids content is found in Jamu Sinom, at 6.71%. However, from the data, it is known that only the total dissolved solids of Jamu Pahitan is significantly lower compared to other herbal drinks. One of the detected components of dissolved solids is simple sugars. In the process, no additional sweeteners such as sugar are added to Jamu Pahitan. Instead, it is purely a decoction of Andrographis paniculata or dried Tinospora crispa. This is causes the total dissolved solids of Jamu Pahitan to be very low.

3.4 Sensory Attribute Intensity (RATA)

In this study, 14 sensory attributes were provided in the questionnaire. Based on the ANOVA test results, it is known that all attributes differ significantly between samples. Therefore, further testing was conducted using Tukey's HSD test at a 95% confidence level. The further test results presented in Table 2 show that the color of Jamu Kunyit Asam shows the highest yellow color. The aroma of Jamu Kunyit Asam and Cabe Puyang has the strongest turmeric aroma, while Sinom has the highest brown sugar aroma. Jamu Kunyit Asam and Sinom exhibit the highest sour taste, while Pahitan has the most dominant bitter taste. Jamu Cabe Puyang has the highest texture thickness and significant gritty sensation, whereas Pahitan shows a high astringent sensation and bitter aftertaste.

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3.5 Level of Likeability of Sensory Attributes (Hedonic)

Based on the ANOVA test results, it is known that all attributes differ significantly between samples. Therefore, further testing was conducted using Tukey's HSD test at a 95% confidence level. The further test results presented in Table 3 show that the overall acceptance of Jamu Sinom and Kunyit Asam received the highest overall acceptance scores, with dominant sensory attributes of sour taste and sour aftertaste. In terms of aroma and taste preference of the five herbal drinks, the most prominent attributes of brown sugar aroma and turmeric aroma are Jamu Sinom and Kunyit Asam. These two herbal drinks also dominate in the attributes of sour taste and sweet aftertaste.

3.6 Sensory, Hedonic, and Chemical PCA Analysis of Jamu Gendong

Principal Component Analysis (PCA) is a statistical method used to reduce the dimensionality of data by transforming the original data, consisting of many variables, into a smaller number of new variables called principal components. In RATA testing, PCA is used to determine the magnitude of influence and correlation between the factors or attributes being tested. Based on **Fig.1**, it is known that Principal Component 1 (PC1) and Principal Component 2 (PC2) contribute 81.7% to the variability of the data set, where PC1 explains 67.6% and PC2 explains only 14.0%.

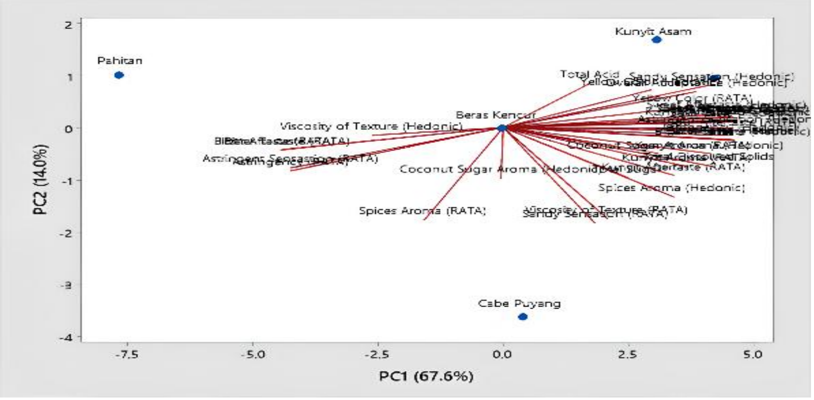

Fig. 1. Principle Component Analysis of jamu gendong sensory profiles

The findings from the chemical analysis provide a crucial understanding of why certain types of jamu were preferred over others. The highest sugar content was found in Sinom (8.07%) and Cabe Puyang (6.31%)**,** which explains their higher overall acceptance scores. Sweetness is a universally preferred taste, particularly among younger consumers, which likely contributed to the popularity of Sinom. The presence of brown sugar aroma in Sinom further enhanced its appeal, as sweet and caramel-like notes are commonly associated with palatable, refreshing drinks. In contrast, Kunyit Asam had the highest acid content (3.69%)**,** which aligned with its dominant sour taste and sour aftertaste. Sourness is often linked to refreshing and invigorating sensations, making it more acceptable to the younger demographic, who tend to favor citrusy or tart flavors in modern beverages. The high acidity from tamarind (Tamarindus indica) used in Kunyit Asam contributed to this profile, reinforcing its preference among panelists.

On the other end of the spectrum, Pahitan had the lowest sugar content (0.07%) and the highest bitterness**,** leading to its significantly lower acceptance. The intense bitter taste and astringent mouthfeel were major deterrents, aligning with established consumer behavior that associates bitterness with medicinal or undesirable flavors. Additionally, Pahitan had the lowest total dissolved solids (1.00°Brix), indicating a lack of natural sweetness or body, which further contributed to its unpopularity.

Panelists showed a strong preference for Sinom and Kunyit Asam, which were characterized by their sour and sweet sensory profiles. The popularity of these drinks can be linked to broader beverage trends among younger consumers, who tend to favor refreshing, fruit-based, and tangy flavors commonly found in modern soft drinks, fruit juices, and functional beverages. The thicker texture and gritty sensation of Cabe Puyang contributed to a richer mouthfeel, making it somewhat more acceptable than Pahitan, despite its moderate bitterness. The turmeric aroma in Kunyit Asam and Cabe Puyang was also a defining factor, as turmeric is often associated with health benefits and functional drinks, making it more appealing to health-conscious individuals. In contrast, Beras Kencur, despite its relatively moderate sugar content, did not score as high in preference. This may be due to its spice-dominated aroma and slightly bitter undertones, which did not align as well with the preferred flavor profile of the young panelists.

The preference trends observed in this study suggest that younger consumers are more likely to accept jamu varieties that offer a balance of sweetness and acidity, rather than those with dominant bitterness. This aligns with global trends in functional and traditional beverages, where refreshing, mildly sweet, and sour flavors are more widely accepted. Bitterness was a major barrier to preference, particularly for Pahitan. This suggests that potential formulation modifications, such as natural sweeteners or blending with aromatic herbs, could improve its acceptance. Texture and mouthfeel played a significant role, with thicker and slightly gritty textures (e.g., Cabe Puyang) being more acceptable than watery or excessively astringent mouthfeels (e.g., Pahitan). Aroma significantly influenced preference, with brown sugar and turmeric notes being well-received, reinforcing the role of familiar, comforting scents in shaping consumer acceptance.

Given the findings, jamu producers looking to appeal to younger consumers may consider enhancing sweetness in traditionally bitter jamu, possibly using honey or natural low-calorie sweeteners. Emphasizing sour notes, as in Sinom and Kunyit Asam, could align with modern beverage trends. Adjusting texture and thickness, ensuring that formulations do not become excessively watery or astringent, could also be beneficial. Marketing jamu as a refreshing, functional drink by leveraging its natural and traditional health benefits while modernizing its appeal would further enhance acceptance. By understanding the interplay between chemical composition and sensory preferences, producers can better tailor their products to meet the expectations of the younger generation, ensuring the longevity of jamu consumption in contemporary markets.

Table 2. Sensory attribute intensity (RATA) of various types of jamu gendong

Types of Jamu	Yellow Color	Tumeric Aroma	Brown Sugar Aroma	Spice Aroma	Sour Taste	Bitter Taste	Texture Thickness	Gritty Sensation	Astringent Sensation	Astringent After-feel	Turmeric After-taste	Sweet After-taste	Sour After-taste	Bitter After-taste
Beras Kencur	0.89 ± 0.82^{d}	2.27 ± 1.22^{c}	1.82 ± 1.04^{c}	3.07 ± 1.37^{bc}	2.48 ± 1.21^{b}	2.53 ± 1.25^{c}	2.72 ± 1.24^{b}	2.10 ± 1.31^{b}	2.59 ± $1,27^{c}$	2.77 ± 1.29^{a}	2.22 ± 1.30^{c}	2.42 ± 1.25^{bc}	2.55 ± 1.28^{b}	2.21 ± 1.22^{c}
Cabe Puyang	2.14 ± 1.36^{c}	3.73 ± 1.19^{a}	2.28 ± 1.07^{b}	3.95 ± 1.06^{a}	2.68 ± 1.23^{b}	3.44 ± 1.33^{b}	3.15 ± 1.26^{a}	2.53 ± 1.40^{a}	3.01 ± $1,32^{b}$	3.02 ± 1.32^{ab}	3.31 ± 1.29^{a}	2.15 ± 1.25^{c}	2.68 ± 1.26^{b}	3.26 ± 1.39^{b}
Kunyit Asam	3.71 ± 0.88^{a}	3.83 ± 1.02^{a}	2.02 ± 1.07^{bc}	3.12 ± 1.38^{b}	3.34 ± 1.17^{a}	2.23 ± 1.22^{c}	2.29 ± 1.15^{c}	1.56 ± 0.97^{c}	2.36 ± 1.28^{cd}	2.35 ± 1.20^{c}	3.25 ± 1.12^{a}	2.68 ± 1.21^{b}	3.05 ± 1.19^{a}	1.94 ± 1.09^{cd}
Pahitan	0.69 ± 0.65^{d}	1.11 ± 0.57^{d}	1.81 ± 1.11^{c}	3.33 ± 1.38^{b}	1.45 ± 0.87^{c}	4.90 ± 0.87^{a}	1.72 ± 1.14^{d}	1.20 ± 0.73^{d}	3.38 ± 1.66^{a}	3.35 ± 1.62^{a}	1.01 ± 0.49^{d}	0.89 ± 0.26^{d}	1.44 ± 0.93^{c}	4.79 ± 0.94^{a}
Sinom	3.13 ± 1.49^{b}	2.80 ± 1.45^{b}	2.56 ± 1.21^{a}	2.76 ± 1.40^{c}	3.28 ± 1.29^{a}	1.76 ± 1.21^{d}	2.24 ± 1.22^{c}	1.71 ± 1.13^{c}	2.07 ± 1.29^{d}	2.13 ± 1.30^{c}	2.22 ± 1.34^{b}	3.33 ± 1.20^{a}	3.16 ± 1.24^{a}	1.70 ± 1.18^{d}

*different superscript within the same column indicates significant different at confidence level of 95%

Table 3. Sensory attribute preferences and acceptability of various type of jamu gendong

Types of Jamu	Yellow Color	Tumeric Aroma	Brown Sugar Aroma	Spice Aroma	Sour Taste	Bitter Taste	Texture Thickness	Gritty Sensation	Astringent Sensation	Astringent After-feel	Turmeric After-taste	Sweet After-taste	Sour After-taste	Bitter After-taste	Overall Acceptance
Beras Kencur	3.62 ± 1.01^{a}	2.87 ± 1.21^{c}	2.91 ± 1.38^{a}	3.19 ± 1.23^{ab}	2.78 ± 1.27^{b}	2.24 ± 1.33^{b}	3.21 ± 1.16^{a}	2.44 ± 1.25^{ab}	2.49 ± 1.31^{ab}	2.51 ± 1.28^{ab}	2.66 ± 1.23^{b}	3.29 ± 1.23^{a}	2.77 ± 1.25^{b}	2.24 ± 1.32^{b}	2.53 ± 1.28^{c}
Cabe Puyang	2.09 ± 1.12^{c}	3.32 ± 1.14^{ab}	2.96 ± 17^{a}	3.39 ± 1.09^{a}	2.89 ± 1.09^{b}	2.37 ± 1.29^{b}	3.00 ± 1.12^{a}	2.34 ± 1.18^{b}	2.41 ± 1.17^{b}	2.43 ± 1.17^{b}	2.82 ± 1.78^{b}	2.94 ± 1.33^{b}	2.77 ± 1.12^{b}	2.34 ± 1.31^{ab}	2.91 ± 1.12^{b}
Kunyit Asam	3.79 ± 0.98^{a}	3.49 ± 1.10^{a}	2.54 ± 1.29^{b}	3.16 ± 1.22^{ab}	3.26 ± 1.17^{a}	2.45 ± 1.42^{ab}	3.13 ± 1.22^{a}	2.54 ± 1.39^{ab}	2.60 ± 1.38^{ab}	2.56 ± 1.36^{ab}	3.28 ± 1.24^{a}	3.38 ± 1.24^{a}	3.13 ± 1.16^{a}	2.42 ± 1.44^{ab}	3.84 ± 1.03^{a}
Pahitan	1.56 ± 0.81^{d}	2.25 ± 1.32^{d}	2.84 ± 1.34^{ab}	2.69 ± 1.21^{c}	2.03 ± 1.28^{c}	1.57 ± 1.13^{c}	3.18 ± 1.25^{a}	2.24 ± 1.41^{b}	1.81 ± 1.16^{c}	1.69 ± 1.06^{c}	1.99 ± 1.27^{c}	2.23 ± 1.48^{c}	2.01 ± 1.20^{c}	1.56 ± 1.09^{c}	2.38 ± 1.32^{c}
Sinom	2.59 ± 1.02^{b}	3.14 ± 1.23^{bc}	3.04 ± 1.15^{a}	3.11 ± 1.24^{b}	3.40 ± 1.17^{a}	2.67 ± 1.56^{a}	2.36 ± 1.23^{b}	2.65 ± 1.41^{a}	2.69 ± 1.38^{a}	2.72 ± 1.39^{a}	3.17 ±1.25^{a}	3.49 ± 1.18^{a}	3.37 ± 1.17^{a}	2.61 ± 1.50^{a}	3.95 ± 1.11^{a}

*different superscript within the same column indicates significant different at confidence level of 95%

4 Conclusion

The research results showed significant variations in the intensity of sensory attributes, chemical profiles, and preference levels among various types of herbal drinks. Jamu Sinom had the highest total sugar content at 8.07%, while Pahitan had the lowest at 0.07%. Jamu Kunyit Asam and Beras Kencur exhibited the highest total acid content, whereas Pahitan and Sinom had the lowest. Apart from Pahitan, all jamu types had relatively high total dissolved solids, exceeding 5°Brix. From a sensory perspective, Kunyit Asam had the most intense yellow color, while Cabe Puyang had the thickest texture. Sinom was distinguished by its strong brown sugar aroma, and Kunyit Asam and Sinom shared a dominant sour taste, both of which contributed to their popularity. On the other hand, Pahitan's high bitterness and astringent mouthfeel contributed to its low acceptance, reinforcing the general aversion to bitter flavors. Thus, jamu producers can enhance consumer acceptance by focusing on sour and refreshing flavors like Sinom and Kunyit Asam, using natural sweeteners (honey, stevia) to improve bitter varieties, and optimizing texture and mouthfeel**.** Branding should emphasize functional health benefits and position jamu as a natural alternative to artificial soft drinks to attract younger consumers.Further studies should explore bitterness-masking strategies as well as cross-cultural consumer preferences for global expansion.

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