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Characteristics of Green Tea Kombucha with Added Jasmine Flowers

S. A. Rahma[1], Novelina[1], and Ismed[1.]*

[1] Department of Food and Agriculture and Product Technology Faculty of Agricultural Technology, Andalas University, Limau Manis Padang, Indonesia

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CORRESPONDING AUTHOR

*E-mail: novelina@ae.unand.ac.id

A B S T R A C T

The objective of this study is to assess the impact of jasmine flower enrichment on the quality attributes of green tea kombucha.The research design was the treatment of adding jasmine flowers with concentrations A (0%), B (0.4%), C (0.8%), D (1.2%), and E (1.6%), repeated three times. The data obtained were analyzed statistically using analysis of variance (ANOVA). If significantly different, the data analysis was continued with the DNMRT (Duncan's New Multiple Range Test) at a significance level of 5%. The results showed that the addition of jasmine flowers had a significant effect on the degree of acidity (pH), total acetic acid, and sugar content. However, the addition of jasmine flowers to green tea kombucha did not significantly affect the results of the analysis of ethanol content, antioxidant activity, and essential oil compounds. The best treatment was the addition of 0.8% jasmine flowers, with a pH value of 3.31, acetic acid content of 2.18%, ethanol content of 0.36%, total sugar content of 2.77%, antioxidant activity of 46.14% in 1000 ppm, total microbes of 5.2 x 10^6 CFU/ml and essential oil compounds of 1.12%, and the sensory attribute value of kombucha was like.

Contribution to Sustainable Development Goals (SDGs)
SDG 3: Good Health and Well-being
SDG 12: Responsible Consumption and Production
SDG 9: Industry, Innovation and Infrastructure

1. INTRODUCTION

1.1. Research Background

Tea is a refreshing drink that is known to people all over the world. This drink is known to have a distinctive aroma and taste. In addition, there are many compounds contained in tea that have many health benefits. The health benefits of consuming tea include reducing the risk of heart disease, cancer, and others.

Based on the processing process, tea can be divided into 3 types, namely fermented tea (black tea), semi-fermented tea (oolong tea), and unfermented tea (green tea). Around 20-22% of tea produced and consumed worldwide is green tea [1]. Green tea is widely consumed because it has polyphenol compounds that are beneficial for health, the polyphenol compound content in green tea is 30-40% [2]. Green tea is usually processed in the form of tea powder to be brewed into a drink directly, besides that it can also be in other processed forms such as kombucha. Kombucha is a traditional beverage product from the fermentation of tea and sugar extract using a kombucha starter culture called SCOBY (Symbiotic Culture of Bacteria and Yeast). During fermentation, kombucha culture will produce several alcohols, carbon dioxide, vitamin B, and vitamin C as well as various types of very important organic acids, such as acetic acid, gluconic acid, glucuronic acid, oxalic acid, and lactic acid [3].

The fermentation process of kombucha lasts for 7-14 days at a temperature of 23-27 0 C. During this fermentation process, it produces a distinctive pungent fermentation aroma. So it is less popular. In this study, jasmine flowers were added to green tea

kombucha to neutralize the sour aroma of kombucha, jasmine flowers are easily found in Indonesia, and commonly used as ornamental plants. In addition, it is also used as a raw material for making jasmine oil (absolute), for the soap, cosmetics, pharmaceutical, perfume, aromatherapy, and spa industries. The aroma contained in jasmine flowers comes from essential oil compounds. The components of essential oils contained in jasmine flowers, namely cis jasmone, methyl jasmonate, indole, benzyl acetate, linalool, and benzyl benzoate [4]. In addition to essential oil compounds, jasmine flowers also contain phenols and flavonoids as antioxidant compounds [5].

1.2. Research Objective

This research aimed to determine the effect of adding jasmine flowers on the physicochemical and organoleptic characteristics of green tea kombucha..

2. MATERIALS AND METHODS

2.1. Materials and Tools

The materials used in this study were green tea, fresh unbloomed jasmine flowers, kombucha starter (SCOBY), and granulated sugar. The chemicals used for analysis were methanol, DPPH solution, 0.1 N NaOH, PP indicator, distilled water, physiological salt, and PCA (Plant Count Agar) media. The tools used in this study were scales, sieves, glass jars, glass bottles, kitchen towels, spoons, beaker glasses, measuring cups, thermometers, analytical scales, droppers, beaker, measuring cups, test tubes, sterile petri dishes, Erlenmeyer flasks, filter paper, plastic containers, desiccators, stoves, autoclaves, colony counters, pH meter, vortex, ultrasonic, Agilent Cray 8454 spectrophotometer, and GS-2010 Plus Shimadzu.

2.2. Research Design

The design used was a Completely Randomized Design (CRD) with 5 treatments and 3 replications. The data obtained were analyzed statistically using the F test and if significantly different, continued with the T-test. Duncan's New Multiple Range Test (DNMRT) at a 5% significance level. The treatment in the study was the addition of jasmine flowers to green tea kombucha, namely A = 0 (control); B = 0.4 %; C = 0.8% ; D = 1.2%; and E = 1.6%

2.3. Making Kombucha Starter Culture

Brew 12 grams of tea in 1 liter of water at 90oC. Let the tea swell for 10-15 minutes, then strain. Add 75-100 grams of white sugar to the tea solution, then stir. After reaching room temperature, the tea solution is put into a glass jar, then add the kombucha starter and kombucha solution. Close the jar tightly using gauze and tie the lid. Fermentation is carried out in a dark room and at room temperature for 14 days. The kombucha starter can be used for kombucha fermentation.

2.4. Making Green Tea Kombucha with the Addition of Jasmine Flowers [6]

Brew 5 grams of green tea in 500 ml of water at 90oC. Let the tea swell for 10-15 minutes, then strain. Add fresh jasmine flowers that have been washed and reduced in size according to the treatment formula, let stand for 15 minutes, and then strain. Add 75 grams of white sugar to the tea solution, then stir. After reaching room temperature, the tea solution is put into a glass jar, then add 10% kombucha starter solution. Close the jar tightly using gauze. Fermentation is carried out in a dark room and at room temperature for 14 days.

2.5. Observation

Observations made in this study were observations of raw materials and green tea kombucha products. Observations of fresh white jasmine flower raw materials were pH values. Observations of kombucha starters were pH values and total microbes. Observations of green tea kombucha products were analysis of antioxidant activity, total titrated acid, pH value, alcohol content analysis, sugar content analysis, essential oil compounds, total microbe analysis, and sensory tests.

3. RESULT AND DISCUSSION

3.1. Number of Microbes in Kombucha Starter

The results of total microbial observations in the kombucha starter were 3.3 × 10 5 CFU/ml, which has been fulfilled as a starter in the fermentation process. The microbes contained in the kombucha starter are mixed microorganisms of bacteria and yeast (yeast). According to [7], the groups of bacteria contained in the starter are *Acetobacter xylinum, Acetobacter ketogenum*, and *Bacterium glucocnicum*. The yeast group, namely *Saccharomyces sp, Candida albicans, Pichia fermentants, Brettanomyces*, and *Zygosaccharomyces*.

3.2. Green Tea Kombucha

The results of the analysis of green tea kombucha with the addition of jasmine flowers can be seen in Table 1 below. The analysis was carried out on pH values, total acetic acid, sugar content, antioxidant activity, alcohol content, volatile compounds, and total microbes.

3.3. Degree of Acidity (pH)

The average results of the pH value of green tea kombucha (Table 1) show that the more jasmine flowers added, the pH value of green tea kombucha increases, but the pH limit of the product is still in the acidic pH range which is an acid formed during fermentation. The neutral pH of jasmine flowers is 6.10, due to the presence of compounds found in jasmine flowers, namely alkaloids, flavonoids, saponins, and essential oils.

During the kombucha fermentation process, several things affect changes in the physical and chemical properties of kombucha, namely the length of fermentation time, the amount of sugar, the amount of starter, and the concentration of other raw materials. Green tea kombucha with the addition of jasmine flowers has a pH that is still within safe limits for consumption. The pH of kombucha is acceptable and safe to consume if the minimum pH = 3.00. If the pH value of kombucha is below the minimum, kombucha must be diluted first before consumption [8].

Table 1. Characteristics of Green Tea Kombucha with added jasmine flowers

Parameter	Addition of Jasmine Flowers				
	A (Control)	B (0.4%)	C (0.8%)	D (1.2%)	E (1.6%)
pH	3.12 ± 0.01 a	3.25 ± 0.02 b	3.31 ± 0.02 c	3.39 ± 0.02 d	3.47 ± 0.02 e
Total acetic acid (%)	2.73 ± 0.0 8 e	2.39 ± 0.11c d	2.18 ± 0.12 b c	1.92 ± 0.12 b	1.64 ± 0.0 6 a
Sugar content (%)	2.48 ± 0.08 a	2.65 ± 0.01 b	2.77 ± 0.07 b	2.90 ± 0.06 c	3.04 ± 0.02 d
Antioxidant activity (% DPPH inhibition)	45.40 ± 0.87	45.98 ± 0.15	46.14 ± 0.21	46.32 ± 1.39	46.53 ± 0.83
Alcohol content (%)	0.24	0.33	0.36	0.38	0.40
Volatile compounds (%)	-	0.47	0.64	0.95	1.12
Total microbes (CFU/ ml)	5.7 x 10^6	5.5 x 10^6	5.2 x 10^6	5.1 x 10^6	4.8 x 10^6

Description: Numbers in the same row followed by different lowercase letters are significantly different according to DNMRT at the 5% level.

3.4. Total Acetic Acid

The total acid produced during the kombucha fermentation process is calculated as acetic acid. The total acetic acid of green tea kombucha shows that the higher the addition of jasmine flowers, the lower the total acid produced. The low total acid produced is caused by the content of compounds in jasmine flowers which have an antibacterial effect, which results in reduced formation of organic acids [9]. According to Essawet, et al . (2015) in [10], during the fermentation process, glucose and fructose are fermented into ethanol by yeast, which is then oxidized by acetic acid bacteria into acetic acid.

According to the Society of Public Analysis (SPA) and Federa Malt VinegarBrewers, all types of vinegar including non-brewed products have a maximum acetic acid content of 4% (b/v). Total acid above 4% will be dangerous for consumers who have stomach problems or ulcers. The average value of total titrated acid is 1.64 -2.73 %, indicating that the acetic acid content contained in the green tea kombucha from this study is still within safe limits for consumption.

3.5. Alcohol Content

During the fermentation process of kombucha, alcohol will be formed from the breakdown of sugar by yeast, the type of alcohol found in kombucha is ethanol. The results of the ethanol content test in Table 1 show that the remaining ethanol of green tea kombucha produced tends to be high with the increasing amount of jasmine flowers added. In this case, the compounds in jasmine flowers may interfere with the performance of acid-forming bacteria, so that the remaining ethanol in the product is still high. The ethanol content produced in this green tea kombucha is still considered safe according to the halal standards of LP POM MUI. Based on a review of MUI fatwa number 10 of 2018, fermented drinks containing alcohol/ethanol are declared halal if the ethanol content is less than 0.5 %.

3.6. Sugar Content

The provision of sugar in the fermentation medium is a source of energy for the growth of microbes that will be used in the fermentation process, in addition to being a source of energy for microbes, one third will be converted into products as a result of fermentation and another third is in the form of residual sugar that is still present in the fermentation substrate.

Analysis of sugar content in green tea kombucha products aims to determine the remaining sugar in kombucha after the fermentation process. The more jasmine flowers added, the higher the sugar content of kombucha produced, this is due to the content of compounds in jasmine flowers that can interfere with the performance of microbes in the kombucha fermentation process, so the remaining sugar after the fermentation process is still high. During the fermentation process, yeast converts sugar in the medium into ethanol and CO2. After that, ethanol is oxidized into acetic acid with the help of acetic acid bacteria, in addition, bacteria can also synthesize glucose into polysaccharide or cellulose compounds. The cellulose forms fiber threads that continue to thicken to form a strong network producing nata polycles [11]. In addition to producing ethanol and organic acids, during the fermentation process sugar is used as an energy source for microorganisms. Energy is needed to maintain cell life, cell reproduction, and the movement of motile organisms [12].

3.7. Antioxidant Activity

Antioxidants are compounds that can prevent or slow down the oxidation process that causes cell damage due to free radicals, namely by inhibiting activity or breaking the chain of oxidation reactions by free radicals [13]. The antioxidant activity of green tea kombucha (Table 1) produced is the more jasmine flowers added, the higher the antioxidant activity value. The increase in the antioxidant activity value of green tea kombucha is because white jasmine flowers contain phenol, flavonoid, and essential oil compounds that have the potential as antioxidant compounds [5]. In the study [10], it was stated that the increase in antioxidant activity of kombucha was due to the results of microorganism biotransformation during the fermentation process. The biotransformation process utilizes a cell's enzymes to increase certain biological activities.

3.8. Total Microbes

Based on the results of this study (Table 1), the addition of jasmine flowers had a minimal effect on the total microbial count in green tea kombucha. However, it may have slightly interfered with microbial activity involved in sugar metabolism and acid production, possibly due to the presence of alkaloids, flavonoids, saponins, and essential oils in jasmine flowers, which are known to exhibit antimicrobial properties. The

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bioactive compounds of jasmine flowers have an antibacterial effect. The content of these compounds in jasmine flowers will affect the growth and activity of microbes during the fermentation process. According to Ref. [14], several factors affect microbial growth during the fermentation process, namely nutrients, pH, water, oxygen, and compounds contained in the raw materials.

3.9. Essential Oil Compounds

The analytical method used for the analysis of essential oil compounds is GC-MS. The dominant essential oil compound found in green tea kombucha from this study is indole. Indole is an essential oil compound found in white jasmine flowers. According to Ref. [15], the content of indole compounds in jasmine flowers ranges from 6.55-17.8%. Based on the results of the study (Table 1), it can be concluded that the more jasmine flowers are added, the more the essential oil compounds in the kombucha are produced.

3.10. Sensory Test

The sensory test of green tea kombucha added with jasmine flower was conducted using a hedonic score of 1 to 5 by 30 semi-trained panelists. The hedonic score was .. 1 = very dislike, 2 = dislike, 3 = neutral, 4 = like, and 5 = very like. The results of the organoleptic test can be seen in Table 2 below.

Table 2. Sensory test results with hedonic scores for the taste, color, and aroma of the green kombucha tea produced.

Addition of Jasmine Flowers	Flavor	Color	Aroma
A (Control)	3.10 ± 0.91 a	3.85 ± 0.58	2.95 ± 0.85 a
B (0.4%)	3.30 ± 0.86 a b	3.75 ± 0.85	3.30 ± 0.92 a b
C (0.8%)	3.90 ± 0.72 d	3.70 ± 0.80	3.80 ± 1.01 b
D (1.2%)	3.75 ± 0.91 cd	3.60 ± 0.75	3.65 ± 0.93 b
E (1.6%)	3.55 ± 0.89 a b c	3.65 ± 0.81	3.50 ± 0.83 ab

The average hedonic score of the panelists' assessment showed a normal score (neutral) for liking the taste, color, and aroma. The dominant taste profile of kombucha is characterized by a balance of sourness, sweetness, and a slight astringencySour is the result of fermentation by acetic acid bacteria, sweet is caused by the remaining sugar after the fermentation process and astringent is produced by polyphenol compounds found in tea leaves and jasmine flowers, the more jasmine flowers added may affect the taste so that it decreases the panelists' assessment score, but still in the range of liking.

Color can provide its appeal to a product, the average hedonic score of the color of green tea kombucha added with jasmine flowers is a liking value, which ranges from 3.60 - 3.85 (Table 2), the color of green tea kombucha with the addition of jasmine flowers obtained from this study is golden brown which can be seen in Figure 1.

Figure 1. Green Tea Kombucha with Added Jasmine Flowers

The average aroma sensory scores of green tea kombucha with added jasmine flowers ranged from 2.95 to 3.80, indicating a range from 'neutral' to 'like'. The addition of jasmine flowers enhanced the aroma profile of the kombucha, contributing characteristic notes of honey and jasmine

The presence of essential oil compounds in jasmine flowers contributed to the distinctive aroma of the kombucha product. However, increasing the concentration of the jasmine flower did not lead to a proportional increase in panelists' preference for the aroma; their acceptance remained within the 'like' category. The highest overall sensory acceptance was observed at 0.8% jasmine flower addition, with average sensory scores of 3.80 for aroma, 3.90 for taste, and 3.70 for color (all indicating 'like'). Overall, green tea kombucha with jasmine flower addition was well accepted by panelists in terms of aroma, taste, and color across all tested concentrations.

4. CONCLUSION

The addition of jasmine flowers to green tea kombucha had a statistically significant effect on the results of pH analysis, total acid, and sugar content, but had no significant effect on the results of ethanol content analysis, antioxidant activity, total microbes, and essential oil compounds. The best treatment was the addition of 0.8% jasmine flowers, with a pH value of 3.31, total acetic acid 2.18%, ethanol content 0.36%, total sugar content 2.77%, antioxidant activity 46.14% in 1000 ppm, total microbes 5.2 x 106 CFU/ml and essential oil compounds 0.64%, and this kombucha had an average value of hedonic analysis at the liking level.

REFERENCES

[1] Kusmiyati, M., Sudaryat, Y., Lutfiah, I. A., Rustamsyah, A., & Rohdiana, D. (2015). Aktivitas Antioksidan, Kadar Fenol Total, Dan Flavonoid Total Teh Hijau (*Camellia Sinensis* (L.) O Kuntze) Asal Tiga Perkebunan Jawa Barat. *Jurnal Penelitian Teh Dan Kina*, *18*(2), 101–106.

[2] Adhy, S., Arifan, F., Mas'ud, A. K. A., Ahmad, Z., & Refi, M. (2019). Pelatihan Pembuatan Inovasi Variasi Olahan Teh Hijau, Pengujian Kandungan Flavonoid dan Antioksidan Variasi Olahan Teh Hijau di Desa Kaliprau. *Seminar Nasional Kolaborasi Pengabdian Kepada Masyarakat UNDIP-UNNES 2019*, *2008*, 354–360.

[3] Simajuntak, D., Herpandi, & Lestari, S. D. (2016). Karakteristik Kimia dan Aktivitas Antioksidan Kombucha dari Tumbuhan Apu-apu (Pistia stratiotes) Selama Fermentasi. *Jurnal Teknologi Hasil Pertanian*, *5*(2), 123–133.

[4] Tahir, M. M., Zainal, & Darma. (2017). Aktivitas Antioksidan dan Karakteristik Orgaleptik Minuman Daun Sukun (Artocarpus Altilis) dengan Penambahan Bunga Melati (Jasminum sambac Ait.). *Journal of Agritech Science*, *1*(2), 1–11.

[5] Putri, P. W., Mulqie, L., & Hazar, S. (2021). *Studi Literatur Aktivitas Antibakteri Tanaman Famili Euphorbiaceae*. *7*(2), 763–770.

[6] Hassmy, N. P., Jemmy, A., & Adithya, Y. (2017). Analisis Aktivitas Antioksidan Pada Teh Hijau Kombucha Berdasarkan Waktu Fermentasi Yang Optimal. *Pharmacon Jurnal Ilmiah Farmasi*, *6*(4), 67–74

[7] Permana, A. H., Yuliana, E., & Nurhalisa, I. A. (2021). Isolasi dan Karakterisasi Morfologi Mikroorganisme pada Proses Fermentasi Kombucha Berbahan Baku Teh Hijau (Camellia sinensis). *Warta Akab*, *45*(2), 60–65. https://doi.org/10.55075/wa.v45i2.38

[8] Suhartatik, N., Karyantina, M., & Purwanti, T. I. (2009). *Kombucha Rosella (Hibiscus sabdariffa Linn) DAN Kemampuannya Sebagai Antihiperkolesterolemia*. *29*(1), 29–35.

[9] Kusnadi, G. S., Maulana, I. T., & Sadiyah, E. R. (2021). Study Literatur Aktivitas Antibakteri Bunga Melati jasminum sambac (L) W . Ait terhadap Bakteri Saluran Cerna. *Prosiding Farmasi*, *7*(2), 102–105.

[10] Khaerah, A., & Akbar, F. (2019). Aktivitas Antioksidan Teh Kombucha dari Beberapa Varian Teh yang Berbeda. *Prosiding Seminar Nasional LP2M UNM*, 472–476.

[11] Wardhana, F. G. (2011). *Pengaruh Suhu Inkubasi Dan Lama Fermentasi Dari Teh Hitam*. 56–129.

[12] Purnami, K. I., Jambe, A. A., & Wisaniyasa, N. W. (2018). Pengaruh Jenis Teh Terhadap Karakteristik Teh Kombucha. *Jurnal Ilmu Dan Teknologi Pangan (ITEPA)*, *7*(2), 1. https://doi.org/10.24843/itepa.2018.v07.i02.p01

[13] Miryanti, Y. A., Sapei, L., Budiono, K., & Indra, S. (2011). Ekstraksi Antioksidan Dari Kulit Buah Manggis (Garcinia mangostana L.). In *Research Report - Engineering Science* (Vol. 2). https://doi.org/Bandung: Universitas Katolik Parahyangan

[14] Firdaus, S., Anissa, I., Livia, I., & Siti, A. (2020). "Review" Teh Kombucha Sebagai Minuman Fungsional dengan Berbagai Bahan Dasar Teh. *Prosding Seminar Nasional Unimus*, *3*, 715–730.

[15] Suyanti, Prabawati, S., & Sjaifullah. (2003). Sifat fisik dan komponen kimia bunga Melati jasminum officinale. *Buletin Plasma Nutfah*, *9*(2), 19–22.