



Hedonic Test and Hedonic Quality Test of Kombucha from Various Types of Indonesian Herbs

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ABSTRACT

Since the COVID-19 pandemic, people have learned the importance of consuming vitamins or supplements that boost the immune system. In fact, compounds that enhance the immune system, usually called immunomodulators, can be obtained easily around us, one of which is from TOGA (Family Medicinal Plants). Even though TOGA has been known for a long time, the utilization of TOGA still needs to be improved, even though the bioactive compounds in TOGA can be utilized, one of which is by fermenting it into kombucha. The method used in this study is quantitative and descriptive. The results of this study indicate that based on pH analysis, kombucha had a pH between 3.4 and 3.89 before fermentation. Meanwhile, after fermentation, the kombucha pH dropped to 2.89 – 3.08. The results of the hedonic test showed that curcuma kombucha had the highest average value in terms of aroma, colour, flavour, sensation of soda and overall preference. The results of the hedonic quality test showed that the preferred TOGA kombucha had a slightly pungent aroma, pale yellow colour, quite sour flavour and quite pronounced soda sensation.

Keywords: Hedonic; hedonic quality; kombucha; TOGA

ABSTRACT

Sejak pandemi Covid-19, masyarakat mulai sadar tentang pentingnya konsumsi vitamin ataupun suplemen yang dapat meningkatkan sistem kekebalan tubuh. Padahal sebenarnya senyawa peningkat sistem kekebalan tubuh atau biasanya disebut sebagai imunomodulator ini dapat diperoleh dengan mudah disekitar kita, salah satunya dari TOGA (Tanaman Obat Keluarga). Meskipun telah dikenal sejak lama, namun sampai saat ini pemanfaatan TOGA masih belum optimal, padahal kandungan senyawa bioaktif pada TOGA dapat dimanfaatkan, salah satunya dengan difermentasi menjadi kombucha. Metode yang digunakan dalam penelitian ini adalah metode kuantitatif dan deskriptif. Hasil penelitian ini menunjukkan bahwa berdasarkan analisa pH, sebelum fermentasi kombucha mempunyai pH antara 3,4 – 3,89. Sedangkan setelah mengalami proses fermentasi, pH kombucha turun menjadi 2,89 – 3,08. Hasil uji hedonik menunjukkan bahwa kombucha temulawak mempunyai nilai rerata yang paling tinggi dari segi aroma, warna, rasa, sensasi soda dan overall kesukaan. Sedangkan hasil uji mutu hedonik menunjukkan bahwa kombucha TOGA yang disukai adalah dengan karakteristik aroma agak menyengat, warna kuning pucat, rasa cukup asam dan sensasi soda cukup terasa.

Keywords: Hedonik;; kombucha; mutu hedonik; TOGA

INTRODUCTION

The Covid-19 pandemic caused by the SARS-CoV-2 virus in early 2020 caused millions of people to die. 6.75 million Indonesians had been exposed to this virus, and as many as 161 thousand Indonesian citizens were declared dead [1]. After the Covid pandemic, people became aware of good food consumption patterns [2]. During the pandemic, spending on dietary supplements increased dramatically, reaching \$220 billion in 2020 [3]. Even though the pandemic is over, people still consume vitamins or supplements that can increase their immune system [4]. Compounds that enhance the immune system can be obtained easily, one of which comes from several types of Indonesian herbs, also called TOGA (Tanaman Obat Keluarga).

TOGA are plants, commonly herbs, grown in the family's yard to independently meet the needs of traditional medicines, including ginger, Kaempferia galanga, turmeric and galangal [5]. However, the use of TOGA as a functional food still needs to be improved. Generally, TOGA is only used as herbal medicine. This medicinal herbs contains bioactive compounds such as polyphenol and essence oil. Galangal kombucha contains phenolics and glycosides [6]; lemongrass kombucha contains citral compounds and steroids [7]; curcuminoids are found in curcuma kombucha [8]; gingerol and shagaol compounds are found in ginger kombucha [9]. The bioactive compounds in these kombuchas can be used to improve the immune system because they can stimulate lymphocyte cell proliferation and increase anti-inflammatory cytokines [10].

The previous study showed that TOGA has functional properties as a source of antioxidants, anti-inflammatory, and anticancer [11]. One way to increase the bioactive compounds and the benefits of TOGA is by fermenting it into kombucha [12], making Kombucha TOGA rich in various benefits, one of which is anti-diabetic [13] and boost the immune system after the Covid-19 pandemic [14]. During the fermentation process, the content of polyphenols and antioxidants in TOGA will increase [12]. Acetic acid bacteria and yeast form biofilm on the surface of kombucha and produce metabolite compounds such as gluconic acid and glucuronic acids that reduce the pH of kombucha and increase the phenolic compound [12].

Gingerol in ginger kombucha is known to improve the immune system in mice with breast cancer [15], phenolic compounds in galangal can reduce the growth of breast cancer [16], and steroid and steroid compounds in lemongrass can increase immune cells against the SARS-CoV virus [17]. Unfortunately, research related to hedonic and hedonic quality tests on TOGA kombucha has never been reported. Hence, this study aimed to investigate the level of people's liking for TOGA kombucha.

LITERATURE REVIEW

TOGA

TOGA is a plant grown by Indonesian people around their yards, one of which is spices such as ginger, galangal, lemongrass and curcuma. These plants contain many bioactive compounds; for example, galangal contains tannins, glycosides, phenolic compounds and diterpenes [18], lemongrass contains citral, isoneral, and steroid groups [19], curcuma contains curcuminoids and sesquiterpenoids [20]. In contrast, ginger contains gingerol, shogaol and paradol [21].

Several studies have shown that TOGA fermentation can significantly increase the content of bioactive compounds and antioxidant activity [11] [22], so that it can be used as an anticancer anti-inflammatory [23] and boost the immune system after the COVID-19 pandemic [24]. By fermenting it into kombucha, symbiosis will occur by lactic acid bacteria, acetic acid bacteria and yeast [25] forming a selective environment, so that at the end of the fermentation process, bioactive compounds [26] will be produced such as organic acids [27], polyphenols and antioxidants [28] which can improve the immune system in the body, because they can increase the response of T lymphocyte cells, stimulate lymphocyte cell proliferation [14], reduce the production of pro-inflammatory cytokines and increase anti-inflammatory cytokines [29]; thus Kombucha TOGA has the potential to use as an immunomodulator after the Covid-19 pandemic.

The public can consume galangal, lemongrass, curcuma and ginger to boost the immune system after the Covid-19 pandemic. Galangal kombucha contains phenolic and glycosides. Lemongrass kombucha contains citral compounds and steroid groups, curcuminoids are found in curcuma kombucha and gingerol and shagaol compounds are found in ginger kombucha. The bioactive compounds in the four kombuchas can boost the immune system by stimulating lymphocyte cell proliferation, thereby increasing anti-inflammatory cytokines.

METHOD

This research is conducted from June 2023 to August 2023. The samples used in this study were several types of TOGAS grown in the Pasuruan area, East Java, such as galangal, lemongrass, ginger and curcuma. Commercial kombucha starter was purchased from local distributors, black tea (Tong Tji) and cane sugar (Gulaku) were bought from a local supermarket. The method used in this study is quantitative and descriptive. Chemical analysis (pH) was carried out quantitatively, while sensory descriptive analysis used organoleptic test parameters (hedonic test and hedonic quality tests), which included aroma, colour, flavour, sensation of soda and overall preference for kombucha TOGA. The research was designed using a Completely Randomized Design which involved one treatment factor consisting of 5 levels with 3 tests.

Kombucha Preparation and Analysis

TOGA infusion was mixed with 10% sugar, pasteurized at 65°C for 30 minutes, placing it in a glass jar and cooling it at room temperature. After that, this TOGA brew was inoculated with a kombucha starter (1:10 b/b) and covered with a cloth to form an aerobic atmosphere. The fermentation process was carried out at room temperature for 14 days [12]. After that, TOGA kombucha was analyzed (pH, hedonic test and hedonic quality test)

Data Analysis

The research data were analyzed statistically using the Minitab 17 program with analysis of variance (ANOVA), and if there was a difference, Tukey's test was carried out with a 95% confidence interval to determine the effect of each treatment.

RESULTS AND DISCUSSION

pH Analysis

Based on the pH analysis data (Table 1), before the kombucha fermentation had a pH between 3.4 and 3.89. Meanwhile, after fermentation, the kombucha pH dropped to 2.89 - 3.08. The results of the pH analysis showed that the TOGA-type treatment had a significant effect on the pH of the TOGA kombucha produced. The decrease in pH in kombucha tea and kombucha TOGA in this study is due to the presence of organic acids and secondary metabolites produced during fermentation. According to Jayabalan [25], during fermentation, bacteria and yeast will metabolize sucrose to produce organic acids such as acetic acid, gluconic acid and glucuronic acid. Increasing the concentration of these organic acids resulted in a decrease in the pH of the fermentation medium [30] because dissolved organic acids could release protons (H⁺), which lowered the pH [31].

Tabel 1. The Result of pH Analysis

Groups	Day-0	Day-12
Tea Kombucha	3,89 ^a ± 0,06	2,90 ^b ± 0,45
Lemongrass Kombucha	3,40 ^b ± 0,16	2,99 ^{ab} ± 0,04
Curcuma Kombucha	3,68 ^{ab} ± 0,21	2,89 ^b ± 0,08
Ginger Kombucha	3,62 ^{ab} ± 0,21	2,99 ^{ab} ± 0,02
Galangal Kombucha	3,79 ^{ab} ± 0,20	3,08 ^a ± 0,06

The Hedonic Test

The hedonic test is the most widely used test to measure the level of preference for a product. This level of preference is called the hedonic scale. Consumer acceptability scores on a 5-point hedonic scale (Scale: 1-dislike extremely; 2-dislike slightly; 3-neither like nor dislike; 4-like slightly; 5-like extremely) [32]. The hedonic scale can also be converted into a numerical scale with quality scores according to the preference level [33]. A hedonic scale in practice is used to find differences, so the hedonic test is often used to assess organoleptically for similar commodities or development products.

a. Aroma

The aroma parameters in Table 2 show that kombucha tea has the lowest average or dislike ($2.350b \pm 0.864$), while kombucha galangal has the highest score ($3.075a \pm 0.944$). The analysis of variance showed that the TOGA-type treatment significantly affected the panellists' preference level for the TOGA kombucha aroma produced. The panellist's preference level with the highest score was obtained for galangal kombucha and curcuma kombucha. The aroma of galangal kombucha and curcuma kombucha is due to the presence of organic acids formed during the fermentation process and the volatile compounds found in TOGA kombucha.

The taste that is formed during the fermentation process will be increasingly sour. This taste will affect consumer preference and acceptance of the fermented drink. The higher the organic acid content produced, the stronger the kombucha drink's taste and aroma [34].

Tabel 2. The result of hedonic for aroma

Groups	Aroma
Tea Kombucha	$2,350^b \pm 0,864$
Lemongrass Kombucha	$2,850^{ab} \pm 0,802$
Curcuma Kombucha	$3,050^a \pm 0,815$
Ginger Kombucha	$2,700^{ab} \pm 0,791$
Galangal Kombucha	$3,075^a \pm 0,944$

b. Colour

From Table 3, kombucha tea has the lowest score (2.825 ± 1.217), while curcuma kombucha has the highest score (3.650 ± 0.949). Colour plays the most role in food acceptance because, according to Winarno [35], visually, the colour determines whether the food is delicious or not. Colour also has an essential role in food acceptance. It indicates whether the mixing or processing method is good [36]. Curcuma kombucha has the highest score allegedly because curcuma contains curcuminoid compounds consisting of curcumin and desmethoxy curcumin compounds, which give a yellow colour [37]. Attractive colours will invite panellists to be more interested because the appearance of the food served can stimulate the nerves through the sense of sight to increase food appetite [35].

Tabel 3. The result of hedonic for colour

Groups	Colour
Tea Kombucha	$2,825^b \pm 1,217$
Lemongrass Kombucha	$3,050^b \pm 0,714$
Curcuma Kombucha	$3,650^a \pm 0,949$
Ginger Kombucha	$3,150^{ab} \pm 0,802$
Galangal Kombucha	$3,250^{ab} \pm 1,006$

c. Flavour

Food tastes are a combination of flavour and smell [35]. Humans recognize four basic types of flavour: salty, sour, sweet and bitter. For the flavour parameters in Table 4, tea kombucha has the lowest score ($2.200^c \pm 0.791$), while curcuma kombucha has the highest ($3.500^a \pm 0.906$). The analysis of variance showed that the TOGA-type treatment significantly affected the panelists' preference level for the TOGA kombucha aroma produced. The flavour of curcuma kombucha is caused by the presence of organic acids formed during fermentation and volatile compounds found in TOGA kombucha. The flavour that is formed during the fermentation process will be increasingly sour. This taste will affect consumer preference and acceptance of the fermented drink. The higher the organic acid content produced, the stronger the Flavor and aroma of kombucha will be [34].

Tabel 4. The Result of Hedonic for Flavour

Groups	Flavour
Tea Kombucha	$2,200^c \pm 0,791$
Lemongrass Kombucha	$2,975^b \pm 0,768$
Curcuma Kombucha	$3,500^a \pm 0,906$
Ginger Kombucha	$3,075^{ab} \pm 0,888$
Galangal Kombucha	$3,200^{ab} \pm 0,853$

d. Soda Sensation

In Table 4, the soda sensation parameters show that kombucha tea has the lowest average or dislike ($2.625^a \pm 1.005$). The sensation of soda or a taste like soda water can arise from a reaction between carbonate and acid, forming CO₂ [34]. In contrast, galangal kombucha has the highest score ($3.075^a \pm 0.971$). The analysis of variance showed that the TOGA-type treatment significantly affected the panellists' preference level for the TOGA kombucha soda sensation produced.

The soda sensation in kombucha is because it uses symbiotic colonies of bacteria and yeast called SCOBYs to produce the slightly alcoholic, slightly sour drink often enjoyed for its sour taste like soda. The symbiosis of these microorganisms will break down the sugar in the tea and release probiotic bacteria. Once fermented, the symbiosis produces carbonated kombucha, leaving a bubbly and fizzy tea.

Tabel 4. The result of hedonic for soda sensation

Groups	Soda Sensation
Tea Kombucha	$2,625^a \pm 1,005$
Lemongrass Kombucha	$2,850^a \pm 0,864$
Curcuma Kombucha	$3,025^a \pm 0,974$
Ginger Kombucha	$2,925^a \pm 0,917$
Galangal Kombucha	$3,075^a \pm 0,971$

e. Overall Acceptance

The overall acceptance results in Table 6 show the average value of the panellists ranging from 2.350 (dislike slightly) to 3.425 (neither like nor dislike). The highest average value was obtained from the curcuma kombucha treatment, while the lowest was obtained from the tea kombucha treatment. Overall acceptance indicated that the panellists received kombucha with various variations. The analysis of variance showed that the TOGA-type treatment significantly affected the panelist's preference level for the overall preference of the resulting TOGA kombucha. Curcuma kombucha is the most preferred type of TOGA kombucha because, based on the characteristics of the raw material, curcuma rhizome has a pleasant smell with a distinctive aroma.

In addition, it contains curcuminoid compounds, which provide striking and attractive colours to the panellists.

Tabel 6. The result of hedonic for overall acceptance

Groups	Overall Acceptance
Tea Kombucha	2,350 ^b ± 0,736
Lemongrass Kombucha	3,150 ^a ± 0,921
Curcuma Kombucha	3,425 ^a ± 0,844
Ginger Kombucha	3,200 ^a ± 0,791
Galangal Kombucha	3,175 ^a ± 0,874

Hedonic Quality Test

The quality of a food product is the overall characteristics that distinguish one product unit from another and determine whether or not the product unit is acceptable to consumers. In addition, the quality of a food product also determines the level or degree of excellence. The impression of hedonic quality is more specific than just an impression of like or dislike, such as the colour scales from dark, moderate or maybe pale. The number of scale levels also varies depending on the desired quality range and sensitivity between scales [33].

a. Aroma

Table 7 shows that galangal has the lowest score (2.850b ± 1.027) or has a non-stinging aroma, while kombucha tea has the highest score (4.375a ± 0.868) or has a strong aroma. The aroma contained in kombucha tea is due to the presence of organic acids and the aroma generated by the tea leaves. The aroma in kombucha tea is also caused by volatile compounds, including alcohol, acetic acid, and organic acids, giving rise to a distinctive sour aroma [38].

Tabel 7. The result of hedonic quality test for aroma

Groups	Aroma
Tea Kombucha	4,375 ^a ± 0,868
Lemongrass Kombucha	3,225 ^b ± 1,050
Curcuma Kombucha	3,000 ^b ± 1,038
Ginger Kombucha	3,000 ^b ± 1,109
Galangal Kombucha	2,850 ^b ± 1,027

b. Colour

The Colour of TOGA kombucha is classified into five scales, ranging from white, yellowish white, pale yellow, very dark yellow to dark brown. The colour parameters in Table 8 show that lemongrass kombucha and ginger kombucha have the lowest score (2.675c ± 0.764) or have a yellowish-white colour. In contrast, kombucha tea has the highest score (5.000a ± 0.000) or has a dark brown colour. Tea plants contain phenol compounds, with catechin compounds as the most significant substance. Tea products undergo an enzymatic oxidation process by polyphenol oxidase enzymes, thereby changing the catechin levels [39]. The polyphenol oxidase enzyme will convert catechin compounds, including epicatechin, epigallocatechin, epicatechin gallate, and epigallocatechin gallate, into four types of theaflavin and thearubigin compounds. Theaflavin influences astringency, brightness, and briskness, while thearubigin influences colour, strength, and mouthfeel [40].

Tabel 8. The result of hedonic quality test for colour

Groups	Colour
Tea Kombucha	5.000 ^a ± 0,000
Lemongrass Kombucha	2,675 ^c ± 0,764
Curcuma Kombucha	3,225 ^b ± 0,891
Ginger Kombucha	2,675 ^c ± 0,829
Galangal Kombucha	3,025 ^{bc} ± 0,832

c. Flavour

Table 9 shows the flavour parameters with the lowest score for curcuma kombucha (3.425c ± 0.958) or a non-sour taste, while tea kombucha has the highest score (4.800a ± 0.4641) or a sour taste. Research by Zubaidah [41] stated that kombucha tea has a strong sour taste because yeast and bacteria metabolize sucrose and produce many organic acids, such as acetic, glucuronic, and gluconic acids.

Table 9. The result of hedonic quality test for flavour

Groups	Flavour
Tea Kombucha	4,800 ^a ± 0,4641
Lemongrass Kombucha	3,900 ^b ± 0,632
Curcuma Kombucha	3,425 ^c ± 0,958
Ginger Kombucha	3,875 ^{bc} ± 0,853
Galangal Kombucha	3,875 ^{bc} ± 0,757

d. Soda Sensation

In the parameter sensation of kombucha soda, lemongrass and curcuma kombucha had the lowest average (3.575b ± 0.958), or the sensation of soda was quite pronounced. In contrast, kombucha tea had the highest average (4.225a ± 1.121), or the sensation of soda was intense.

Tabel 10. The result of hedonic quality test for soda sensation

Groups	Soda Sensation
Tea Kombucha	4,225 ^a ± 1,121
Lemongrass Kombucha	3,575 ^b ± 0,958
Curcuma Kombucha	3,575 ^b ± 1,059
Ginger Kombucha	3,825 ^{ab} ± 0,958
Galangal Kombucha	3,675 ^{ab} ± 1,023

CONCLUSION

The results of this study indicate that based on pH analysis, kombucha had a pH between 3.4 and 3.89 before fermentation. Meanwhile, after undergoing the fermentation process, the kombucha pH dropped to 2.89 – 3.08. The results of the hedonic test showed that curcuma kombucha had the highest average value in terms of aroma, Color, flavour, sensation of soda and overall preference. The results of the hedonic quality test showed that the preferred TOGA kombucha had the characteristics of a slightly pungent aroma, pale yellow Color, quite sour flavour and quite pronounced soda sensation.

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