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Organoleptic Test of Kombucha Made from Various Tea Sources and Fermentation Time

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Abstract

Background: This research aims to find the best mixture of kombucha that can accept by the community in BTN Pa'jukukang, Bantaeng district. Kombucha is a fermented beverage made from tea and sugar mixed with the kombucha culture. A kombucha culture is a mixture of bacteria and yeast designated as SCOBY in this work. **Methods:** In this research, kombucha was made from 4 various teas, i.e., black tea, green tea, oolong tea, and white tea. Each tea was fermented for 7 and 14 days. The kombucha tea samples were subjected to an organoleptic test based on the consumer's acceptance level. The organoleptic test data were analyzed using the hedonic and score test. **Results:** The test showed that respondents preferred to choose the color, smell, and taste of the black kombucha tea, which was fermented for seven days. **Conclusions:** Furthermore, the observation of the physical characteristics of the tea showed that the longer the fermentation time, the more acidic the kombucha. This acidic kombucha resulted from the decreasing sugar level during fermentation due to the activity of bacteria and khamir in the SCOBY.

Keywords: Kombucha; SCOBY; Organoleptic Test; Hedonic; Fermentation.

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Introduction

Kombucha is a well-known fermented beverage that is spread in many countries. As a result, kombucha has many names depending on the place, such as dipo fungus, cha, fungus tea, fermented tea, manchurian tea, etc. (Chakravorty et al., 2016). This beverage has become a daily drink for some regular consumers.

Kombucha is made from tea liquid and sugar mixed with a kombucha starter containing bacteria and yeast (Wistiana & Zubaidah, 2015). SCOBY (symbiotic Culture of Bacteria and Yeast) is the name given to a mixture of bacteria and yeast. SCOBY plays a role in the kombucha fermentation process and changes the physical and chemical characteristics. Following fermentation, kombucha liquid is produced, which is acidic and high in chemical constituents such as organic acids, vitamins, and minerals (Tran et al., 2020). The sour characteristic of the kombucha makes the contaminant hard to grow. This situation makes traditionally home-based industries can produce kombucha without any concern of pathogenic risk to health. Moreover, the organic compounds in kombucha can act as antioxidant compounds that are very good for health.

The free phenolic created during the fermentation process increases antioxidant activity in kombucha tea, so the more phenolic content produced, the higher the antioxidant activity (Suhardini & Zubaidah, 2016). In addition, kombucha is also known as a fermented drink with many health functions. Kombucha is confirmed to contain antibacterial compounds that can fight various types of pathogenic bacteria (Vitas et al., 2018). With this ability, drinking kombucha has been considered to have several potential

health benefits.

Microbial activity in kombucha fermentation causes several characteristic changes, both physical and chemical. From a biological point of view, changes in color, aroma, taste, and smell can be observed. The decrease in the pH value indicates that the kombucha fermentation is running. From a chemical perspective, there may be an increase in the composition and amount of chemical compounds that are important for the health of the human body. Danielle St-Pierre (2019) said that the level of acceptance of kombucha taste for consumers is different for each person, including how consumers describe the taste of kombucha in the form of words. In this study, St-Pierre found that several terms describe the taste of kombucha, including vinegar, sour, and bubbly flavor notes.

Generally, tea is used as a primary ingredient in making kombucha. Along with the exploration carried out by several researchers, it is known that the investigation of the essential elements of kombucha is very wide open. Several types of leaves are known to be used as crucial ingredients for making kombucha, such as coffee leaves, bay leaves, and soursop leaves (Suhardini & Zubaidah, 2016). However, kombucha is not notably recognized in some regions of Indonesia, such as the Bantaeng district, South Sulawesi, and especially in BTN Pa'jukukang. Initial observations were carried out to evaluate the residents' familiarity with kombucha, and it was discovered that they did not. This study aimed to determine the level of public acceptability of kombucha. This study used various teas as the essential ingredients for making kombucha.

Method

This research was an experimental study that explores new essential ingredients that can be used in making kombucha. Four types of tea were used: black, green, white, and oolong. In the fermentation process, two kinds of fermentation time were used: seven days and 14th days. Sterile equipment and the work environment were ensured during the kombucha tea production. The fermentation container was clear glass. Three liters of boiling water and five bags of tea (10 g) were mixed and stirred for 5 minutes. Then 300 gr of sugar was added and stirred thoroughly. Next, the tea liquid was filtered, put into the fermentation container, and cooled. As much as ten wt % of kombucha starter and the SCOBY were added. The kombucha starter was obtained from the previous fermentation of the kombucha itself. Next, two layers of tissue were placed over the container's mouth and secured with a rubber band. The fermentation system was placed in a dark glass cabinet and harvested on the 7th and 14th days.

The organoleptic test was carried out the following the Indonesian National Standard (SNI) 01-2346-2006 related to the instructions for organoleptic and sensory difficulties. Based on these standards, the tested samples were given to 30 non-standard panelists aged 20-60 years and carried out at 09.00–11.00 am. Respondents were asked to fill out a questionnaire in the form of a statement table regarding the color, aroma, and taste of the resulting kombucha samples. Furthermore, the questionnaire data were analyzed using hedonic test analysis and score tests.

Nine levels of preference were used for each criterion tested, i.e., Very much Dislike, Very Dislike, Dislike, Slightly Dislike, Neutral, Slightly Like, Like, Very Like, and Very Much Like. The quality value was produced by determining the average result for each respondent at the 95 percent confidence level using the data from the evaluation sheet. The following formula was used to calculate each sample's organoleptic value (Badan Standardisasi Nasional, 2006).

$$P\left(\bar{x} - \left(1{,}96 \cdot \frac{s}{\sqrt{n}}\right)\right) \leq \mu \leq \left(\bar{x} + \left(1{,}96 \cdot \frac{s}{\sqrt{n}}\right)\right) \cong 95\%$$

$$\bar{x} = \frac{\sum_{i=1}^{n} x_i}{n}$$

$$S^2 = \frac{\sum_{i=1}^{n} (x_i - \bar{x})^2}{n}$$

$$s = \sqrt{\frac{\sum_{i=1}^{n} (x_i - \bar{x})^2}{n}}$$

Information:

n = The number of panelists;
S^2 = The diversity of quality values;
1.96 = The standard deviation coefficient at the 95% level;
x = The average quality value;
x_i = The quality value of the panelist, where i = 1,2,3.....n;
s = The standard deviation of the quality value.

Result and Discussion

Kombucha is a fermented beverage that has excellent health benefits. The activity of a bacteria and yeast combination known as SCOBY causes the fermentation to take place. As a primary material, various kinds of leaves can be used which have a relatively high antioxidant content, such as coffee leaves, bay leaves, cocoa leaves, etc. However, the essential ingredients most often used are fresh and processed tea leaves (tea bags or powder).

It is generally acknowledged that not every new type of food can be accepted by a community. The organoleptic test is an approach to test type food acceptability in a community. The standard testing criteria include color, aroma, and taste. In an organoleptic test, there is an assessment to level people's preference for a particular type of food (Kusdiana et al., 2020). In this research, the representative illustrations of the kombucha fermentation process, i.e., for black tea, are presented in Figure 1. The following passage shows the results for each testing criterion.

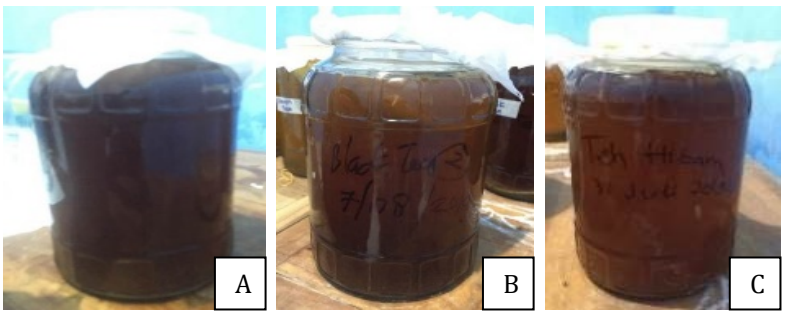

Figure 1. Black Tea Kombucha Fermentation Process; A. 0 days, B. 7 days, C. 14 days (Source: Personal Documentation)

Color

Figure 2. presents the hedonic test value of color. Both for 7th and 14th days of fermentation, black kombucha tea exhibits the highest hedonic value, while white kombucha tea has the lowest. It means the color of food significantly affects the level of consumer acceptance. Respondents prefer the light color other than the dark color because it seems to be more interesting. In Figure 1., it can be noticed that the longer the kombucha ferments, the lighter the color becomes. According to Wistiana & Zubaidah (2015), this color change occurs due to changes in physical and chemical

characteristics. It is well known that the longer the fermentation period, the lower the pH of kombucha (Hassmy & Abidjulu, 2017; Khaerah & Akbar, 2019). This change in pH affects the interpretation of color in kombucha after fermentation. Furthermore, it was said that, in addition to the effects of the primary ingredients, the longer the fermentation time, the brighter the color of the kombucha tea (Nurikasari et al., 2017).

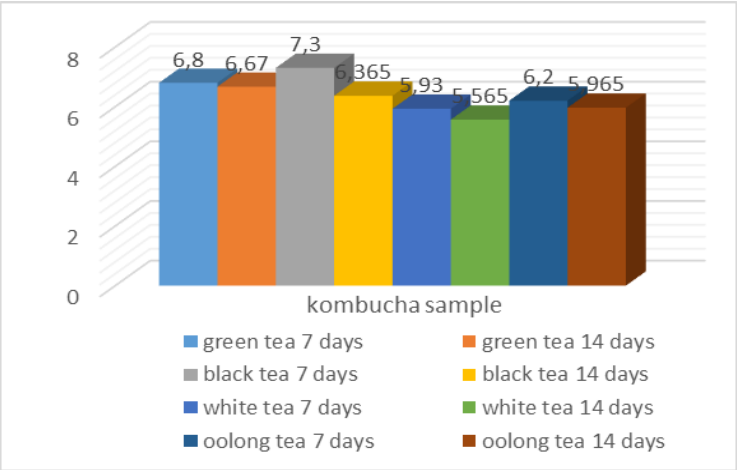

Figure 2. Graph of Hedonic Test Value of Color

There was a reduction in pH and a rise in chemical compounds during fermentation. This, of course, can affect the color of the kombucha. Figure 2. showed that the panelists' favorite color was kombucha, prepared with black tea and fermented for seven days. This is in line with the research results of Kusdiana et al. (2020), which said that panelists liked the color of kombucha, which was light in color and usually obtained from kombucha with tea-based ingredients.

Aroma

Figure 3. shows the hedonic test value of aroma. Along with the color test, respondents also prefer black kombucha tea with seven days of fermentation, while the lowest hedonic test value was white kombucha tea with 14th days of fermentation. Kombucha is made by fermentation, so the aroma produced is very diverse. A fermentation beverage has a specific fragrance that increases with the fermentation time. Another reason that affected kombucha's scent was the organic compound that formed during the fermentation.

The longer the fermentation time, the richer the kombucha will be with beneficial organic compounds. Jayabalan et al. (2014), said that the number and types of organic acids produced will increase as the fermentation time increases. Organic acids such as acetic acid, gluconic acid, glucuronic acid, and a variety of others are produced as a result. Various organic compounds' presence is what causes kombucha's aroma to be different. Gramza-Michałowska et al. (2016), discovered a significant change in smell after the kombucha fermentation was completed. The original scent of the base ingredients is wholly obscured. According to panelist observations, there was at least a citrus, sweet, sour, typical fermenting aroma and an unidentified smell felt during sampling.

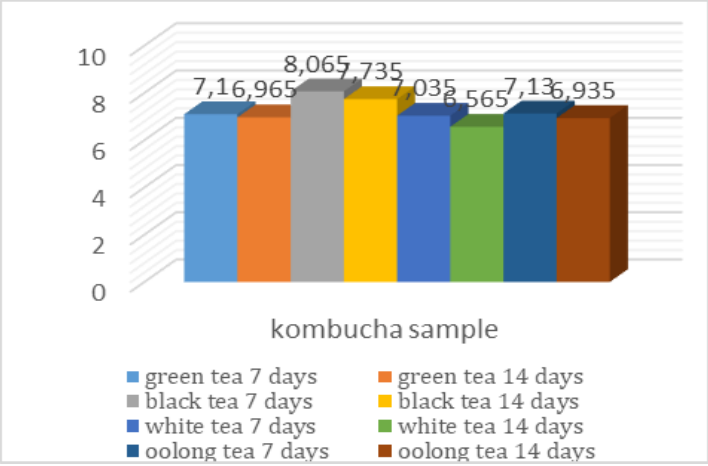

Figure 3. Graph of Hedonic Test Value of Aroma

Taste

Figure 4. shows the hedonic test value of taste. Taste is one of the determinants of the level of consumer acceptance of a food ingredient. From the average hedonic test results related to taste, there is a significant difference in the level of acceptance of the panelists. It can be seen that the seven days fermentation kombuchas have the highest value of all kombucha atea sources. The seven days fermentation kombucha has a sweeter taste than the 14th days fermentation because the fermentation process causes the increase of sour taste.

The chemical content of kombucha changes during the fermentation process, as detailed in the previous section. In addition to affecting the aroma, it has much to do with the taste of kombucha. One thing that plays a role in the taste of kombucha is the basic ingredients used. Because it uses different essential elements, the final result of the kombucha taste will also be different (Vitas et al., 2018). Wang et al. (2020) discovered that the panelists stated that kombucha had a vibrant like in the organoleptic taste test results. Tea's primary flavor remains slightly pronounced, with various sour, bitter, umami, and aftertastes. In line with this Ivanišová et al. (2020), found in the kombucha sensory test that the panelists liked the taste of kombucha, with a fruity-sour flavor dominating.

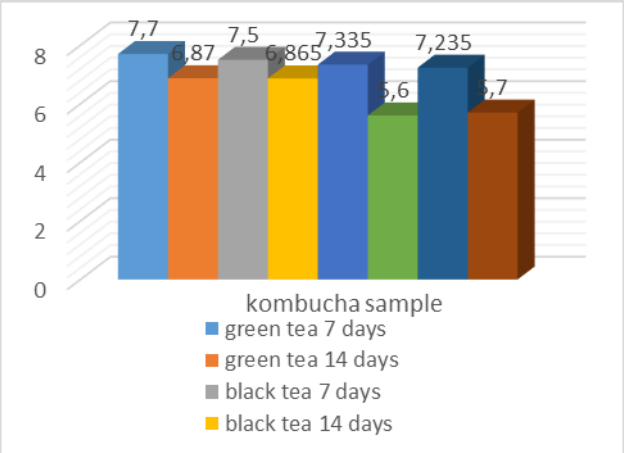

Figure 4. Graph of Hedonic Test Value of Taste

Score test

The score test was carried out as the last part of the organoleptic test detailing the results in the previous three sections. In Figure 5. can be seen that from all the samples tested, the panelists most liked kombucha made from black with a fermentation time of 7 days.

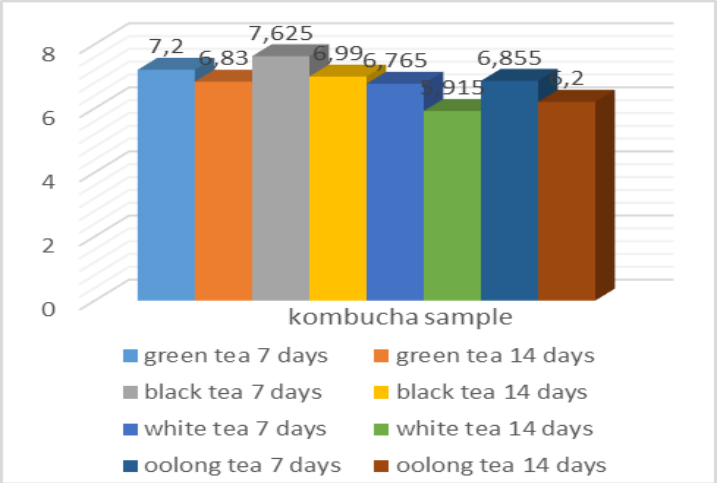

Figure 5. Graph of Score Test

This is in line with the results obtained by Habibah & Mahadi (2017) that panelists prefer the color, aroma, and taste of kombucha made from black tea. The production of fermented foods is hazardous and susceptible to failure; numerous conditions must be met during manufacturing. The microbial composition in the fermentation process also significantly impacts the quality of the fermented product. The effect of growth factors on microbial growth must be considered when determining growth factors in the fermentation process. This will also significantly impact the organoleptic test results of fermented foods like kombucha (He et al., 2020).

Tea is given a carbohydrate source as sugar (sucrose) in the fermentation process. Furthermore, yeast will divide sucrose into fructose and glucose. Glucose will be transformed into gluconic acid, while fructose will be converted to various organic acids. Moreover, the glucose and fructose produced will be fermented by yeast into ethanol, which bacteria will oxidize to make acetic acid (Jayabalan et al., 2014; Essawet et al., 2015).

In addition, yeast uses glucose for cell metabolism to produce ethanol and CO_2. Ethanol will then be oxidized by Acetobacter to acetic acid. So the increase in total kombucha acid levels continued until the 14th day of observation (Sreeramulu et al., 2000; Villarreal-Soto et al. (2018). The formation of these compounds is also influenced by the essential blends possessed by the vital ingredients for making kombucha. The presence of various organic compounds causes the aroma of kombucha to be different. Kombucha's antioxidant effect is aided by the chemical compounds found in the tea. Khaerah & Akbar's (2019) research indicated that the longer the fermentation period, the more antioxidant activity kombucha has. The total amount of acid generated is inversely proportional to this.

Kombucha can be used as a functional food to improve body health because of its different organic components. However, consumption of this kombucha must consider the general rules because it can be harmful if too much. Nevertheless, kombucha can be used daily to replace soft drinks with various health benefits and therapeutic properties it contains (Watawana et al., 2015).

Conclusions

Kombucha is a fermented beverage that has excellent health benefits. The activity of a bacteria and yeast combination known as SCOBY causes the fermentation to take place. As a basic material, various kinds of leaves can be used which have a relatively high antioxidant content, such as coffee leaves, bay leaves, cocoa leaves, etc. However, the essential ingredients most often used are fresh and processed tea leaves (tea bags or powder).

Declaration statement

The authors reported no potential conflict of interest.

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