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Effect of Initial Brewing Temperature on Color Intensity and Sensory Evaluation of Black Rice Bran Tea

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Abstract: The brewing temperature will affect the organoleptic, physical, and chemical characteristics of brewing tea. The brewing time affects the dissolved material content, colour intensity, and aroma. The purpose of this study was to determine the effect of the initial brewing temperature on colour intensity and the sensory characteristics of black rice bran tea and determine the initial brewing temperature most preferred by consumers to produce black rice bran tea. The experiment in this study used a completely randomized design for colour intensity tests and organoleptic tests. The influencing factor in this research is the initial brewing temperature which consists of 5 levels, namely 60^{o}C, 70^{o}C, 80^{o}C, 90^{o}C, 100^{o}C. The variables analyzed were colour intensity systems L*, a*, b* and sensory evaluation. The results showed that the initial temperature treatment significantly affected brightness level (L*), redness level (a*), yellowness level (b*), and the sensory test. The initial temperature treatment of 90^o C is the most preferred treatment by consumers to produce brewed black rice bran tea with sensory evaluation characteristics of brightness level (L*) 46.10±0 .65, level of redness (a*) 21.19±0.10, level of yellowness (b*) 30.54±0.24 and 6.60±0.50 (like to very like).

Keyword: Black rice bran tea, initial brewing temperature, colour intensity and hedonic test.

Introduction

Tea is consumed in the form of a drink by brewing it at a certain temperature and time. Brewing temperature and time will affect the organoleptic, physical and chemical characteristics of brewing tea [1].The tea brewing process is influenced by water temperature, brewing conditions, brewing time, and water quality. The higher the temperature of the water used in the brewing process, the higher the water's ability to extract the chemical content contained in the tea [2]. The brewing time affects the dissolved material content, colour intensity, and aroma. The longer the brewing time, the longer the chance of contact between the brewing water and the tea. The extraction process becomes perfect, and the total polyphenol content increases to a certain extent with the amount of solute, or the desired compound has been exhausted in the material.

Research conducted by Ramlah [3]stated that the optimum temperature and time for brewing green tea is 85^{0}C and 5 minutes, with the characteristics of caffeine at 1.239% and tannins at 3.506%. Somantri [4] showed that the temperature and time of brewing white tea at 95^0 C and brewing time of 9 minutes produced the highest polyphenols at 6.01%,and the most effective IC_{50} DPPH is 34.41ppm. The yield and antioxidant activity in brewing tea increased along with the increase in brewing temperature and brewing time.The best brewing of green tea was obtained at a brewing temperature of 95^0 C with a brewing time of 20 minutes [5]. According to Haras et al. [6], the results of testing the preference level of binahong leaf tea with the taste, aroma, and colour preferred by the panellists were samples with a brewing temperature 100^0 C and a brewing time of 7 minutes. Dewata et al. [7] stated that the best treatment results on avocado leaf tea were treated with a temperature of 100^{o}C and a brewing time of 5 minutes with sensory characteristics of a brownish-green colour, the preferred aroma was somewhat uncharacteristic of avocado leaf herbal tea, in terms of a slightly bitter taste, as well as good overall acceptancewell received.

Rice bran is a by-product of milling paddytorice. The milling process produced rice as much as 60-65%, rice bran as much as 8-12% and the remaining 23% is rice husk. In the past, people considered that rice bran was less useful and was known as waste used for low-quality animal feed [8]. The epidermis and endosperm in black rice contain high-intensity anthocyanins so that the colour of the rice becomes dark purple close to black. Anthocyanins are a class of organic chemical compounds that can dissolve in polar solvents and are responsible for giving orange, red, purple, blue, to black colours in higher plants such as flowers, fruits, seeds, vegetables, and tubers [9].

Research by Wartini et al. [10] showed that the best treatment to produce black rice bran dye extract was the ratio of ingredients to solvents 1:10 and pH 3, with yield characteristics of 9.45%, anthocyanins 596.94 mg/l, polyphenols 810.56 mg GAE/100 g, and colour (L* 51.53, a* 26.93, b* 42.13). Pitija et al. [11] found cyanidin-3-O-glucoside and peonidin-3-O-glucoside levels between 16.01–34.40 and 2.43–7.36 lg/ml^{-1} were the most abundant anthocyanins in black rice bran. Black rice bran extract showed strong antiproliferative activity, with IC_{50} values of 148.6 and 119.2 mg/mL against MCF-7 and MDA-MB-231 cells [12]. The current utilization of rice bran is not only used as animal feed but can also be used as flour, natural dyes and can also be used as bran tea.

This tea is a new product on the market, so research is needed on the right brewing temperature to get tea that is accepted by consumers. This study aims to determine the effect of the inisial brewing temperature on the black rice bran teaon colour intensity and sensory assessment and determine the best initial temperature to get the most preferred tea by consumers.

Materials and Methods

Materials and equipment

The materials used in this study were bran (fine bran) from black rice varieties obtained from a rice milling factory in Bengkel Village, Kediri District, Tabanan Regency, Bali and aquadest.

The tools used in this study were a colour reader, electric kettle for the water heater (Arashi), sample bottle, magnetic stirrer, thermometer, filter paper, analytical balance (Shimadzu), beaker glass (Pyrex), aluminium foil, label paper, 100 ml cup, questionnaire, and stainless steel spoon.

Research design

This study used a completely randomized design with an initial brewing temperature treatment of black rice bran tea consisting of 5 levels, namely (100º C), (90º C), (80º C), (70º C), and (60º C). Each treatment was carried out 3 times based on the processing time so that 15 experimental units were obtained.

Methods

Sample preparation begins with taking black rice bran obtained at a grain mill in Tabanan Regency. The black rice bran obtained was then sorted. The next stage was roasted using the oven drier at 190^{0}C for 10 minutes with a reversal process in the first 5 minutes. The next process was the cooling process to obtain black rice bran tea. This process followed the research conducted by Dewi et al. [13]. The black rice bran tea was then weighed as much as 2 grams and then brewed with the initial water temperature according to the treatment as much as 100 ml. The brewing was carried out using a magnetic stirrer for 9 minutes and then filtered using filter paper to obtain the brewed black rice bran tea. The filtering resultswere stored for 5-10 minutes until the temperature reaches 35^0 C - 40^0 C, and the brewed black rice bran tea was ready to be analyzed.

Observation and Analysis

Variables observed in black rice bran tea were sensory evaluation [14] and colour intensity, namely brightness (L*), redness (a*), and yellowness (b*) [15].

Data analysis

The data obtained in this study were analyzed using variance (ANOVA) using the Minitab 18 software. If there was an effect of treatment on the observed variables, it was continued with the Tukey test.

Results and Discussion

1. Color Intensity (L*, a*, b*) Black Rice Bran Tea

a. Brightness Level (L*)

The result showed that the initial brewing temperature treatment had a very significant effect (P<0.01) on the brightness level of brewing black rice bran tea. The brightness level value (L*) represents the dark to light level with a range of 0-100. The average value of the brightness level of steeping black rice bran tea can be seen in Fig. 1.

Fig. 1 showed that the average value of the highest brightness level was obtained from the initial temperature treatment of 60^{0}C with an average value of 64.38±0.31. At the same time, the average value of the lowest brightness level was obtained from the initial temperature treatment of 100^{0}C with an average value of

39.04±0.92. Therewere a decrease in the brightness level of brewing black rice bran tea with increasing brewing temperature.At a temperature of100^0 C, the compounds in black rice bran tea dissolved more completely than at other temperatures and produced the darkest tea colorRohdiana et al. [16] showed that the higher the brewing temperature would affect the colour intensity. Putra et al. [17] showed that the initial brewing temperature and brewing time affect the brightness level of silver needle tea. Brewing at a temperature of 95º C had the darkest appearance.

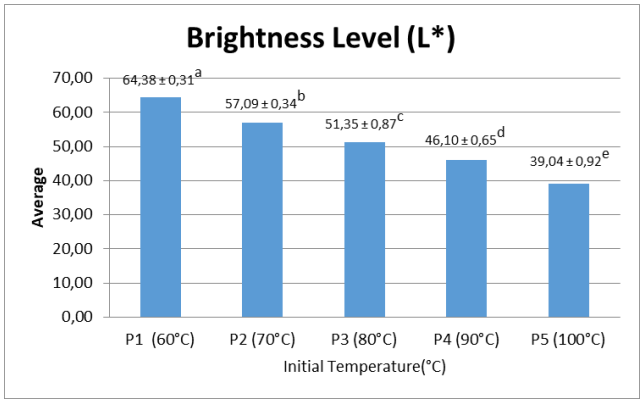

Fig. 1. The average brightness level (L*) of black rice bran tea

b. Redness Level (a*)

The result showed that the initial temperature treatment had a very significant effect (P<0.01) on the redness level of black rice bran tea. The a* value indicates the colour trend from green to red with a value range of -100 to +100. The average of redness level of black rice bran tea can be seen in Fig. 2.

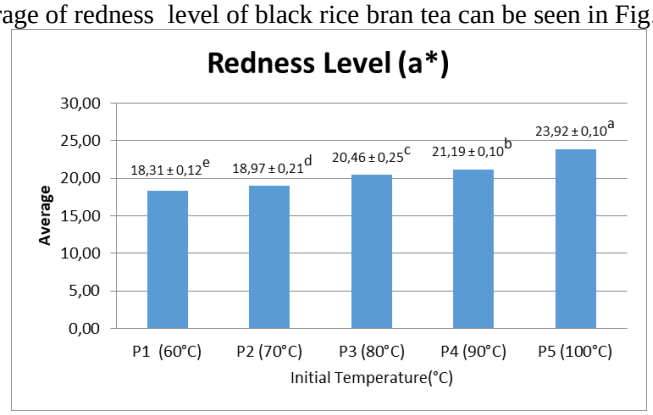

Fig. 2. The average redness level (a*) of black rice bran tea.

Fig. 2 showed that the average value of the highest level of redness was obtained from the initial temperature treatment of 100^0 C with an average value of 23.92±0.10. At the same time, the average value of the lowest level of redness was obtained from the initial temperature treatment of 60^0 C with an average value of 18.31±0.12.

Fig. 2 shows that the average value of the highest level of redness was obtained from the initial temperature treatment of 100ºC with an average value of 23.92±0.10. While the average value of the lowest level of redness was obtained from the initial temperature treatment of 60º C with an average value of 18.31±0.12.Black rice bran has a high anthocyanin content, which is 596.94 mg/l (Wartini et al. 2020). Anthocyanins are soluble in water. The high initial brewing temperature (100º Celsius) is able to open and damage the pores of the bran so that the color that appears in the tea becomes dark red. The research of Putra et al (2020) showed that silver needle tea brewed at 95º Celsius had the redder color compared to that brewed at 75º C.

c. Yellowness Level (b*)

The result showed that the initial temperature treatment and brewing time had a very significant effect (P<0.01) on the yellowish level of brewing black rice bran tea. The yellowness level value (b*) represents the blue to yellow colour level with a range of -100 to +100. The greater the value of b* indicates the tendency of the colour to be more yellow. The average value of the yellowish level of steeping black rice bran tea can be seen in Fig. 3.

Fig. 3 showed that the lowest average yellowness level was obtained from the initial temperature treatment of 60º C with an average value of 28.27±0.05 and was not significantly different from the initial temperature treatment of 70º C. While the average value of the highest yellowness level was obtained from the initial temperature treatment of 100º C with an average value of 32.34±0.51.Anthocyanins are a group of phenolic compounds, that have a spectrum of red, purple, and blue colors and found in vacuoles in cells (Wartini et al 2020). In the research of Putra et al. (2020) showed that at 75º C the color of the silver needle tea was the most yellow.

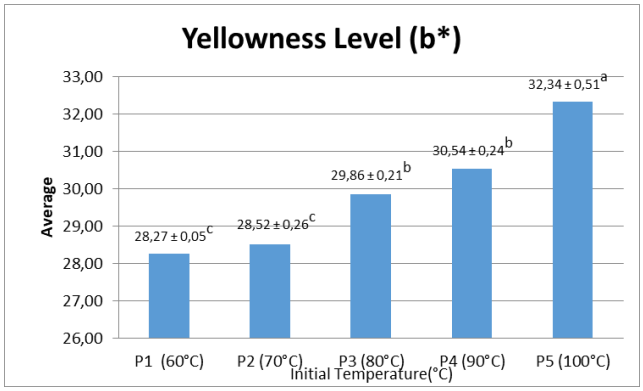

Fig. 3. The average yellowness level (b*) of black rice bran tea.

2. Sensory evaluation

The result showed that the initial brewing temperature treatment had a very significant effect (P⩽0.01) on the sensory evaluation of brewing black rice bran tea. The average score of the panel lists on the sensory test of brewing black rice bran tea can be seen in Fig. 4.

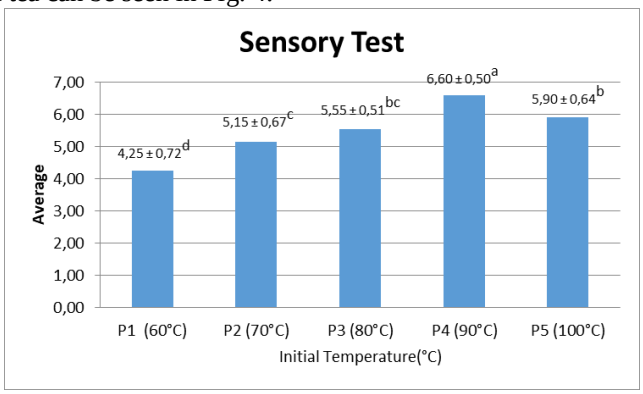

Fig. 4. Graph of The average score of panellists on the sensory test of brewing black rice bran tea
Note: Score 1= Very dislike, Score 2= Dislike, Score 3= Slightly dislike, Score 4= Neutral, Score 5=Slightly like, Score 6= Like, Score 7= Very much like

Fig. 4 showed that the highest average value obtained from the initial temperature treatment of 90^0C, namely 6.60±0.50 (like to very like). The lowest average value was obtained from the initial temperature treatment of 60^0 C, namely 4.25±0.72 (neutral to slightly like). The average value of the overall acceptance test of silver needle white tea steeping was between 4.25 ± 0.72 - 6.60 ± 0.50 with the criteria of neutral to very like. The initial temperature treatment of 90^0 C was the most preferred product by the panellists based on the colour, taste and aroma.

Conclusion

Based on the discussion above, it can be concluded several things as follows:

1. The interaction of the initial brewing temperature treatment had a very significant effect on the level of brightness (L*), level of redness (a*), and level of yellowness (b*), and very significant effect on sensory evaluation.
2. The initial temperature treatment of 90º C is the most preferred treatment by consumers to produce brewed black rice bran tea with sensory evaluation characteristics of brightness level (L*) 46.10±0 .65, level of redness (a*) 21.19±0.10, level of yellowness (b*) 30.54±0.24 and 6.60±0.50 (like to very like).

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