

DEVELOPMENT OF SPECIALTY ROBUSTA COFFEE WITH *Saccharomyces cerevisiae* FERMENTATION TO IMPROVE COFFEE QUALITY

Pengembangan Kopi Robusta Specialty dengan Fermentasi Saccharomyces cerevisiae untuk Meningkatkan Mutu Kopi

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ABSTRAK

Kopi robusta merupakan salah satu komoditi hasil perkebunan yang mempunyai peran cukup penting dalam kegiatan perekonomian di Indonesia. Kopi menjadi salah satu komoditas ekspor Indonesia yang cukup penting sebagai penghasil devisa negara. Indonesia tercatat sebagai produsen kopi keempat terbesar setelah Brazil, Vietnam, dan Kolombia. Namun pada pasar ekspor kopi Indonesia masih di urutan kesembilan. Penanganan pascapanen kopi ditingkat petani, pada umumnya menghasilkan kopi asalan dengan mutu rendah. Oleh karena itu, sangat perlu ditingkatkan mutunya untuk menaikkan daya saing di pasar internasional. Salah satu alternatif yang di pandang efektif yaitu perbaikan proses pengolahan untuk menghasilkan kopi robusta menjadi kopi robusta *specialty*. Penelitian ini bertujuan untuk menentukan konsentrasi starter ragi terbaik dan menentukan waktu fermentasi terbaik untuk menghasilkan specialty coffee berupa kopi robusta *specialty*. Penelitian ini menggunakan dua faktor, yaitu konsentrasi ragi dengan menggunakan *Saccharomyces cerevisiae* yang meliputi tiga taraf (2%; 3%; 4%) dan waktu fermentasi dengan 3 taraf yaitu 8, 10, dan 12 jam. Pengulangan dilakukan tiga kali. Variabel respon yang diamati adalah pH dan suhu selama fermentasi, presentase biji tidak terkupas, mutu fisik kopi beras, densitas kopi beras, peningkatan volume sangrai, dan mutu cita rasa. Data dianalisis menggunakan Analysis of Varians (ANOVA) dengan tingkat kepercayaan 5% jika hasil ANOVA menunjukkan perbedaan yang signifikan, dilanjutkan dengan Duncan Multiple Range Test (DMRT). Hasil terbaik pada perlakuan R3F3 (konsentrasi 4% dan waktu 12 jam) yang dapat menghasilkan kopi dengan kategori cita rasa specialty (kopi robusta *specialty*). Konsentrasi ragi berpengaruh nyata terhadap pH dan suhu setelah fermentasi. Sedangkan lamanya fermentasi berpengaruh nyata terhadap pH dan suhu dan presentase biji tidak terkelupas. Hasil uji organoleptik perlakuan konsentrasi ragi dan lamanya fermentasi berpengaruh nyata terhadap seduhan kopi dan dapat disukai oleh panelis.

Kata kunci: kopi robusta, specialty, fermentasi, *Saccharomyces cerevisiae*, mutu

ABSTRACT

Robusta coffee is one of the plantation commodities that has an important role in economic activities in Indonesia. Coffee is one of Indonesia's export commodities which is quite important as a foreign exchange earner for the country. Indonesia is listed as the fourth largest coffee producer after Brazil, Vietnam and Colombia. However, in the export market, Indonesia's coffee is still in ninth place. Post-harvest handling

*of coffee at the farm level generally produces low-quality, random coffee. Therefore, it really needs to be improved in quality to increase competitiveness in the international market. One alternative that is seen as effective is the improvement of the processing process to produce robusta coffee into robusta specialty coffee. This study aims to determine the best yeast starter concentration and determine the best fermentation time to produce specialty coffee in the form of specialty robusta coffee. This study used two factors, namely yeast concentration using *Saccharomyces cerevisiae* which included three levels (2%; 3%; 4%) and fermentation time with 3 levels namely 8, 10 and 12 hours. Repetition is carried out three times. The response variables observed were pH and temperature during fermentation, percentage of unpeeled beans, physical quality of rice coffee, density of coffee rice, increase in roast volume, and taste quality. Data were analyzed using Analysis of Variance (ANOVA) with a confidence level of 5% if the ANOVA results showed a significant difference, followed by the Duncan Multiple Range Test (DMRT). The best results were in the R3F3 treatment (4% concentration and 12 hours time) which could produce coffee with the specialty/ (specialty robustacoffee) flavor category. Yeast concentration has a significant effect on pH and temperature after fermentation. Meanwhile, the duration of fermentation has a significant effect on pH and temperature and the percentage of seeds that are not peeled. The results of the organoleptic test of the concentration of yeast and the duration of fermentation had a significant effect on the brewing of coffee and the panelists liked it.*

Keywords: *robusta rcoffee, specialty, fermentation, Saccharomyces cerevisiae, quality*

INTRODUCTION

Coffee is one of the plantation commodities that has an important role in economic activities in Indonesia. Coffee is one of Indonesia's export commodities which is quite important as a foreign exchange earner for the country. In addition to increasingly open export opportunities, the domestic coffee market is still quite large (BPS, 2019). Coffee cultivation in Indonesia is 98.60% (731,600 tons) carried out on smallholder plantations, 0.80% (5,600 tons) on large state plantations, and 0.60 (4,400 tons) on large private plantations (BPS, 2019). The preferred type of coffee cultivated in Indonesia is Robusta coffee. The area of the Robusta coffee plantation is around 86%. Robusta coffee (*Canephora*) has a high selling value in the international market. The community's need for coffee will continue to increase in line with the increase in population, so that the market opportunity remains prospective for all time (Tjahjani *et al.*, 2021). In 2019, the three largest Indonesian coffee export volumes were robusta OIB, not roasted, not decaffeinated (HS 0901111000) at 98.14%, Arabica coffee WIB/robusta OIB, not roaste, (HS 0901119000) at 0.90 %, and coffee, roasted, not decaffeinated (HS 0901212000) of 0.68% (BPS, 2019).

Indonesia is listed as the fourth largest coffee producer after Brazil, Vietnam and Colombia (FAO, 2016). Indonesian coffee is able to penetrate the export market, although it is still in ninth place (BPS, 2019). Indonesian coffee needs to be maintained and increased in quantity and quality in the production process, with improved quality it can increase competitiveness in the international market (Panjaitan, 2020) one of the alternatives that is seen as effective is improving the processing process, handling and processing of post-harvest coffee cherries is one one of the stages that guarantees the final quality of the coffee powder so that it can produce robusta coffee into specialty robusta coffee.

The quality of the coffee produced is closely related to how it is handled postharvest (Panjaitan, 2020). Post-harvest handling of coffee at the farm level generally produces low quality random coffee due to limited processing equipment and yields obtained. Inappropriate coffee processing can cause taste defects. One of the efforts emphasized for quality improvement is related to postharvest handling (Pratiwi, 2018).

The fermentation process is one of the stages of postharvest handling which is carried out to remove mucilage that is still attached to the beans and helps improve the taste of coffee brew by

producing microbial metabolites, which are precursors of volatile compounds formed during roasting. *Saccharomyces cerevisiae* has enormous potential for used in the wet method of fermenting coffee beans can improve the expected taste and aroma, the use of *Saccharomyces cerevisiae* will produce volatile compounds which play an important role in modifying the aroma of coffee (Panjaitan, 2020). One example of this genus is the species *Saccharomyces cerevisiae* which is used in the manufacture of wine, bread and beer (Larassati *et al.*, 2021).

Saccharomyces cerevisiae is one of the most frequently used yeasts in food fermentation processes because of its favorable properties in industry such as high fermentation capacity, high ethanol tolerance, low pH tolerance, does not cause problems related to large amounts of oxygenation, is economical, stable and can used in various forms under various fermentation conditions (Noerdinna, 2021). Soaking the coffee beans before stripping the lenders/pulp (pulping) can soften the outer skin of the coffee beans so that the pulping process is easier, but soaking for too long can produce low quality and can lose the flavor of the coffee (Budi *et al.*, 2020). Baker's yeast can be an alternative to using *Saccharomyces cerevisiae* isolate in ethanol production fermentation, this is because it is easy to obtain on the market and does not require specific treatment (Putri *et al.*, 2019). The most important components are pectic substances with carbohydrates and their derivative products (Saputra *et al.*, 2019). The mucus layer will decompose due to microbial activity and endogoeal enzymes (Thalia *et al.*, 2018)

The drying process generally uses sunlight, with this drying it takes a long time. This rotating rack type dryer can shorten the drying time of coffee. Drying is defined as the process of removing water using heat and air currents to prevent or inhibit the growth of mold and bacteria so that they cannot develop anymore or develop but slowly. The basis of the drying process is the evaporation of material water into the air due to differences in the moisture content between the air and the material being dried. In order for a material to dry, the air must have a lower moisture content than the material to be dried. During the drying process, two processes occur, namely heat transfer and water mass transfer which occur simultaneously. Heat is needed to evaporate the water of the material to be dried. Evaporation occurs because the temperature of the material is lower than the air temperature. Based on these conditions, drying using a rotating rack type dryer can speed up coffee processing. In addition, fermentation using *Saccharomyces cerevisiae* can be developed to produce specialty robusta coffee by paying attention to the concentration of *Saccharomyces cerevisiae* and the fermentation time of the coffee beans to make it easier to exfoliate mucus (Pratiwi, 2018) so that specialty robusta coffee will be produced to improve the quality of Indonesian coffee which is competitive.

The aims of this research were: (1) to determine the best yeast starter concentration to produce specialty coffee in the form of specialty robusta coffee. (2) determining the best fermentation time to produce specialty coffee in the form of specialty robusta coffee.

RESEARCH METHOD

Materials and Equipments

The materials used in this study were *Saccharomyces cerevisiae* starter (2%; 3%; 4%), water, distilled water, robusta coffee cherries obtained from Sunyalangu Village, Karanglewas District, Banyumas Regency, Central Java. The tools used in this study were jars, roaster machines (roasters), grinder machines (roasted coffee grinders), digital scales, rotating rack type dryers, 1000 ml measuring cups, 250 ml beaker glasses, 500 ml beaker glasses, thermometers and pH meters.

Experimental Design

This research used Factorial RAL to see the effect of yeast concentration and fermentation time on pH and fermentation temperature, percentage of unpeeled beans, physical quality of rice

coffee, density of rice coffee, increase in roast volume, and taste quality. This study used two factors, namely yeast concentration and fermentation time. Yeast concentration using *Saccharomyces cerevisiae* as R factor which includes three levels (2%; 3%; 4%). While the fermentation time with 3 levels, namely 8, 10, and 12 hours. Repetition is carried out three times. The coffee processing approach used is wet dry hulling (full wash dry hulling) (Salsabila, 2019). The combination of yeast concentration and fermentation time factors is presented in Table 1.

Table 1. Combination of yeast concentration and fermentation time factors

R/F	F1	F2	F3	Explanation
R1	R1F1	R1F2	R1F3	R1= concentration 2%; R2= concentration 3%; R3= concentration 4%;
R2	R2F1	R2F2	R2F3	F1= fermentation 8 hours; F2= fermentation 10 hours;
R3	R3F1	R3F2	R3F3	F3= fermentation 12 hours;

Variables and Measurement

The research response variables observed consisted of water content, pH and fermentation temperature, percentage of unpeeled beans, physical quality of rice coffee, density of rice coffee, increase in roast volume, and organoleptic tests. The following is an explanation of the details of the research variables.

1) Moisture Content

The value of the water content is measured after drying the coffee beans, the equation for the water content is as follows:

$$\% \text{ Moisture content (wet basis)} = \frac{\text{Water mass}}{\text{Total solid and water mass}} \times 100\% \quad (1)$$

$$\% \text{ Moisture content (dry basis)} = \frac{\text{Water mass}}{\text{Total solid and water mass}} \times 100\% \quad (2)$$

One of the coffee quality parameters is the water content, based on SNI 01-2907-2008 the moisture content of coffee beans is 10-12% with a maximum of 12.5%.

2) pH and Temperature during Fermentation

The pH value is measured using a pH meter, the pH meter is dipped in the coffee mass that is soaked in the jar. While the temperature of the coffee in the jar is measured during fermentation using a thermometer. pH based on SNI 01-2907-2008 is > 4 (4-6).

3) Percentage of Unshelled Seeds

The percentage of unshelled seeds was measured using a scale with units of percent (%). The equation for the percentage of unshelled seeds is as follows:

$$\% \text{ the seeds are not peeled off (\%)} = \frac{\text{the weight of the seeds is not exfoliated}}{\text{coffee weight}} \times 100\% \quad (3)$$

4) Physical Quality/Content of Defective Seeds

Calculation of dirt content is expressed in % mass fraction using the Equation:

$$\text{Fraksi massa (\%)} = \frac{\text{dirt weight}}{\text{snippet weight}} \times 100\% \quad (4)$$

The total value of defects is calculated using the Equation:

$$\text{Total value of defects} = \frac{\text{Number of defects}}{\text{Defect value}} \times 100 \% \quad (5)$$

Based on SNI 01-2907-2008 the physical quality of rice coffee is that there are no insects, the beans do not smell bad and the maximum total defect value is 11%.

5) Density of Coffee Rice

The density of rice coffee was measured using a measuring cup. The density equation is as follows:

$$\text{Density}(\rho_b) = \frac{M_{bk}}{V} \quad (6)$$

Where: M_{bk} is the weight of rice coffee (g) and V is the volume of rice coffee/roasted coffee in a container (ml).

6) Percentage Increase in Roast Volume

The percentage increase in volume of roasted coffee was determined using modification method. The percentage increase in coffee bean volume during roasting (Δv) is calculated using the following equation:

$$\text{Increase in roast volume} \left(100 \frac{v}{v} \right) = 100 \frac{(V_t - V_v)}{V} \quad (7)$$

Where: the volume of roasted coffee (ml) and is the volume of rice coffee (ml).

7) Organoleptic Test

The resulting coffee beans are roasted using a roaster machine with a medium roasting level which will produce a brownish color of coffee beans with the temperature used is 200-205°C and 8-12 minutes. Roasted coffee is ground using a grinder. Based on SNI 01-2907-2008 fermented coffee has a sour taste with a pH of 4-6 and the color of roasted coffee beans is brownish. The organoleptic test was carried out by a semi-trained panel consisting of 25 semi-trained panels selected from a limited circle. The questionnaire used in the organoleptic test. The description of the response variables tested for coffee taste quality is as follows:

- a) Fragrance/Aroma is a taste character that is captured by the senses
- b) Flavor is the combination felt on the tongue and the aroma of vapor on the sense of smell that flows from the mouth to the sense of smell
- c) Color is the color produced from brewing coffee
- d) Aftertaste is the impression that arises after brewed coffee leaves the mouth
- e) Acidity is the acidity that describes a good, fresh, sweet and fruity coffee when tasted or sipped
- f) Body/mouthfeel is the strong taste of coffee in the mouth
- g) Overall is an assessment that reflects the overall aspects above from an example that the panelists feel

Data Analysis

The data obtained are numerical to be analyzed quantitatively and qualitatively, with a clear and systematic method. Processing of research data was carried out by Analysis of Variance (ANOVA) using the Microsoft Excel application and if significantly different treatments were obtained, it would be followed by DMRT (Duncan Multiple Range Test) analysis.

RESULTS AND DISCUSSIONS

Water Content

The drying process reduced the water content of the coffee to 10.04-11.99 and can be seen in Figure 1. The water content values for the treatments R1F1, R1F2, R1F3 were 10.04, 10.50 and 11.30, for the treatments R2F1, R2F2 and R2F3 were 10.19, 10.54 and 11.74, while the water content values for the R3F1, R3F2 and R3F3 treatments were 11.53, 11.42 and 11.99. The highest water content value was in the R3F3 treatment (4% concentration and 12 hours fermentation time) with a value of 11.99, while the lowest water content value was in the R1F1 treatment (2% concentration and 8 hours fermentation time) with a value of 10.04. The water content produced is in accordance with SNI.

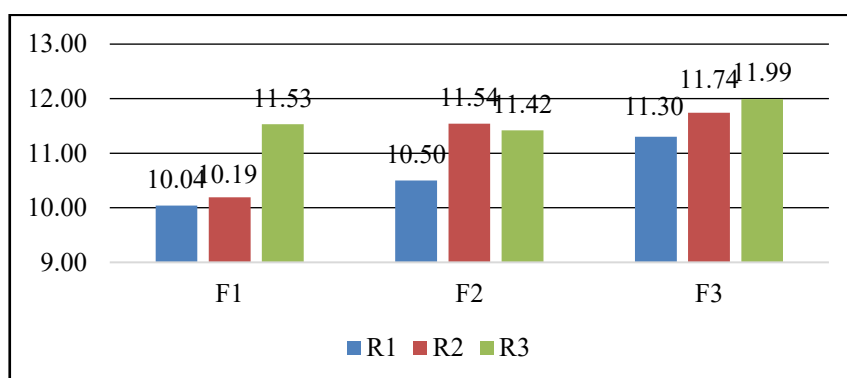


Figure 1. Coffee rice water content

The results of the 5% ANOVA test analysis. The results show that yeast concentration and fermentation time have no significant effect on water content. The water content is affected by the temperature and time used during the drying process which causes evaporation so that the water content in the coffee is lower. The drying process for each treatment was carried out using a rotating rack type dryer with a temperature of 100°C and a time of 6 hours.

pH and temperature during fermentation

The decrease in coffee pH during fermentation can be seen in Figure 2. The decrease in coffee pH occurred during the fermentation of *Saccharomyces cerevisiae* (2%; 3%; 4%) with fermentation times of 8, 10 and 12 hours. The pH values for the R1F1, R1F2, R1F3 treatments were 5.70, 5.50, and 5.30, for the R2F1, R2F2, and R2F3 treatments were 5.67, 5.47, and 5.27, while the pH values for the R3F1 treatment, R3F2, and R3F3 are 5.53, 5.17, and 4.53. The highest pH value was in the R1F1 treatment (2% yeast concentration and 8 hours of fermentation time) with a value of 5.70, while the lowest pH value was in the R3F3 treatment (4% yeast concentration and 12 hours of fermentation time) with a value of 4.53.

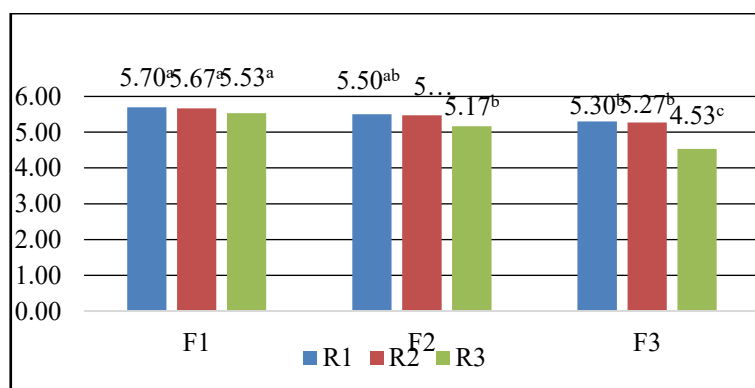


Figure 2. Changes in pH after fermentation

The results of the 5% ANOVA test analysis. The results show that the concentration of yeast and the duration of fermentation have a significant effect on the pH value after fermentation. Fermentation is able to break down the glycoside bonds that bind bioactive compounds and secondary metabolites in plant seed cells, so that they become free aglycones. The results of research that has been done that the higher the concentration of yeast used and the longer the fermentation time, the pH of the coffee will decrease. The decrease in pH during fermentation with *Saccharomyces cerevisiae* yeast occurs due to the degradation of the mucilage component (mucilage) into simple sugars, the mucilage layer by producing various enzymes, alcohols, and acids during the fermentation process. The process of slime degradation is related to the duration of the fermentation process (Budi *et al.*, 2020).

The increase in temperature values after fermentation can be seen in Figure 3. The temperature values in the R1F1, R1F2, and R1F3 treatments were 27.30 °C, 28.00 °C, and 28.50 °C, the R2F1, R2F2, and R2F3 treatments were 27.70 °C, 28.20 °C, 28.70 °C, whereas in the R3F1, R3F2, and R3F3 treatments it was 28.20 °C, 28.50 °C, 29.20 °C. The highest temperature yield was in the R3F3 treatment (4% yeast concentration and 12 hours of fermentation time) with a value of 29.20, while the lowest temperature was in the R1F1 treatment (2% yeast concentration and 8 hours of fermentation time) with a value of 27.30.

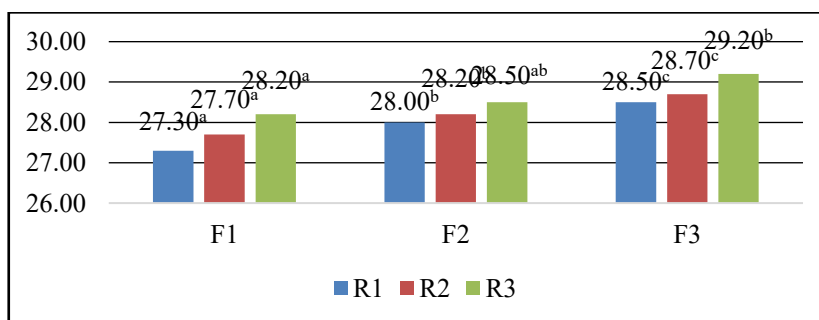


Figure 3. Temperature change after fermentation

The results of the 5% ANOVA test analysis. The results show that the concentration of yeast and the duration of fermentation have a significant effect on the temperature after fermentation. The increase in temperature occurs due to the degradation process and exothermic reactions (Pratiwi, 2018). The increase in temperature continues to increase as the yeast concentration increases and the fermentation time used. The fermentation that occurred in this study was anaerobic, the temperature during fermentation affected the growth of lactic acid bacteria, causing conditions to become more acidic.

Percentage of seeds not peeled

The percentage of seeds not peeled in this study was between 8.00-10.00% which can be seen in Figure 4. The percentage values of seeds not peeled for the R1F1, R1F2, R1F3 treatments were 10.00, 9.50, and 8.83, for the R2F1 treatment, R2F2, and R2F3 were 9.67, 9.17, and 8.50, while for the treatments R3F1, R3F2, and R3F3 were 9.33, 8.67, and 8.00. The highest percentage of seeds not peeled off was in the R1F1 treatment (2% yeast concentration and 8 hours of fermentation time) with a value of 10.00, while the lowest was in the R3F3 treatment (4% yeast concentration and 12 hours of fermentation time) with a value of 8.00.

The results of the 5% ANOVA test analysis. The results show that the duration of the fermentation has a significant effect on the percentage of not peeled beans. The percentage of unpeeled seeds was affected by soaking before fermentation, during soaking an imbibition process occurs which causes water absorption in the cell walls. During the imbibition process, the bean expands rapidly to double its actual size, and the skin covering the bean becomes softer, making it easier to pulp

the coffee cherries. Apart from soaking, the fermentation treatment had a significant effect on the percentage of unpeeled seeds. Fermentation in this study used starter yeast *Saccharomyces cerevisiae* with a time of 8, 10 and 12 hours. Before fermentation, the fruit is peeled manually, but not all fruit can be peeled perfectly. Some seeds are still covered by fruit skin. The skin has been released but not completely separated from the seeds. During fermentation, the seeds that are still covered with the skin of the fruit undergo a process of imbibition again. Fruit skin becomes softer and easily detached. At the time of washing after the fermentation process, the skin of the fruit is separated from the seeds.

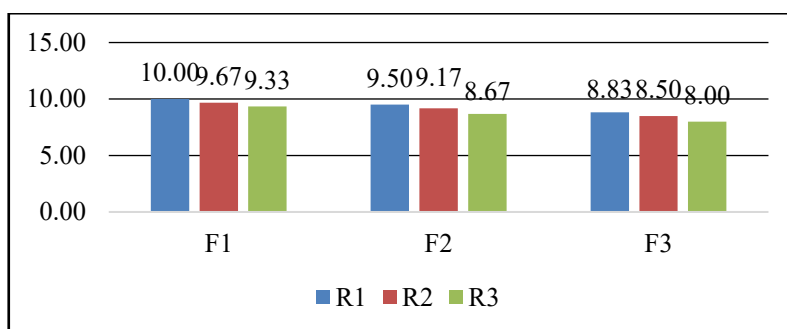


Figure 4. Percentage of unshelled seeds

Physical Quality of Rice Coffee

The physical quality of rice coffee can be seen from the defect values of all treatments, the defects found in all treatments, namely between 2.33-7.33 can be seen in Figure 5. The defective values of the treatments R1F1, R1F2, R1F3 were 7.33, 3.67, and 7.00, the R2F1, R2F2, and R2F3 treatments were 5.00, 3.67, and 5.33, while the defect values for the R3F1, R3F2, and R3F3 treatments were 5.67, 4.00, and 2.33. The highest defect value was in the R1F1 treatment (2% yeast concentration and 8 hours of fermentation time) with a value of 7.33, while the treatment with the lowest defect value was the R3F3 treatment (4% yeast concentration and 12 hours of fermentation time) with a value of 2.33.

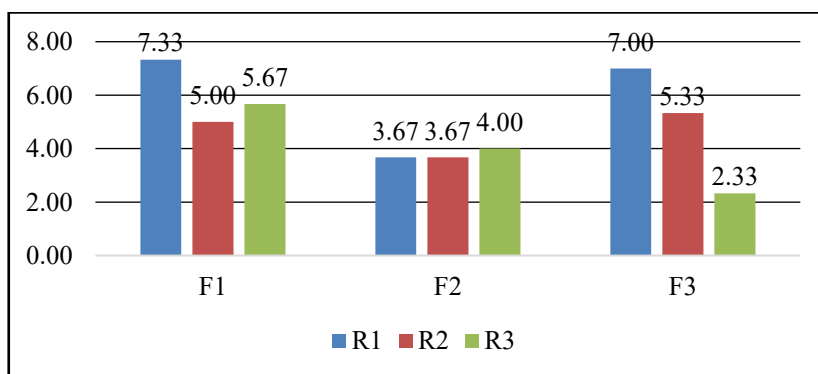


Figure 5. Physical quality of rice coffee

The results of the 5% ANOVA test analysis. The results show that the concentration of yeast and the duration of fermentation did not significantly affect the value of the physical quality of rice coffee, because there was no over-fermentation of coffee during the processing (Yusianto & Nugroho, 2014). Some of the defects found were the presence of black seeds, broken seeds, and hollow seeds. The presence of defective beans in rice coffee is caused by pests and diseases causing holes in the seeds/black seeds and picking of coffee cherries that have fallen to the ground so that the seeds break.

Density of Rice Coffee and Density of Roasted Coffee

The density of rice coffee and roasted coffee produced in this study ranged from 0.55-0.66% and 0.47-0.55%. The treatment with the highest density of rice coffee was in the R3F3 treatment (4% yeast concentration and 12 hours of fermentation time), while the lowest was in the R3F2 treatment (4% yeast concentration and 10 hours of fermentation time). The highest density value of roasted coffee was in the R3F3 treatment (4% yeast concentration and 12 hours of fermentation time), while the lowest was in the R1F1 treatment (2% yeast concentration and 8 hours of fermentation time). The density of rice coffee and roasted coffee can be seen in Table 2.

Table 2. Density of rice coffee and roasted coffee

Treatment	Density of Coffee Rice (g/ml)	Density of Roasted Coffee (g/ml)
R1F1	0.59	0.47
R1F2	0.61	0.51
R1F3	0.63	0.51
R2F1	0.58	0.52
R2F2	0.59	0.50
R2F3	0.62	0.53
R3F1	0.60	0.51
R3F2	0.55	0.51
R3F3	0.66	0.55

The density of rice coffee and the density of roasted coffee based on the results of the 5% ANOVA test. The results show that the concentration of yeast and the duration of fermentation have no significant effect, this happens because the density of is affected by the roasting process, the process of roasting coffee beans experienced several physical changes, namely a decrease in weight due to water loss, an increase in the volume of coffee beans, and a decrease in density due to evaporation. The density of roasted coffee continues to decrease slowly until the end of the roasting process. The decrease in weight and increase in volume of coffee beans during roasting will cause a decrease in the density of roasted coffee (Yusianto & Sukrisno, 2013).

Percentage Increase in Roasted Coffee Volume

The increase in roasted coffee volume ranged from 5.33-10.67 which can be seen in Figure 6. The treatment values R1F1, R1F2, R1F3 were 10.67, 7.00 and 10.33, the treatments R2F1, R2F2 and R2F3 were 6.33, 5.33, and 8.00, while the R3F1, R3F2, and R3F3 treatments were 6.33, 6.00, and 6.67. The increase in roasted coffee volume had the highest percentage in the R1F1 treatment (2% concentration and 8 hours of fermentation time) with a value of 10.67, while the increase in the volume of roasted coffee had the lowest percentage in the R2F2 treatment (3% yeast concentration and 10 hours of fermentation time) with a value of 5.33.

The results of the 5% ANOVA test analysis. The results showed that the concentration of yeast and the duration of fermentation had no significant effect on the increase in the volume of roasted coffee beans. The increase in volume occurred in the roasting process using a temperature of 200 °C and 15 minutes. The physical changes in coffee beans during roasting trigger the development of bean size, causing an increase in the volume of roasted coffee beans (Yusianto & Sukrisno, 2013).

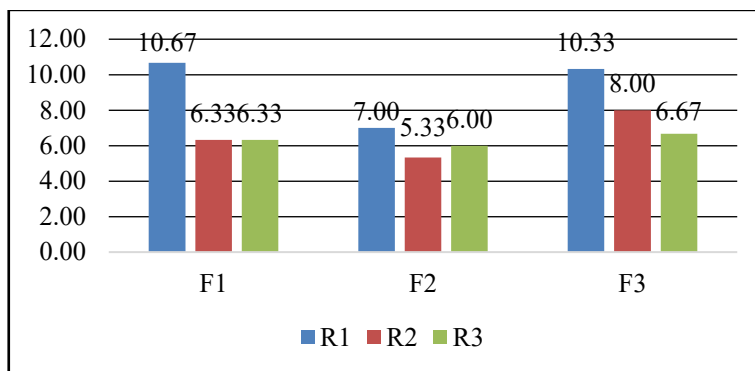


Figure 6. Increase in the volume of roasted coffee beans

Taste Quality

Based on the research that has been done, there are several descriptions of the response variables tested in the quality of coffee taste, namely as follows:

1. Fragrance/Aroma

The panelists' preference value for the fragrance/aroma of brewed coffee in this study was between 2.40-2.63 and can be seen in Figure 7. Fragrance/aroma values for the treatments R1F1, R1F2, R1F3 were 2.53, 2.50, and 2.50, the R2F1, R2F2, and R2F3 treatments were 2.53, 2.43, and 2.60, while the R3F1, R3F2, and R3F3 treatments were 2.40, 2.50, and 2.63. The treatment that was preferred by the panelists was the R3F3 treatment (4% yeast concentration and 12 hours of fermentation time), the treatment that was not preferred by the panelists was the R3F1 treatment (4% yeast concentration and 8 hours of fermentation time).

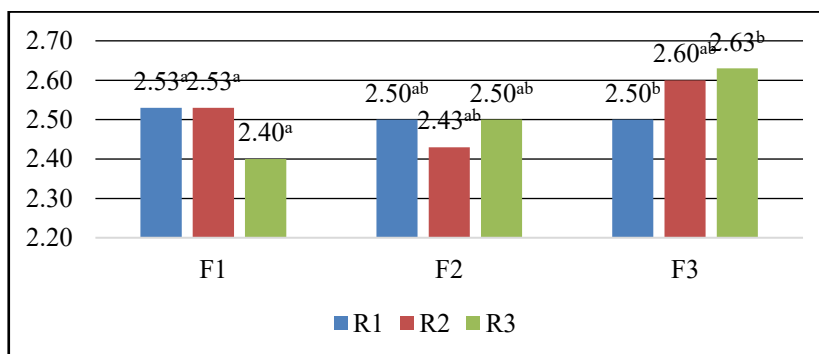


Figure 7. Fragrance/aroma values

The results of the 5% ANOVA test analysis. The results show that the concentration of yeast and the duration of fermentation have no significant effect on the fragrance of the brewed coffee. Aroma is the gas that comes out after ground coffee is brewed. The aroma of coffee is related to the chemical composition (volatile compounds) contained in coffee, these fermented coffee beans consist of volatile compounds formed from the reaction of reducing sugars, organic acids, lipids and amino acids which cause these compounds to break down carbohydrates and proteins that take place in the process fermented so that the aroma produced is getting better, when coffee is brewed these volatile compounds will evaporate due to heat which pushes these compounds to change form from liquid to gas (Wijaya & Sudarminto, 2015).

2. Flavors

The results of the research panelist's preference value for the flavor of brewed coffee was between 2.03-2.70 and can be seen in Figure 8. The flavor values for the treatments R1F1, R1F2, R1F3 were 2.70, 2.30, and 2.30, treatment R2F1, R2F2 and R2F3 were 2.40, 2.20 and 2.03, while the

treatments R3F1, R3F2 and R3F3 were 2.40, 2.20 and 2.30. The treatment that was preferred by the panelists was the R1F1 treatment (2% yeast concentration and 8 hours of fermentation time) with a value of 2.70, and the treatment that was not preferred by the panelists was the R2F3 treatment (3% yeast concentration and 12 hours time) with a value of 2,03.

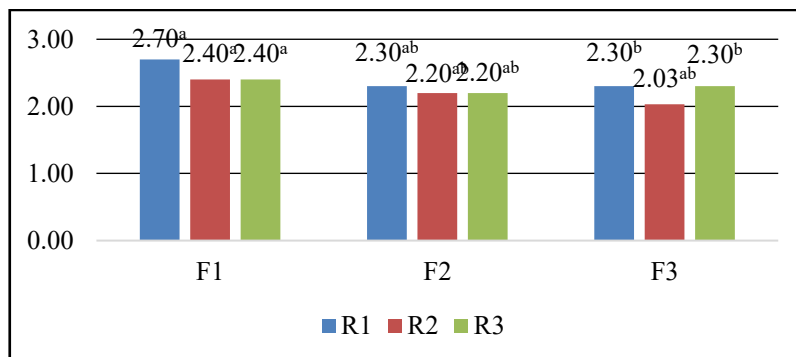


Figure 8. Flavor value

The results of the 5% ANOVA test analysis. The results show that the duration of fermentation has a significant effect on the flavor of the brewed coffee. Flavor is the gas that comes out When coffee is sip, flavor is generally formed from sugar carbonyl compounds because of the results of caramelization during roasting. This happens because the longer the fermentation, the degradation of chemical components will occur which produces lactic acid which causes the flavor to increase (Panjaitan, 2020).

3. Aftertaste

The panelists' preference value for the aftertaste of brewed coffee produced in this study was between 2.37-2.80 and can be seen in Figure 9. The aftertaste of coffee steeped in the treatments R1F1, R1F2, R1F3 were 2.37, 2.47, and 2.53, the R2F1, R2F2, and R2F3 treatments were 2.40, 2.47, and 2.53, while for the R3F1, R3F2, and R3F3 treatments were 2.60, 2.67, and 2.80. The treatment favored by the panelists was the R3F3 treatment (4% yeast concentration and 12 hours of fermentation time) with a value of 2.80, and the treatment that the panelists did not like was the R1F1 treatment (2% yeast concentration and 8 hours of fermentation) with a value of 2, 37.

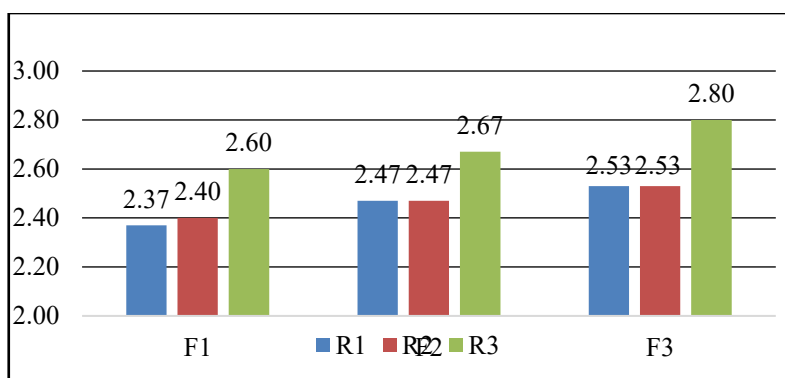


Figure 9. Aftertaste values

The results of the analysis of the 5% ANOVA test. The results show that the concentration of yeast has a significant effect on the aftertaste of brewing coffee. Aftertaste is the impression that remains after the coffee is swallowed. The higher the concentration used, the more pronounced the remaining impression will be when the brewed coffee is swallowed, some of the organic compounds with high molecular weight evaporate so that they leave an impression in the mouth (Wahyudi *et al.* 2016).

4. Color

The panelists' preference value for the color of the brewed coffee produced in this study was between 2.80-3.60 and can be seen in Figure 10. The color values for the color of the brewed coffee for the treatments R1F1, R1F2, R1F3 were 3.40, 2.90, and 3.10, the R2F1, R2F2, and R2F3 treatments were 3.40, 3.20, and 2.90, while for the R3F1, R3F2, and R3F3 treatments were 3.60, 3.40, and 2.80. The treatment that was preferred by the panelists was the R3F1 treatment (4% yeast concentration and 8 hours fermentation time) with a value of 3.60, and the treatment that was not preferred by the panelists was the R3F3 treatment (4% yeast concentration and 12 hours fermentation time) with a 2.80.

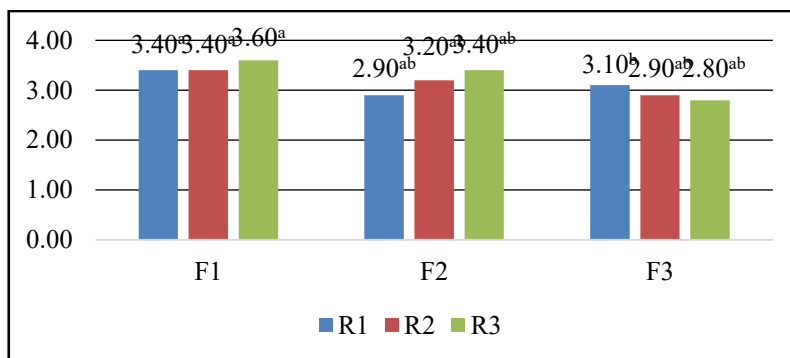


Figure 10. Color values

The results of the 5% ANOVA test analysis. The results show that the length of fermentation time has a significant effect on the color of the coffee brew. According to Galuh & Fibrianto (2018), this is due to the formation of acids which cause a decrease in pH and the color of the coffee brew fades, tannin damage due to the presence of acid causes a bright color, so the duration of fermentation can increase the brightness value of the coffee brew, the longer the time it takes used in the fermentation process the color is getting brighter, from the results of research that has been done colors that are too bright are not liked by the panelists.

5. Acidity / Acidity

The results of the research on the panelists' preference value for the acidity of the brewed coffee were between 3.10-3.77 and can be seen in Figure 11. The acidity values of the coffee steeped in the treatments R1F1, R1F2, R1F3 were 3.10, 3.17, and 3.23, the R2F1, R2F2, and R2F3 treatments were 3.33, 3.40, and 3.47, while for the R3F1, R3F2, and R3F3 treatments were 3.57, 3.63, and 3.77. The treatment that was preferred by the panelists was the R3F3 treatment (4% yeast concentration and 12 hours of fermentation time) with a value of 3.77, and the treatment that the panelists did not like was the R1F1 treatment (2% yeast concentration and 8 hours of fermentation time) with a value of 3.10.

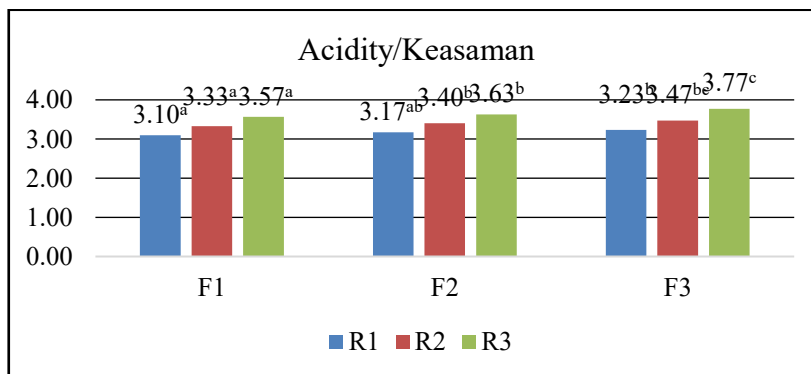


Figure 11. Acidity value

The results of the 5% ANOVA test analysis. The results show that the treatment and duration of fermentation have a significant effect on acidity. Acidity is the level of acidity of brewed coffee when you drink it. Yeast treatment using *Saccharomyces cerevisiae* in this study showed that the longer the fermentation time caused the acidity to increase.

6. Mouthfeel

The preference value for the mouthfeel of brewed coffee produced in this study was between 2.40-2.90 and can be seen in Figure 12. The mouthfeel values of coffee steeped in the treatments R1F1, R1F2, R1F3 were 2.80, 2.70 and 2.50 , the R2F1, R2F2, and R2F3 treatments were 2.80, 2.60, and 2.43, while for the R3F1, R3F2, and R3F3 treatments were 2.90, 2.60, and 2.40. The treatment that was preferred by the panelists was the R3F1 treatment (4% yeast concentration and 8 hours of fermentation time) with a value of 2.90, and the treatment that was not preferred by the panelists was the R3F3 treatment (4% yeast concentration and 12 hours of fermentation time) with a value of 2, 40.

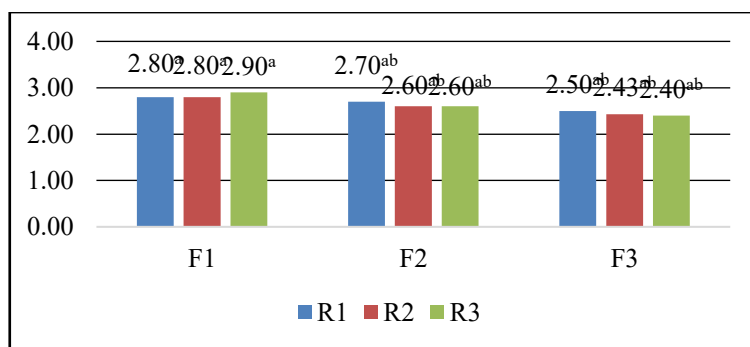


Figure 12. Mouthfeel value

The results of the 5% ANOVA test analysis. The results show that the duration of fermentation has a significant effect on the mouthfeel of brewed coffee. Mouthfeel is the feeling when coffee enters the mouth, especially between the tongue and the roof of the mouth. In this study, the amount of yeast concentration and the duration of fermentation will affect the preference of panelists for the sour taste when coffee enters the mouth.

7. Overalls

The preference value for the overall brewed coffee produced in this study was between 2.30-2.73 which can be seen in Figure 13. The overall value of the brewed coffee for the treatments R1F1, R1F2, R1F3 were 2.33, 2.50 and 2.50 , the R2F1, R2F2, and R2F3 treatments were 2.30, 2.40, and 2.60, while for the R3F1, R3F2, and R3F3 treatments were 2.50, 2.60, and 2.73. The treatment favored by the panelists was the R3F3 treatment (4% yeast concentration and 12 hours of fermentation time) with a value of 2.73, and the treatment that the panelists did not like was the R2F1 treatment (3% yeast concentration and 8 hours of fermentation time) with a value of 2, 30.

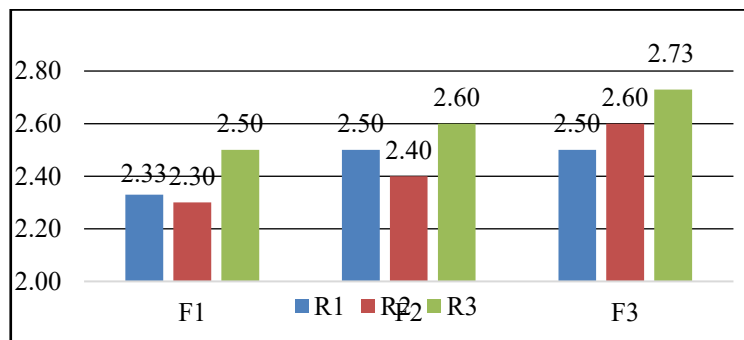


Figure 13. Overall value

The results of the 5% ANOVA test analysis. The results show the concentration of yeast and the duration of soaking have a significant effect on the overall value of coffee brewing. Overall is the panelist's overall assessment of the several parameters assessed.

CONCLUSSION

The results of the study can be summarized as follows: (1) The concentration of *saccharomyces cerevisiae* (2%, 3%, 4%) and the duration of fermentation are 8 hours, 10 hours and 12 hours. Getting the best results in the R3F3 treatment (4% concentration and 12 hours of fermentation time) this treatment can produce coffee with the specialty robusta coffee flavor category. (2) the concentration of *saccharomyces cerevisiae* significantly affected the pH and temperature after fermentation with a pH value of 4.53 and a temperature of 29.20. Meanwhile, the duration of fermentation had a significant effect on the percentage of unchipped seeds with a value of 8.00. (3) the results of the organoleptic test, the concentration of *saccharomyces cerevisiae* and the duration of fermentation had a significant effect on the brewing of coffee. In the R3F3 treatment (4% concentration and 12 hours of fermentation time) with an overall value of 2.73 the panelists liked it.

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