

# Trying the Utilization of Rice to Reduce Caffeine Levels in Making Tubruk Coffee

Robiatul Adawiyah<sup>1</sup>, Mohammad Syaltut Abduh<sup>2</sup>, Erris Kusumawidjaya<sup>3</sup>, S.P Djati<sup>4</sup>, Nurbaeti<sup>5\*</sup>  
<sup>1,2,3,4,5</sup>Trisakti School of Tourism

**Abstract:-** Coffee is a drink that is popular with many people. However, some people have a sensitivity to the caffeine contained in coffee. This research was conducted with the hope that the results of this research product can be an alternative product that has lower caffeine content. This research was carried out by utilizing roasted rice as an additional ingredient in the manufacture of brewed coffee. The results revealed that brewed coffee using roasted brown (reddish) rice was a superior product. This can be seen after the hedonic test and the decrease in caffeine levels is the most significant, from 627.31 mg / L (control product) to 497.73 mg / L. To complement this research, it is advisable to try other variations of rice and other variations of coffee beans.

**Keywords:-** Coffee 1; caffeine 2; roasted rice 3.

## I. INTRODUCTION

Indonesia is the 4th most populous country in the world. The composition of culture, ethnicity, climate, and topography is also diverse. Therefore, Indonesia is a country that has many nicknames such as the land of a thousand islands, maritime countries, agricultural countries, and so on. Coffee plants are often known as mountain cultivation because most are cultivated on hilly lands that have medium to high altitudes. The higher the place, the more diverse the land conditions (Sari et al., 2013) [1]

Coffee is a type of beverage that comes from the processing of coffee beans. Coffee is classified into the Rubiaceae family with the genus *Coffea*. In general, coffee only has two species, namely *Coffea arabica* and *Coffea robusta* (Study et al., 2016) [2]. Coffee is one of the most popular drinks in society, because coffee has been consumed from generation to generation. For many people, coffee is not just a side drink, but also part of a lifestyle.

There are generally two types of coffee cultivated in Indonesia, namely Arabica coffee and Robusta coffee. Arabica coffee is coffee that has a better taste than robusta coffee, because robusta coffee tastes more bitter, slightly acidic and contains higher caffeine than arabic coffee (Hastuti, 2018) [3]. According to Spinale & James in Aditya et al. (2016) [4]. The caffeine content of raw Arabica coffee beans is lower than that of raw Robusta coffee beans, the caffeine content of Robusta coffee is about 2.2% and Arabica is around 1.2%. Caffeine is one of the secondary metabolites of the alkaloid group from the coffee plant and has a bitter taste. The effects of caffeine will be seen a few hours after consuming coffee, the effects felt can last up to 10 hours.

Based on the Food and Drug Administration (2018) [5] the permissible dose of caffeine is 100-200 mg/day, while according to SNI 01-7152-2006 the maximum limit of caffeine in food and beverages is 150 mg/day and 50 mg/serving. Effects of excessive (overdose) consuming caffeine can cause nervousness, restlessness, tremors, insomnia, hypertension, nausea and seizures. There are also mild symptoms such as sleep disturbances, heart palpitations, and acid reflux. (Ana Farida, Evi Ristanti, 2013) [6].

In addition to caffeine, coffee also contains acids that can be bad for health. In some people with sensitive stomach conditions, excess acid content can cause stomach pain after consuming coffee.

One way to overcome the side effects of coffee is to look for alternative products to replace coffee, but simply replacing coffee will not be enough for coffee lovers because coffee has a distinctive taste. Therefore, certain ingredients can be added to reduce the caffeine content and acid content in the coffee, and still maintain the coffee's distinctive taste. *Rice coffee* or rice coffee is rice that goes through a *roasting* process to produce a taste that resembles coffee. (Japan Premium Malaysia, 2018) [7]. Coffee made from rice does not contain caffeine and is not acidic, so it is safe for those with sensitive stomachs.

Black rice contains pigments belonging to the anthocyanin group. Anthocyanins are antioxidants that have a positive effect on human health. (Yustina & Abadi, 2017) [8].

According to Spinale and James, the caffeine content of raw Arabica coffee beans is lower than that of raw Robusta coffee beans, the caffeine content of Robusta coffee is about 2.2% and Arabica is around 1.2%.

### A. Problem

- Can roasted brown rice, roasted black rice and roasted brown rice be used as additional ingredients in brewed coffee?
- Is there a difference in terms of aroma, taste and *aftertaste* of brewed coffee that uses roasted brown rice, roasted black rice and roasted brown rice?
- What is the level of preference of the panellists in terms of aroma, taste and *aftertaste* to brewed coffee using roasted brown rice, roasted black rice and roasted brown rice?
- Is there a decrease in caffeine levels in brewed coffee after the addition of roasted brown rice, roasted black rice, and roasted brown rice?

### B. Research purposes

- To know that roasted brown rice, roasted black rice and roasted brown rice can be used as additional ingredients in brewing coffee.
- To find out the difference in terms of aroma, taste and *aftertaste* of brewed coffee using roasted brown rice, roasted black rice and roasted brown rice.
- To determine the level of preference of the panellists in terms of aroma, taste and *aftertaste* of brewed coffee using roasted brown rice, roasted black rice and roasted brown rice.
- To find out whether there is a decrease in caffeine levels in brewed coffee with the addition of roasted brown rice, roasted black rice and roasted brown rice.

## II. RELATED WORKS/LITERATURE REVIEW

### A. Brown Rice

Rice is the part of the grain (grain) that has been separated from the husk. Husk (Javanese merang) is anatomically called 'palea' (covered part) and 'lemma' (covered part). This part of the content, which is white, reddish, purple, or even black, is called rice (Hernawan & Meylani, 2016) [9].

Brown rice has various advantages in nutritional content and has the potential as a functional food choice. Brown rice contains anthocyanin pigments that function as antioxidants, fiber, -aminobutyric acid (GABA) which can suppress blood cholesterol levels, proteins, carbohydrates, and various essential fatty acids (Rachma et al., 2018) [10].

BERAS MERAH	
kalori	216 kkal
karbohidrat	45,8 g
protein	4,4 g
lemak	1,8 g
serat	4 g
GI	rendah

Table 1: Nutritional content of brown rice

Source: <https://ekafarm.com>

In addition, brown rice also contains flavonoid antioxidants, such as the anthocyanins apigenin, myricetin, and quercetin. Anthocyanins are included in the group of strong antioxidants that are able to protect the body from free radicals (Hernawan&Meylani, 2016) [9].

Anthocyanins can improve eye vision and inhibit tumor growth. These benefits can be obtained if you consume brown rice regularly.

A study conducted by the Asian-Australian Journal of Animal Sciences (2018) [11] found that the antioxidant content of brown rice flavonoids is higher than brown rice,

so it works more effectively to fight the effects of free radicals in the body.

Brown rice can reduce the risk of developing type II Diabetes Mellitus. This is because the magnesium content in brown rice aleurone is able to increase glucose metabolism in the blood by increasing the secretion of the hormone insulin (Daeli&Ardiaria, 2018) [12].

### B. Black Rice

Black rice is a local variety that has a pigment, in contrast to white rice or rice that has other colors. Black rice has a deep red-purple-blue pericarp, aleurone and endosperm. The color is achieved because of the anthocyanin content (Hernawan&Meylani, 2016) [9]. Black rice also has a higher dietary fiber content than white rice. Black rice also contains other nutrients such as:

BERAS HITAM	
kalori	200 kkal
karbohidrat	34 g
protein	6 g
lemak	2 g
serat	2 g
GI	rendah

Table 2: Nutritional content of black rice

Source: <https://ekafarm.com>

According to Mbanjo et al. (2020) [13], Consuming black rice is highly recommended because it has many health benefits such as:

a) Reducing the risk of cancer.

The anthocyanin content in black rice helps reduce the risk of developing cancer. Not only that, the anthocyanins in black rice can also have a good effect on cancer patients by slowing the growth and spread of cancer cells.

b) Strengthen the body's immunity

Black rice contains Vitamin E which can strengthen the immune system by multiplying and improving the quality of immune cells.

c) Increase energy

Black rice contains carbohydrates that can be useful as an energy source. Black rice is also rich in various types of B vitamins, including thiamine, riboflavin, and folic acid which are important in the process of energy formation, red blood cell production, and cell regeneration.

d) Smooth digestion

Black rice has a high content as well, which means it helps with various digestive disorders such as constipation. In addition, the anthocyanins in black rice can act as a good prebiotic to support the growth of good bacteria in the body.

- e) Helps to lose weight  
The protein content in black rice is higher than other types of rice, making black rice more filling.
- f) Prevent metabolic syndrome  
The content of vitamin E and anthocyanins in black rice can help reduce levels of bad cholesterol (LDL) and blood sugar.

### C. Brown Rice

Brown rice is a whole grain that is not strained or refined. Brown rice has a chewier texture than white rice and has a nutty taste. Brown rice has nutrients that are useful for health such as fiber, phytochemicals, and minerals (Mcdonell, 2016) [14]. Brown rice in addition to containing lower calories than white rice, brown rice contains nutrients such as:

BERAS COKLAT	
kalori	216 kkal
karbohidrat	45 g
protein	4,5 g
lemak	1 g
serat	4 g
GI	rendah

Table 3: Nutritional content of brown rice

Source: <https://www.ekafarm.com>

Klamer (2020) [15] said that brown rice also has many health benefits, namely:

- a) Protects the body from various diseases  
Grains are a source of folate, riboflavin (B2), potassium, and calcium which are important for bone development, wound healing, metabolism, and blood regulation.
- b) Lose weight  
In 158 grams of brown rice contains 3.5 grams of fiber. Fiber helps you feel fuller for a longer time, so you consume fewer calories.
- c) Maintain heart health  
Brown rice is rich in fiber and beneficial compounds that help reduce the risk of heart disease. Brown rice also contains compounds called lignans. These compounds can reduce the risk of heart disease.
- d) Good for diabetics  
Brown rice has a lower glycemic index than white rice, which means it takes longer to digest and has less impact on blood sugar.
- e) Gluten free  
Brown rice is naturally gluten-free, so it is safe for consumption for those who are allergic to gluten.

### D. Coffee

Coffee was first described in the 18th century by a Swedish botanist named Carolus Linneaus. He also described arabica coffee (*Coffea Arabica*) in his book entitled "*species plantarum*" in 1753. Coffee plants have various characteristics, from small shrubs to tall trees and also have various colours from purple or yellow or green (Wright, 2020) [16].

According to the National Coffee Association USA (2020) [17] In the commercial coffee industry, the two most common types of coffee are Arabica and Robusta.

#### a) Arabica

Arabica coffee is a traditional type of coffee with the best taste. Most of the coffee circulating in the community is Arabica coffee. This coffee comes from Ethiopia and has been cultivated in various parts of the world.

Arabica coffee grows at an altitude of 600-2000m above sea level. Coffee plants can grow up to 3 meters and the optimal temperature for cultivating arabica coffee is 18-26°C. Arabica coffee beans are quite small and are green to dark red.

#### b) Robusta

Robusta coffee was first discovered in the Congo in 1898. Robusta coffee is often referred to as class 2 coffee, because it tends to be more bitter, slightly sour, and contains more caffeine than Arabica coffee. In addition, robusta coffee has a wider coverage, robusta coffee can be grown at an altitude of 800m above the sea. Robusta coffee is also more resistant to pests and diseases, making the price of this coffee cheaper. Robusta coffee is found in West Africa, Central Africa, Southeast Asia and South America.

Before becoming a beverage, coffee undergoes a series of processing processes. Various methods have been tried to produce the best coffee drinks. The process of planting and caring for coffee plants also plays a role in producing a good coffee taste. Coffee has three criteria as a determinant of quality, namely the level of acidity, aroma, viscosity (body) (Kurniawan & Hastuti, 2017) [18]

## III. MATERIAL & METHODOLOGY

### A. Data

In this study, the data analysis method was carried out in the form of the Anova Test. This test was carried out as a prerequisite in the One Way ANOVA analysis. The underlying assumption in the Analysis of Variance (ANOVA) is that the variances of the population are the same. As a test criterion, if the significance value is more than 0.05, it can be said that the variance of two or more data groups is the same. Through the Anova Test oral so known as the Z or F test, it is used to test more than two samples and want to find out whether there is a significant (clear) difference between the calculated averages of 4 data in this trial.

Through the test, a decision will be made whether the product being tested can be accepted or rejected in this study. The requirements needed for decision making from the significance test according to Sugiyono (2007) are:

1. If the significant number is  $> 0.05$ , then  $H_0$  is accepted
2. If the significant number is  $< 0.05$ , then  $H_0$  is rejected

Based on the data obtained from the results of the Organoleptic Test Questionnaire and the Preference Test on the aroma, taste and *after taste* aspects of brewed coffee products using roasted brown rice, roasted black rice and roasted brown rice, the average value of each of these aspects can be calculated. And from the calculation of the average, it will be known that there are differences and the level of preference by the panelists on the aroma, taste and *after taste* between brewed coffee and brewed coffee using roasted rice. To process and analyze the data obtained from the questionnaire, SPSS 23 (*Statistica Package for the Social Science*) software was used.

#### B. Method

This study uses experimental research methods. In this case, the researcher manipulates a stimulus and experimental conditions, then observes the effect caused by the treatment that has been carried out systematically. To get a clean influence from the manipulated factor, it is necessary to do good control so that it does not affect other factors. (Mardalis, 2009) [19]

Organoleptic tests will be carried out to observe the respondent's preference for aroma, taste, and aftertaste (the taste that is still left in the mouth after drinking coffee (Läderach et al., 2011) [20] of the resulting rice coffee product. Organoleptic test is the nature of a product. judged by sensory perception (taste, appearance, smell, or touch)

Analysis to be performed:

- The taste that is felt by using the tongue as a taster.
- Aroma is felt by using the nose as an olfactory instrument.
- *After taste* that is felt by using the tongue as a taster

Laboratory tests will also be carried out to measure the caffeine content and acidity of the resulting product. This test will be carried out by PT Intertek Utama Services.

## IV. RESULTS AND DISCUSSION

### A. Result

In the procedure for filling out the questionnaire, 25 panelists were selected consisting of 16 men and 9 women. In the table below, the researchers selected panelists for organoleptic and hedonic tests, which consisted of 25 panelists, with the percentage of male panelists 64% and female panelists 36%. With a location at Starbucks Tanjung Duren with 6 panelists, Aroma Medan *Café* Tanjung Duren with 2 panelists, Coffee Family Ceger with 2 panelists, Hakasa Coffee Kalibata with 3 panelists, *Café* Andara Pondok Labu with 2 panelists, and 10 untrained panelists who are coffee drinkers. and have a sensitivity to caffeine.

Dimension	Indicator	Amount	%
Gender	Man	16	64%
	Woman	9	36%
Total		25	100%
Work Place	Starbucks Tanjung Duren	6	24%
	Aroma Medan <i>Café</i> Tanjung Duren	2	8%
	Kopi Family Ceger	2	8%
	Hakasa Coffee Kalibata	3	12%
	<i>Café</i> Andara Pondok Labu	2	8%
	Lainnya	10	40%
Total		25	100%

Table 4: Panelist Data

**B. Organoleptic Test**

To determine the difference in aroma, taste, and *aftertaste* in brewing coffee using roasted brown rice, roasted black rice, and brown rice. The data presented below were obtained using SPSS 23, here are the results of the 25 panelists' assessments from the table below:

Aroma		
Sample	Mean	Definition
ME 05	3.00	Herbal
HI 05	2.40	Chocolately
CO 05	2.28	Chocolately
Flavor		
Sample	Mean	Definition
ME 05	2.84	Bitter
HI 05	3.52	Sweet
CO 05	2.56	Bitter
Aftertaste		
Sample	Mean	Definition
ME 05	2.56	Bold
HI 05	2.44	Bitter
CO 05	2.68	Bold

Table 5: Sample Organoleptic Test Table in terms of Aroma, Taste and Aftertaste

Based on table 2 above, in terms of aroma, the average panelists classified the ME 05 sample as having the highest value and belonging to the herbal category, the HI 05 sample into the chocolately category, and the CO 05 sample into the chocolately category, while in terms of taste the ME sample 05 into the Bitter category, sample HI 05 has the highest

value and is included in the Sweet category, and sample CO 05 into the Bitter category and in terms of *aftertaste*, sample ME 05 into the Bold category, sample HI 05 into the Bitter category, and sample CO 05 has the highest value and is included in the Bold category.

Sample Code	Aroma		Flavor		Aftertaste	
	F	Sig	F	Sig	F	Sig
A ME 05	29.778	0.000	4.112	0.030	3.664	0.029
B HI 05	133.448	0.000	4.061	0.032	4.159	0.018
C CO 05	1.575	0.225	1.982	0.162	2.380	0.098

Table 6: Anova Test

Based on the table above, in terms of aroma, sample A (ME 05) has a Sig value of 0.000 or less than 0.05 so that the null hypothesis (H0) is rejected and the first hypothesis (H1) is accepted, namely there is a change in the aroma of brewed coffee added with roasted brown rice. .

Furthermore, sample B (HI 05) has a Sig value of 0.000 or less than 0.05 so that the null hypothesis (H0) is rejected, and the first hypothesis (H1) is accepted, namely there is a change in the aroma of brewed coffee added to roasted black rice.

Meanwhile, sample C (CO 05) has a Sig value of 0.225 or greater than 0.05 so that the first hypothesis (H1) is rejected, and the null hypothesis (H0) is accepted, that is, there is a change in the aroma of brewed coffee added with roasted brown rice.

In terms of taste, sample A (ME 05) has a Sig value of 0.030 or less than 0.05 so that the null hypothesis (H0) is rejected, and the second hypothesis (H2) is accepted, namely there is a change in the taste of brewed coffee added with roasted brown rice.

Furthermore, sample B (HI 05) has a Sig value of 0.032 or less than 0.05 so that the null hypothesis (H0) is rejected, and the second hypothesis (H2) is accepted, namely there is a change in the taste of brewed coffee added with roasted black rice.

Meanwhile, sample C (CO 05) has a Sig value of 0.162 or greater than 0.05 so that the second hypothesis (H2) is rejected, and the null hypothesis (H0) is accepted, namely there is no change in the taste of brewed coffee added with roasted brown rice.

Finally, in terms of aftertaste, sample A (ME 05) has a Sig value of 0.029 or less than 0.05 so that the null hypothesis (H0) is rejected, and the third hypothesis (H3) is accepted, namely there is a change in the aftertaste of brewed coffee added with roasted brown rice.

Furthermore, sample B (HI 05) has a Sig value of 0.018 or less than 0.05 so that the null hypothesis (H0) is rejected, and the third hypothesis (H3) is accepted, namely there is a change in the aftertaste of brewed coffee added with roasted black rice.

Meanwhile, sample C (CO 05) has a Sig value of 0.098 or greater than 0.05 so that the null hypothesis ( $H_0$ ) is rejected, and the third hypothesis ( $H_3$ ) is accepted, namely there is no change in the aftertaste of brewed coffee added with roasted brown rice.

### C. Hedonic Test (Like Test)

Before looking for differences between aroma, taste, and *aftertaste*, the researcher wants to know the level of preference of the panelists for each sample that has been provided, here are the results of the hedonic test (liking test):

Aroma		
Sample	Mean	Definition
KN 05	2.60	Like
ME 05	3.04	Like
HI 05	2.84	Like
CO 05	2.36	Don't like much
Flavor		
Sample	Mean	Definition
KN 05	2.40	Don't like much
ME 05	2.96	Like
HI 05	2.92	Like
CO 05	2.44	Don't like much
Aftertaste		
Sample	Mean	Definition
KN 05	1.68	Don't like
ME 05	2.80	Like
HI 05	2.72	Like
CO 05	2.04	Don't like much

Table 7: Table of Hedonic Test (Test of Pleasure) in terms of Aroma, Taste, and Aftertaste

Based on table 4 above, the ME 05 sample has the highest score among all the samples provided. This is probably due to the characteristic of brown rice which has a distinctive aroma, so that the distinctive aroma of brown rice mixes with the distinctive aroma of coffee, while the ME 05 sample gets the highest score, which means the taste of the ME 05 sample is the most favored by the panelists among

all the samples provided. This is probably caused by brown rice which has a distinctive taste and for the ME 05 sample, the sample with the most preferred aftertaste by the panelists among all the samples provided. This is probably because brown rice has a lighter taste, so it doesn't create an *aftertaste* that most panelists don't like.

Sample	Caffeine Level (mg/l)
Control (KN 05)	627.31
Treatment A (ME 05)	497.73
Treatment B (HI 05)	600.34
Treatment C (CO 05)	511.22

Table 8: Table of Caffeine Levels Test results

Based on table 5 above, it can be seen that the caffeine contained in roasted coffee products added with roasted brown rice (treatment A), roasted black rice (treatment B), and roasted brown rice (treatment C) was lower than the caffeine content. contained in the control sample.

## V. CONCLUSION

Based on the results of the tests that have been carried out regarding the trial of the use of roasted rice to reduce caffeine levels in brewed coffee, it can be concluded that:

- Roasted rice used as an additive in brewed coffee can reduce caffeine levels and change aroma, taste, and *aftertaste* along with the type of roasted rice used.
- The best 2 products were selected, namely Treatment A (ME 05) in terms of aroma and taste and Treatment B (HI 05) in terms of aroma and *aftertaste* from 3 types of products through organoleptic testing with comparison of control products and Treatment C (CO 05).

- Selected the best 1 product that is most in demand, namely Treatment A (ME 05) from 3 types of products through a hedonic test with comparison of control products, Treatment B (HI 05), and Treatment C (CO 05).
- The best product was selected, namely Treatment A (ME 05) with a caffeine content of 497.73 mg/L from 3 types of products through laboratory tests where the caffeine content of Treatment A had the lowest value compared to the control sample.

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