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Influence of Robusta Coffee (Coffeea Canephora) Waste Type and Coffee Waste Substitution on Chemical and Organoleptics of Roasted Brownies

Arzetha Ragilia Novita[1], Fadjar Kurnia Hartati[2*]

Department of Aquaculture, Dr. Soetomo University, Surabaya, Indonesia

Author Email: Arzetharagilia@gmail.com[1], fadjar.kurnia@unitomo.ac.id[2]

Abstract. Most Indonesians choose robusta as a coffee that is often consumed, one type of robusta that is often consumed is arjuna and temanggung. With the increase in coffee consumption, there will also be a lot of coffee grounds left. Coffee has a distinctive aroma coffee also has several contents which include several flavonoid compounds and other chemical compounds. So that coffee grounds can still be utilized, one of which is as a substitute for cocoa powder in baked brownies. The purpose of this study was to determine the type of robusta coffee grounds and the best coffee grounds substitution on chemistry and organoleptic. This study used a Completely Randomized Design (CRD) which was arranged with factorial and consisted of two factors, namely robusta arjuno coffee and robusta temanggung with each concentration of 15 g, 22.5 g, 30 g per treatment. The results showed that the type of interaction effect of robusta coffee grounds with coffee grounds substitution had no significant effect on moisture content, ash content and fiber content. Organoleptic test based on Kruskal Wallis showed that the addition of coffee grounds did not significantly affect the parameters of color, aroma, taste and tenderness. The best treatment for brownie products is 30 g robusta arjuno coffee grounds with treatment code (R1A3), with the highest Result Value (NH) of 0.577. And has a non-parametric criteria value of aroma 4.90 (neutral), fiber 9.08%, water 9.08%, tenderness 4.96 (neutral), ash 2.80%, taste 5.32 (somewhat like), color 5.29 (somewhat like).

Keywords: Chemical and Organoleptic, Robusta Coffee Ground

1 Introduction

Coffee is one of the plantation commodities that has a fairly high economic value among other plantation crops and has an important role as a source of foreign exchange for the country. So that the area of coffee plantations in Indonesia has increased and is in the second big order, while for production and export it is fourth after Colombia, Brazil, and Vietnam. This can be seen from the amount of Indonesian coffee productivity of 792 kg of dry beans per hectare per year. (Rahardjo, 2012)

Coffee contains chemical compounds that are divided into two, namely, volatile and non-volatile compounds. Volatile compounds are volatile compounds, these compounds can affect the aroma of coffee. Included in volatile compounds are aldehydes, ketones, hirdrocarbons, alcohols, carbosyl acids, esters, pyrazines, pyrrols, pyridine, sulfur components, and so on. While non-volatile compounds found in coffee beans are caffeine, chlorogenic acid and nutritional compounds. Nutritional compounds in coffee beans are carbohydrates, proteins, fats, and minerals. (Diah, 2018)

Coffee grounds are a by-product that is underutilized or even still not utilized optimally. Coffee grounds still have several other contents among them, namely carbohydrates, dietary fiber, protein, and fat. That way, in addition to coffee or coffee grounds can be used in the food sector, one of which is brownies. In this study using the types of robusta coffee grounds Arjuna and Temanggung.

Brownies are one type of blackish-brown cake with a distinctive taste that is predominantly chocolate. The structure of brownies is porous uniformity and does not require high development power.

Brownies consist of several raw materials including wheat flour, sugar, eggs, margarine, baking powder, and chocolate bars. In addition to chocolate bars, the supporting ingredient in making brownies is cocoa powder. Cocoa powder is one of the ingredients that can produce a deep taste and aroma in brownies, this is in accordance with the opinion, on (Hermawan, 2021)*Recipe* baked brownies use 45 g of cocoa powder, while

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according to (Nadya, 2021), 20g of cocoa powder is used. In addition to cocoa powder, there is coffee grounds which also have a thick taste and aroma, so it can be used as an additional ingredient in making baked brownies.

According to preliminary studies that have been carried out in the use of coffee grounds can not in large quantities to replace cocoa powder completely, because it can change the texture and aroma caused. Utilization in adding coffee grounds is expected to reduce the accumulation of coffee waste and minimize the use of cocoa powder as a supporting material as a fiber enhancer in making brownies. By using the right coffee grounds can get a good brownie product.

From the description above, this study aims to determine the different types of robusta coffee rounds, and find out the best coffee grounds suspension in roasted brownies against kimis and organoleptic.

2 Research Method

2.1 Material

The main ingredients used in making Roasted Brownies with coffee grounds substitution include, wheat flour, sugar, eggs, chocolate bars, margarine, baking powder, salt, cocoa powder, some types of robusta coffee grounds. The analysis materials used are aquades, protase enzymes, ethanol, ammonia, NaOH 2N, caffeine, ether, glass wool, chloroform, selite 545, H2SO4, NaOH, filter paper (whatman 54.51 or 541), ethanol 96%.

2.2 Tool

Tools used in making roasted brownies with robusta coffee grounds substitution are scales, mixers, baking sheets, spoons, ovens, balloon wisks, 60 mesh sieves, large and small stainless bowls, baking paper. The tools used for analysis are weighing bottles, desiccators, ovens, stirrers, spray bottles, beakers, analytical scales, 50 ml measuring flasks, 250 ml measuring flasks, 100 ml measuring flasks, water baths, goblet cups, columns, Erlenmeyer, color readers, saucers, organoleptic test attachments and questionnaires. This study used a factorial Complete Randomized Design (RAL factorial), using two factors, and two levels of each factor

2.3 Experimental Design

Factor: The type of robusta coffee grounds used with 2 levels, namely Arjuno and Temanggung coffee grounds. And the substitution factor of robusta coffee grounds used with 3 levels, namely, 15 g, 30 g and 22.5 g.
R1A1= Arjuno Robusta Coffee Grounds 15 g
R1A2= Arjuno Robusta Coffee Grounds 22.5 g
R1A3= Arjuno Robusta Coffee Grounds 30 g
R2A1= Temanggung Robusta Coffee Grounds 15 g
R2A2= Temanggung Robusta Coffee Grounds 22.5 g
R2A3= Temanggung Robusta Coffee Grounds 30 g

2.4 Coffee Grounds Procurement Process

From the results of research that has been done, there are several processes carried out in making roasted brownies that use different types of Arjuno robusta coffee grounds and GTemanggung robusta coffee grounds substitution.

From the results of the study, there are several processes in making robusta coffee that produce arjuna and temanggung coffee grounds using the mocha pot method. The stages of making coffee grounds include, Weighing coffee beans, using 20 g of coffee beans, Grinding coffee with a grinder, Filling ingredients in mocha pots, Heating process mocha pots on stove stoves, for 25 minutes, Collection of Arjuno and Temanggung Robusta coffee grounds, Drying coffee grounds, coffee grounds obtained are the results of wet coffee grounds. Drying coffee grounds is done using modern techniques, using an oven at a temperature of 750 C within 30 minutes, Grinding coffee grounds using a dry mill, 2 minutes, Sieving coffee grounds using a sieve (60 mesh), Producing usable coffee grounds powder.

2.5 Roasted Brownies Process

The process of making roasted brownies coffee grounds, the process of making roasted brownies with robusta arjuno coffee grounds and temanggung includes, heating ingredients. Melt the ingredients that can be mixed, the melted ingredients are margarine, and chocolate bars, beating is done by mixing eggs, sugar, palm sugar using a mixer at a *speed* of 1-3 for 4 minutes or until the sugar dissolves and the egg dough rises slightly, then mixing is done by mixing dry ingredients including flour, cocoa powder, baking powder, and also

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substitution of coffee grounds with ingredients that have been beaten (eggs, sugar, etc.) and also the ingredients have been melted (butter and chocolate bars) mixing is done manually, printing is done using a square baking sheet 20 cm x 20 cm x 7 cm, baking dough that has been poured on a baking sheet, ovened at a temperature of 180^0 C within 30 minutes., brownie cooling is done for 5 minutes.

From the description above, you can see clearly in the flow diagram of the process of making coffee grounds roasted brownies contained in the picture

2.6 Analysis Method

Data collection in the form of inorganic and orgnaik data. Inorganic tests involving ash content, fiber content, water content, and organic tests involving 30 panelists. The favorability scale is 1: strongly dislike, 2: dislike, 3: somewhat dislike, 4: neutral, 5: somewhat like, 6: like, 7: strongly like.

3 Result and discussion

3.1 Results of Chemical Analysis

Table 1. The Results of Chemical Analysis of Baked Brownies Coffee Grounds

Treatment Code	Information (robusta type, concentration)	Air (%)	Ash (%)	Fiber Rate (%)
R1A1	Arjuno 15 g	10,81	2.39	6,68
R1A2	Arjuno 22.5 g	10,41	2,36	8,23
R1A3	Arjuno 30 g	9,08	2,80	9,08
R2A1	Temanggung 15 g	11,44	2,15	4,07
R2A2	Temanggung 22.5 g	11,20	2,21	4,86
R2A3	Temanggung 30 g	10,22	2,42	6,39

3.1.1 Air

The results of the analysis of various water content fingerprints, showed that the type of robusta coffee grounds, different coffee grounds substitution and the interaction between robusta coffee grounds type treatment and coffee grounds substitution had no real effect on water content, this is suspected because the coffee grounds substitution concentration interval is too close, and coffee grounds are used in powder form so that there is no addition of water. (Santosa, 2021)

The table above shows that the treatment on robusta temanggung 15 g gives the highest moisture content value of 11.44% with the treatment code R2A1, this is because at the time of ovening the hot baked brownie product released in the oven is uneven, so that the heat in the robusta temanggung treatment is less than the oven heat in the robusta arjuno treatment, so that the water contained in the robusta temanggung treatment does not evaporate optimally and has a high moisture content. While robusta arjuno 30 g has the lowest value of 9.08% with the treatment code R1A3.

The water content contained in baked brownies is not only from the factor of coffee grounds, but comes from other basic ingredients, for example chocolate bars, flour, sugar and so on. Water in food plays a role in influencing the level of freshness, stability, durability and ease of occurrence of chemical reactions, enzyme activity and microbial growth. (Winarno, 2004)

If it is related to the quality requirements of sweet bread based on SNI 01-3840-1995, it has a moisture content standard of 40% so that the coffee grounds substitute brownies produced can be declared still in accordance with the standards set by the Indonesian National Agency.

3.1.2 Ash Content

The results of the analysis of the variety of ash content, show that the type of robusta coffee grounds, different coffee grounds substitution, and the interaction of robusta coffee grounds type treatment and coffee grounds substitution have no real effect on ash content, this is suspected because the coffee grounds substitution concentration interval is too close, and so the amount of minerals contained in it is not much different. The table above shows that the treatment on Arjuno 30 g robusta gives the highest ash content value of 2.80% with the treatment code R1A3, while the Temanggung 15 g robusta has the lowest value of 2.15% with the treatment code R2A1. Ash content is an inorganic residue from the ashing process and usually the components found in natural inorganic compounds are potassium, potassium and so on. (Winarno, 2004)

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If it is related to the quality requirements of sweet bread based on SNI 01-3840-1995, it has an ash content standard of 3.0 so that the coffee grounds substitute brownies produced can be declared still in accordance with the standards set by the Indonesian National Agency.

3.1.3 Fiber Content

The results of the analysis of fingerprints of various fiber contents, showed that the type of robusta coffee grounds, and the substitution of different coffee grounds had a very real effect on fiber content, while the interaction of robusta coffee grounds type treatment and coffee grounds substitution had no real effect on fiber content. This is thought to be because the concentration interval of coffee grounds substitution is too close. The table above shows that the treatment on Arjuno robusta 30 g

Provides the highest fiber content value of 9.08% with the treatment code R1A3, while robusta Temanggung 15 g has the lowest value of 4.07% with the treatment code R2A1. This is because, that a high concentration of coffee grounds will produce high fiber content, so that the decrease in coffee grounds will reduce fiber content. This is because coffee grounds are one of the fibers. Crude fiber is a compound that is commonly analyzed in the laboratory, that is, compounds that cannot be hydrolyzed by acids or alkalis. (Sudarmadji, 1997)

In the results of the study, fiber content does not only come from the substitution of coffee grounds, but also comes from other basic ingredients, one of which is flour.

3.2 Organoleptic Test

Table 2. Analysis Results of Organoleptic Brownie Roasted Coffee Grounds

Treatment Code	Information (dregs type, concentration)	Taste	Color	Flavor	Tenderize
R1A1	Arjuno 15 g	5,32	5,35	5	5
R1A2	Arjuno 22.5 g	5,19	5,38	4,96	5,06
R1A3	Arjuno 30 g	5,32	5,29	4,90	4,96
R2A1	Temanggung 15 g	5,54	5,45	5,29	5,29
R2A2	Temanggung 22.5 g	5,19	5,41	4,93	5,03
R2A3	Temanggung 30 g	4,96	5,32	4,93	4,74

3.2.1 Taste

The table above shows that, roasted brownie products with 15 gr robusta arjuno coffee grounds gave the highest taste value of 5.54 which means the taste of the brownies was considered somewhat preferred by the panelists, while robusta temanggung 30 g with the lowest value of 4.96 which means the taste of the baked brownies was considered neutral by the panelists. This is because, the taste of Temanggung coffee grounds is more concentrated than arjuno, so that the 15 g Temanggung coffee grounds brownie product is preferred by panelists.

Based on the results of Wallis's crucial test, stating that the value of $p = 0.56 > \alpha = 0.05$, shows that the resulting value is not significantly different between each treatment, meaning that the difference in substitution on coffee grounds has no influence on the level of acceptance of panelists on the taste parameters of arjuno pulp baked brownies and temanggung.

3.2.2 Color

The table above shows that, the roasted brownie product robusta coffee grounds temanggung 15 g gave the highest value of 5.45 which means the color of the baked brownie product was considered somewhat like by the panelists, but the roasted brownie product robusta arjuno 30 g gave the lowest value of 5.29 which means the color of the brownie product was considered somewhat like by the panelists.

In coffee grounds baked brownie products, the resulting color is dark brown, which is caused by the formula of the main ingredients, namely chocolate bars and cocoa powder used according to a formula that has been modified with the addition of coffee grounds. However, browning reactions (maillard reactions) can arise due to the presence of proteins and sugars in the basic ingredients for making brownies. During the processing process, sugars and amino acids from proteins will react in the presence of heat with aldehyde or ketone groups from reducing sugars and produce a brown color. (Melapa, 2015)

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Based on the results of the crucal wallis test, stating that the value of $p = 0.99 > \alpha = 0.05$, shows that the resulting value does not differ significantly between each treatment, meaning that the difference in substitution on coffee grounds has no influence on the level of acceptance of panelists on the color parameters of roasted brownies arjuno pulp and temanggung

3.2.3 Flavor

The table above shows that, roasted brownie products with Temanggung 15 gr robusta coffee grounds provide the highest flavor value of 5.29 which means they are considered somewhat like by the panelists, but the roasted brownie products of Arjuno robusta 30 g give the lowest value of 4.90 which means the flavor of the brownie product is considered neutral by the panelists. This is because, the flavor on the coffee grounds is more concentrated than arjuno, so the flavor of coffee grounds on roasted brownie products is more pronounced.

One of the influences on brownies is the use of chocolate bars and cocoa powder with the same amount in each treatment. Chocolate bars and cocoa powder when heated will cause a sharp chocolate aroma with the addition of flavor to the coffee ground. However, there are some treatments that have a sharper coffee flavor and also not. (Wahyudi, 2008).

Based on the results of Wallis's crucial test, stating that the value of $p = 0.69 > \alpha = 0.05$, shows that the resulting value does not differ significantly between each treatment, meaning that the difference in substitution on coffee grounds has no influence on the level of acceptance of panelists on the color parameters of arjuno pulp baked brownies and temanggung.

3.2.4 Tenderize

The table above shows that, baked brownie products with Temanggung robusta coffee grounds 15 gr provide the highest tenderness value of 5.29 which means the tenderness of the brownie product is considered somewhat preferred by the panelists, but in robusta temanggung 30 g with the lowest value of 4.74 which means the tenderness of the baked brownies is considered neutral by the panelists.

In the process of processing coffee grounds brownies the technique used is the same, with the same time. Using the roasting process in the roasting process occurs the release of water bound in the starch gel at a certain temperature and time interval. Increasing temperature during roasting results in evaporation of water, thus pushing the gel tissue and resulting in emptying in the tissue that forms cavities in brownies. (Winarno, 2004)

Based on the results of Wallis's crucial test, stating that the value of $p = 0.51 > \alpha = 0.05$, shows that the resulting value is not significantly different between each treatment, meaning that the difference in substitution on coffee grounds has no influence on the level of acceptance of panelists on the color parameters of arjuno pulp baked brownies and temanggung

3.3 Best Formula Brownis Coffe Waste

Based on the determination of effectiveness tests on all research parameters that include parametric data including water content, ash content, fiber content, and non-parametric data including taste, color, flavor, and tenderness listed in annex 23, which shows that the treatment of Arjuno 30 g robusta coffee grounds is the best treatment with the highest Nilasi Results (NH).

Judging from the results of the effectiveness test, it shows that the 30 g robusta arjuno coffee grounds brownie product with the treatment code (R1A3) is the best treatment, with the highest Yield Value (NH) of 0.577. And the criteria values are aroma 4.90 (neutral), fiber 9.08%, water 9.08%, tenderness 4.96 (neutral), ash 2.80%, taste 5.32 (somewhat like), color 5.29 (somewhat like).

4 Conclusion

There is no effect of interaction between robusta coffee grounds type and coffee grounds substitution on chemical quality, and organoleptic roasted brownies. The best treatment that can be obtained from the results of the study is, the type of arjuno coffee grounds 30 g with the treatment code (R1A3) is the best treatment with the highest Yield Value (NH) of 0.577, with the criteria value is aroma 4.90 (neutral), fiber 9.08%, water 9.08%, tenderness 4.96 (neutral), ash 2.80%, taste 5.32 (somewhat like), color 5.29 (somewhat like).

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