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The Effect of the addition of Durian (*Durio Zibethinus* Murr) Flesh on Gayo Wine Coffee Characteristics

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A B S T R A C T

Effect of durian flesh on the characteristics of Arabica Gayo wine coffee quality by fermentation methods have been investigated. This study aims to determine the effect of giving durian flesh to the characteristics of the Arabica Gayo Wine Coffee and to determine the optimum addition amount of durian flesh. This study used a completely randomized design (CRD) with 5 treatments and 3 replications. Data analysis using ANOVA was then continued with Duncan's New Multiple range test (DNMRT) at a significance level of 5%. The treatments were: the addition of durian flesh 0, 25, 50, 75, and 100 g to 1000 g of coffee cherry. Based on the sensory test, the highest score was obtained by adding 0 g of durian flesh to 1000 g coffee cherry (score: 76.5) which was followed by the addition of 75 g of durian flesh to 1000 g coffee cherry (score: 72.75). The results showed that the addition of durian pulp had a significant effect on the ash content and caffeine content but did not significantly affect the water content. It can be seen that the addition of durian flesh for fermentation for 30 days is not suitable, because it can cause over-fermentation Over fermentation can cause a decrease in the sensory score of the arabica wine coffee.

1. INTRODUCTION

1.1. Research Background

Indonesia is one of the largest and best coffee-producing countries in very high quality and taste. Therefore, it is not surprising that Indonesian coffee is loved by the world community, especially the Gayo Arabica coffee type, this type of coffee grows in the Gayo-Aceh highlands. Previously, Arabica coffee was only processed traditionally, which is called with the natural process. Along with the times and the increasing development of technology, the coffee process method is also growing and has many variants of the process, one of which is fermented coffee or called wine coffee.

Wine coffee is coffee obtained from the fermentation process. The main purpose of coffee fermentation is to break down the mucilage which is attached to the skin of the coffee horn so that it is easy to clean when it is washed. In addition, fermentation can reduce the caffeine content of coffee beans and can improve the taste. It is also used to improve the physical quality of coffee, in improving the quality of coffee that is fermented using microorganisms, microorganisms must be adjusted, because if the microorganisms are not suitable, it will change the balance of the population of microorganisms that play a role in the fermentation process, so that the process and results of fermentation will change. [1].

In this study, fermentation was carried out with the addition of durian fruit in the fermentation process. Durian fruit is a type of climacteric fruit which is characterized by rapid CO_2 and ethylene production during ripening so that it is easily damaged due to chemical changes, enzyme and microbial activity [2]. Thus, the addition of durian will trigger an enzymatic reaction in the durian fruit flesh, so changes can occur biochemicals that will form compounds that give coffee its aroma, flavor and color [3]. Fermentation aims to create a distinctive taste profile reduce coffee caffeine levels [4].

1.2. Literature Review

The fermentation process is divided into 3 stages, namely: (1) carbohydrates are broken down into sugar (2) sugar into alcohol (3) Bacteria convert alcohol into lactic acid [4].

According to Ref. [5], the term lactic acid bacteria includes a group of microorganisms that have the ability to produce lactic acid from fermentable carbohydrate sources, lactic acid bacteria play a role in various food fermentations, including fruits,

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vegetables, milk and meat. Ref. [6] reported that a fundamental biochemical change in the fermentation process is to make the environment acidic, so that many harmful microbes cannot survive in that environment, but lactic acid bacteria can live in an acidic environment, suitable for the development of lactic acid bacteria.

There are several types of microbes that are effective for the hydrolysis of proteins and carbohydrates under anaerobic conditions, namely the Lactic Acid Bacteria group. Durian flesh contains a lot of protein and carbohydrates for nutrients or food sources for the lactic acid bacteria group, namely *Aeroccous, Carnobacterium (Atopical Lactobacilli), Enterococcus, Lactobacillus, Lactococcus, Leuconostoc, Oenococcus, Pediococcus, Streptococcus, Tertragenococcus or Pediococcus halophilus, Weisella,* and *Vaganococcus*

1.3. Research Objective

The research objectives are as follows: (1) To identify the effect of durian flesh on fermentation of Gayo Arabica wine coffee; (2) To observe the best sensory profile of Gayo Arabica Wine coffee.

2. MATERIALS AND METHODS

2.1. Material and Equipment

The ingredients used are Gayo Arabica coffee fruit with perfect ripeness and evenly red. Durian flesh from Gayo market that has been selected with a sweet taste and hot water with a temperature of 90^{o}C, distilled water, chloroform, and $CaCO_3$

The tools used in this research are questionnaires and stationery, analytical balance, coffee grinder, rosting machine, glass, thermometer, kettle, long neck, spoon, coffee rosted machine, tablespoon, oven, rotary evaporator, cup, aluminum, goblet , Porcelain cup, Aluminum cup, Beaker, Desicator, Gegep, Erlenmeyer, Dropper, Test tube, Filter paper, Spatula, Measuring flask Water bath Measuring flask, Separating funnel, 5 kg plastic,

2.2. Design Experiment

The research design used in this study was a completely randomized design (CRD) with 5 treatments and 3 replications. a)*Treatment A*: Without adding durian to 1000 g of coffee cherries. b) *Treatment B:* Addition of 25 g of durian flesh into 1000 g of coffee cherries; c) *Treatment C*: The addition of 50 grams of durian flesh into 1000 g of coffee cherries, d) *Treatment D*: Addition of 75 g of durian flesh into 1000 g of coffee cherries; e) *Treatment E*: Addition of 100 g of durian flesht to 1000 g of coffee cherries. The results of the observations of each parameter were statistically analyzed with the F test and continued with the Duncan's New Multiple Range Test (DNMRT) test at a 5% significance level.

2.3. Coffee Processing

2.3.1. Preparation of Raw Material

The raw material used in this study was 15 kg of Gayo Arabica coffee cherries. Harvesting of coffee cherries is done manually as is done by farmers, the coffee cherries used are perfectly ripe coffee cherries.

2.3.2. Sorting

The coffee cherries are put in a plastic bucket which is filled with water to separate the good coffee cherries from the damaged coffee cherries. The damaged coffee cherries will float and the good and full coffee cherries will sink.

2.3.3. Fermentation

The coffee cherry is put in a closed plastic fermentation container so that the fermentation process can take place properly, then given a mixture of durian flesh. There are 5 treatments so that each plastic contain 1000 g of cherry. In plastic A without durian, plastic B was given a mixture of 25 grams of durian flesh, plastic C was given a mixture of 50 grams of durian flesh, plastic D was given a mixture of 75 grams of durian flesh, and finally plastic E was given a mixture of 100 grams of durian flesh. This fermentation lasts for 30 days in a tightly closed container and at room temperature. Every two days the container is opened and shaken in a plastic bucket.

2.3.4. Drying

Beans that have been fermented for 30 days are then dried directly in the sun to dry until the outer skin of the coffee is black and hard or until the water content is 12%.

2.3.5. Dehulling

For natural processing or coffee wine, peeling the skin directly using a Dry Huller, which will produce coffee beans which are then sorted properly for processing.

2.3.6. Roasting

The coffee beans that are ready to be sorted are then roasted using a roasting machine, where the roasting used is medium type. After roasting, roasted beans are stored for 3 days.

2.3.7. Grinder

The roasted coffee beans are then allowed to stand for 3 days, for the release of carbon gas, the coffee beans that have been allowed to sit directly enter the grinder or milling process to become coffee powder.

2.4. Observation

In this study, the observations made were chemical tests and sensory tests. Chemical tests include water content, ash content, caffeine content, and sensory testing by means of a cupping test.

2.4.1. Moisture Content [8]

First, clean the aluminum cup from dirt and then dry it in the oven at 110^{o}C for 1 hour. After that the cup was cooled in a desiccator and weighed. After the weight of the cup is obtained, put 5 grams of coffee powder into the aluminum cup. The aluminum cup containing the sample was placed in an oven at 110^{o}C. Every 1 hour heating the cup is removed from the oven and transferred to a desiccator for 10-15 minutes and then weighed. Warm up until a constant weight is obtained. Calculate the moisture content of the sample using the following formula:

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Moisture Content (%) = (W1-(W2-W0))/W1 x 100%

Information:
W0 = weight of empty cup (g)
W1 = sample weight (g)
W2 = weight of the cup and the powdered sample (g)

2.4.2. Ash Content [8]

5 grams of coffee powder was weighed and put into a pre-weighed porcelain crucible. The sample is heated until it becomes charcoal and does not emit smoke. Then it is burned in a kiln at a maximum temperature of 550℃ to become ash. Cool in a desiccator for 15 minutes and weigh as soon as it reaches room temperature.

Ash Content (%) = ((ash (g)+procelein(g)-porcelein (g))/(sample (g)) x 100%

2.4.3. Analysis of Caffeine Content [9]

1 gram of coffee powder is put into a beaker, added 150 mL of hot distilled water while stirring. hot coffee solution is filtered through a funnel with filter paper into a xerlenmeyer. An amount of 1.5g of Calcium Carbonate ($CaCO_3$) and the coffee solution was put into a separating funnel and then extracted 4 times, each with the addition of 25 mL of chloroform. The bottom layer was taken, then the extract (chloroform phase) was evaporated with a rotary evaporator until the chloroform evaporated completely. The solvent-free caffeine extract was put into a 100 mL volumetric flask, diluted with distilled water to the x mark and homogenized. To read the value of concentration x on spectrophotometry at a wavelength of 275 nm, each 100 mL sample was taken 0.1 mL, diluted in 6 mL of distilled water.

2.4.4. Sensory Test

The cupping test was carried out by trained panelists (Q graders. The taste variables assessed included aroma (the smell of aroma when brewed), flavor (taste on the tongue), body (thickness), acidity (acidity), after taste (taste left in the mouth), sweetness (sweet taste), balance (taste balance aspect), clean cup (overall taste aspect). Sensory test was carried out based on SCAA (Specialty Coffee Association of America) method [10].

Panelists were asked to define and rate each of the specified flavor attributes. The scale used in the cupping test is 4 numerical scales, namely good (6-6.9), ver goodx (7-7.9), excellent (8-8.9) and outstanding (9.9-9). If the total sensory score of steeping coffee is > 80 on a scale of 100. Based on the cupping test, it can be categorized as specialty coffee.

The presentation of the cupping test for each sample is carried out in the following way:

a) Coffee is ground for 15 minutes before pouring hot water, otherwise the coffee in the test cup must be tightly closed.
b) Coffee is weighed in a ratio of 8.25 g to 150 ml of water.
c) Medium coarse ground coffee particles such as fine granulated sugar.
d) Ensure that each ground coffee in the test cup is clean and not contaminated (the grinder must be clean) as well as other glassware to prevent contamination of aroma and taste.
e) Prepare boiling water and let it stand until the water temperature is 93ºC, then pour hot water into the cup (the amount of water according to the coffee ratio) is left for 3-5 minutes before being evaluated.

3. RESULT AND DISCUSSION

3.1. Moisture Content

Water content is one of the factors that affect the durability of a product, the lower the water content of the product will extend the shelf life of a material, on the contrary if the dried material is not too dry, the shelf life will be lower. Based on the analysis of the variance of the moisture content of Gayo Arabica coffee powder, this study gave an insignificant difference at the level of = 5% (F count < F Table 0.05) on the water content of Gayo Arabica coffee powder produced. The following are treatments that are not significantly different, so the DNMRT further test is not carried out at a 5% significance level. The results of the study can be seen in Table 1.

Table 1. The Effect of Addition of Durian Flesh to Water Content, Ash Content and Caffeine Content of Gayo Arabica Wine Coffee

Treatment	Moisture Content (%)	Ash Content (%)	Caffeine Content (%)
A	2.05 ± 0.010	3.05 ± 0.095	0.66 ± 0.02
B	2.07 ± 0.069	3.26 ± 0.089	0.53 ± 0.05
C	2.08 ± 0.026	3.27 ± 0.098	0.53 ± 0.01
D	2.04 ± 0.152	3.26 ± 0.089	0.51 ± 0.03
E	2.09 ± 0.025	3.31 ± 0.057	0.50 ± 0.04

The highest water content was shown by treatment C (50 grams) which was 2.08%, while the lowest water content was in treatment D (75 grams) which was 2.04% (Table 1). Based on the data above, it can be seen that the addition of durian fruit flesh does not have a different effect on the moisture content of the Gayo Arabica coffee powder produced, this is due to the processing process when the coffee beans are fermented, this bound water is very strongly attached to the molecular network of the material. Therefore, microorganisms cannot reach and utilize bound water for their living media. Microorganisms can only consume free water up to the limit of its A_w value.

The water content of coffee grounds tends to decrease when the temperature and roasting time increase, according to the results of the research of Ref. [11] there is an effect on the decrease in the value of the water content of coffee beans after roasting. The higher the temperature used, it will affect the value of the water content in the coffee beans. According to Ref. [12], the water content of coffee grounds is influenced by the moisture content of the beans and the processing of coffee grounds such as the drying and roasting process, relative humidity of the air, air temperature, air flow, environmental conditions, and storage places can also affect the moisture content of coffee grounds.

Ash content is a mineral element as a residue left after the material is burned until it is free of carbon elements. Based on the analysis of the variance of the ash content of coffee grounds, this study gave a significantly different effect on the level of = 5% (F count < F Table 0.05) on the results of the ash content of Gayo Arabica coffee powder produced (Table 1).

The highest ash content was shown by treatment E (100 grams) which was 3.31%, while the lowest ash content was in treatment A (0 grams) which was 3.05% (Table 1). Based on the

data above, it can be seen that the more giving of durian fruit flesh has a different effect on the ash content of the Gayo Arabica coffee powder produced, in the process of processing coffee beans using meat there is a relationship the more durian flesh, the more ash produced in coffee powder. gay arabica.

Ash is an inorganic substance from the rest of the combustion of an organic material, the minerals contained in a material consist of two kinds of salts, namely organic salts and inorganic salts. The longer the fermentation, the ash content will increase because during the fermentation process it will increase the content of organic acids such as acetic acid, malic, oxalic and others [13].

If the content of organic acids increases, the salt content in these organic acids will also increase, which will cause an increase in the ash content in coffee. The high ash content is due to the high content of mineral compounds, besides that, dirt and remaining epidermis can also affect the ash content contained in coffee beans. Differences in ash content of coffee grounds are caused by factors, including plant cultivation, post-harvest treatment processes and the quality of the coffee produced from the whole process. All of the observed fermentation time treatments met the quality requirements of ground coffee (SNI 01-3542-2004). According to SNI 01-3542-2004, the quality requirement of ground coffee ash content is a maximum of 5% [14].

Coffee is a drink with different caffeine content depending on the type of coffee. The same thing was also expressed by Ref. [15], the caffeine content of coffee beans varies depending on the type of coffee and the geographical conditions in which the beans are grown. Excess caffeine and acid content can have a negative impact on health. Based on the analysis of the variance of the caffeine content of the coffee powder, this study gave a significantly different effect of the level = 5% (F count < F Table 0.05) on the results of the caffeine content of the Gayo Arabica coffee powder produced. The results of the average ash content can be seen in Table 1.

The highest caffeine content was shown by treatment A (0 grams) which was 0.66%, while the lowest caffeine content was in treatment E (100 grams) which was 0.50%. Based on the data above, it can be seen that the more giving of durian fruit flesh has a different effect on the caffeine content of the Gayo Arabica coffee powder produced. With the addition of durian flesh, the caffeine content of Gayo Arabica coffee powder decreases (Table 1).

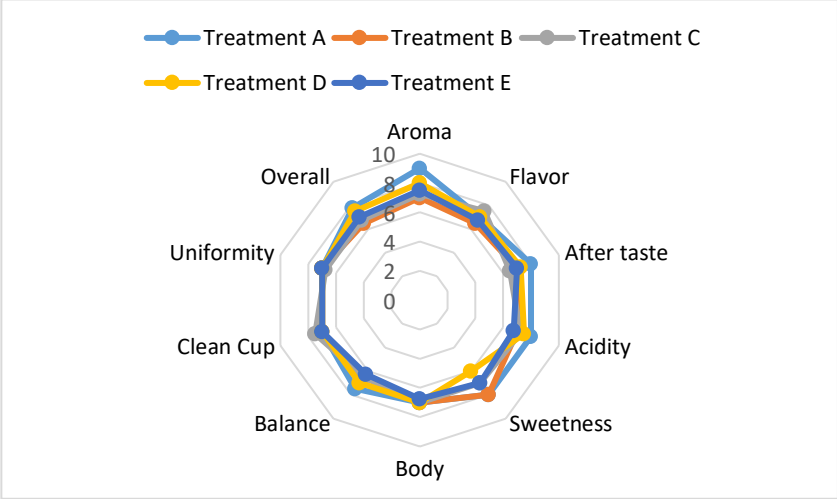

Figure 1. The sensory profile of of Gayo Arabica Wine Coffee in the five fermentation treatments

Through the fermentation method, the addition of durian flesh will create an acidic condition that is suitable for the growth of lactic acid bacteria. Where the caffeine content in coffee is broken down into ester compounds by lactic acid bacteria. Caffeine belongs to a class of alkaloid compounds which are broken down into esters in the form of chlorogenic acid through an esterification process so that the amount in coffee is reduced or also known as decaffeination [16].

From the results of testing the caffeine content of ground coffee in this study, the test results ranged from 0.5-0.66%, from these results obtained a good value because it did not exceed the standard caffeine content of ground coffee (SNI 01-3542-2004) standard caffeine content ground coffee ranges from 0.45-2%, the caffeine content test in this study has met the standard..

3.2. Sensory Analysis by Cupping Test

The value of the sensory score of coffee powder in this study can be seen in Table 2 and Figure 1. Coffee bean fermentation affects the formation of the taste of coffee beans, especially to reduce the bitter taste and encourage the formation of a mild impression on the brewed taste. Microbes that play a role during fermentation are also able to produce metabolites that form an acidic and alcoholic taste in coffee brewing. The flavors formed during fermentation include aroma, aftertaste, acidity, body, uniformity, balance, clean cup, sweetness and so on. On the other hand, excessive fermentation can cause flavor defects in coffee beans such as fermented taste, sour and stinkers [17].

The highest total cupping test score in various treatments without the addition of durian fruit flesh with a total score of 76.5, while the lowest score was indicated by the treatment with 100 grams of durian fruit growing, which was 69. The score below 75, is categorized as off grade category. It can be seen that the addition of durian flesh for fermentation for 30 days is not suitable, because it can cause over-fermentation where the environment is no longer good for coffee, so it can cause a decrease in the taste quality of the arabica wine coffee.

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Table 2. Sensory attribute of Arabica Gayo Wine Coffee from Various Treatment

	Treatment				
Sensory attribute	A	B	C	D	E
Aroma	9	7	7.25	8	7.5
Flavor	7	6.5	7.5	7	6.75
After taste	8	7	6.5	7.25	7
Acidity	8	7	7.25	7.5	6.75
Sweetness	8	8	7	6	7
Body	7	7	7	7	6.75
Balance	7.5	6.5	6.5	7	6.25
Clean Cup	7	7	7.5	7	7
Uniformity	7	7	6.75	7	7
Overall	7.8	6.5	6.75	7.5	7
Total	76.5	69.5	70	71.75	69

The decrease in the quality of the taste of coffee is influenced because the fermentation time is too long with the addition of durian, coffee wine that does not add durian has a high enough score to enter the category of fine commercial coffee. The overall score of the cupping test decreased due to over-fermentation which can change the taste of the coffee and reduce the quality of the coffee. The sensory profile of each sensory attribute in details can be seen in Figure 1.

4. CONCLUSION

Based on the results of the research that has been carried out, the following conclusions can be drawn: (1) The treatment of giving Gayo Arabica coffee durian meat has a significant effect on ash content and caffeine content. However, it has no significant effect on the water content; (2) The results of the calculation of the highest sensory test in various treatments with the addition of durian flesh were shown by the treatment without the addition of durian flesh. With a total score of 76.5 while the lowest score was indicated by treatment with 25 grams of durian fruit, which was 69.5. Gayo coffee cupping score is 80 which is included in specialty, so it can be concluded that the total score for coffee wine with the addition of durian is close to good results; (3) Based on the research that has been done, it is recommended to conduct further research in coffee processing with innovation and creativity in different treatments, so that coffee powder will be produced with better quality and create new flavors.

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