



Characteristics of Blended Arabica and Robusta Coffee with Cocoa and Red Ginger Powder

Candra Sigalingging* 

Department of Food Technology, Universitas Nahdlatul Ulama Sumatera Utara, Medan, 20125, Indonesia

*Corresponding Author: canlin0401@gmail.com

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ABSTRACT

Coffee is blended using different proportions of cocoa and red ginger powder. The best hedonic results were tested for antioxidants, total phenols and total flavonoids. This study was conducted using DPPH (1.1 diphenyl 2 picrylhydrazil, total phenol content and total flavonoids. Research results show that the method of mixing cocoa and red ginger ingredients with coffee as raw materials for making coffee drinks has a significant effect on the maximum total phenol content of coffee with vo (P and It; 0.05) 72.9 mg/l, minimum 51.22 mg/l for arabica coffee, this compound is assumed to be dominated by 74% chlorogenic acid according. The content of phenol compounds in ginger has the ability to inhibit the growth of E. coli bacteria and maximum for total flavonoids 87.22 (mg quercetin/g), minimum 80 (mg kercetin/g). The value of antioxidant activity (IC50) of coffee drinks was in the range of 6.49 - 9.7 µg / ml which indicates that coffee drinks have very strong antioxidant activity. The IC50 value of the material ≤10 µg / ml is a very strong antioxidant. A comparison of coffee powder, red ginger powder and cocoa powder (7: 2: 1) has a positive effect on the antioxidant activity and total phenol content of Arabica coffee beverages, depending on the panellist preferences.

Keyword: antioxidant, coffee, cocoa, flavonoids, red ginger



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1. Introduction

According to Statistics Center Department (BPS), coffee commodity exports recorded in 9 codes of the Harmonized System (HS Code), in the period January-June 2018, the value dropped 37.5% to US \$ 359.85 million, while the volume fell 47.54% to 116,511 tons. In the same period in 2017, the value of coffee exports reached US \$ 575.78 million with a volume of 222,099 tons [1] (BPS, 2018). Brewed coffee is a beverage product that has a distinctive flavor and aroma. In general, there are two types of coffee beans which are often known as robusta coffee and arabica coffee. In general, the coffee beverage products produced are ground coffee and instant coffee. The difference from ground coffee and instant coffee is in the production process. If ground coffee after roasting only ends at the grinder. While in instant coffee after refining and into ground coffee, then proceed with the suspension process. After the suspension and filtering are produced, the coffee water will be processed further crystallization, then the last one is refining with a ball mill machine.

However, research on the effect of coffee consumption and cocoa products simultaneously is still limited [2][3] Many studies have been carried out on antioxidant properties and health effects related to coffee and cocoa products all studies including the antioxidant properties of coffee and cocoa beans were carried out with a focus on antioxidants, ignoring the presence of bound antioxidants.

Ginger extract is generally added to beverages with less favorable sensory values, so adding ginger extract is expected to increase the sensory value of a drink. One example is the ginger coffee drink. The coffee drink is

less favorable from a sensory point of view, but adding ginger can increase the sensory acceptance of the coffee drink. Ginger is a distinctive spicy flavor enhancer.

The combined coffee from ginger with subcritical water which is shown to be very good functional properties and beneficial sensory attributes is comparable to conventional types of coffee (traditional, instant, espresso, American / filter). Acidity, astringency and bitterness are more pronounced in ginger-based drinks compared to other drinks [4].

Coffee drinks mixed with cocoa powder with repeated intake of drinks are newly developed drinks. Consumers can be easily identified with their drinks since the appearance of 'Americano' coffee with a rather dark color. The bitter taste in cocoa coffee arises because of phenolic and flavonoid compounds that negatively affect consumer acceptance. Consumers tend to be conservative in evaluating new products and have different conceptualization processes to determine their likes and dislikes [5].

Therefore, this study aimed to investigate the interaction between ginger powder and cocoa powder to color, aroma and taste and antioxidant activity found. This knowledge as a background for making coffee powder how much mixing the red ginger and cocoa is and the antioxidant activity produced. The selected coffee powder is used in experimental research originating from North Sumatra.

2. Materials and Methods

2.1 Materials

The materials used in this study were Lintong Arabica and robusta coffee powder and Cocoa powder and red ginger powder. The chemicals used in this study were aquades, Sodium chloride, Hydrochloric Acid and methanol, DPPH (1,1-diphenyl-2-picrylhydrazyl). The tools used include a set of UV-Visible spectrophotometric SCITEK 809 Model: SP-UV759, digital scales, 60 mesh sieves, soxhlet, filter funnels, Erlenmeyer, gas stoves, stainless steel pans, thermometers, pH meters, saucers, ovens dryer, desiccator, maceration tube.

2.2 Procedures

2.2.1 The production of Coffee Powder containing Cocoa and Red Ginger Powder

Making coffee ingredients, was done by: G1: Arabica coffee 7g, G2: Robusta coffee 7g G3: Arabica and robusta coffee 7g mixed with a ratio of 1: 1. Phase II research was made coffee with a comparison of a mixture of red ginger and cocoa powder K1: Coffee with a ratio of red ginger + cocoa powder 0: 3 gr / bb, K2: Coffee with a ratio of red ginger + 1: 2 gr / bb cocoa powder, K3: Coffee with a ratio of red ginger + cocoa powder 2: 1 gr / bb, K4: Coffee with a ratio of red ginger + cacao powder 3: 0 gr / bb. After that, a hedonic analysis was carried out to determine the mix that the panelists preferred. The best hedonic results will be tested for antioxidants and total phenolic content.

2.2.2 Analysis Procedure

2.2.2.1 Analysis Antioxidants

2.2.2.1.1 Determination of absorbance curve of DPPH Solution

The DPPH solution with a concentration of 40 µg/ml was transferred into the curvette and placed into the spectrophotometer. The absorbance was measured within the wavelength between 400 to 800 nm to get absorbance curve. From this absorbance curve, the maximum absorbance of DPPH solution was found to be 516 and used in this study.

2.2.2.1.2 DPPH free radical scavenging assay of Coffee Powder containing Cocoa and Red Ginger Powder

10 µg of sample was put into a 10 ml measuring flask and methanol was added to the tera limit, which is referred to as a stock solution. Then from the stock solution a solution was made with several concentrations of 40 µg / ml, 80 µg / ml, 120 µg / ml, 70 µg / ml and 160 µg / ml. The trick, the stock solution is piped as many as 0.4; 0.8; 1.2; and 1.6 ml then added methanol to 10 ml. The ingredients of each solution were piped as much as 0.1 ml and put in a test tube, then added to 2 ml of DPPH and methanol to the limit of tera. Then the solution shaken and left for 30 minutes at room temperature and placed in a dark. This solution is then measured for absorbance using a spectrophotometer at a wavelength of 516 nm [6]. The readings were recorded in triplicates. The percentage of radical scavenging activity (RSA) was calculated:

$$RSA(\%) = \frac{A(\text{control}) - A(\text{sample})}{A(\text{control})} \times 100 \quad (1)$$

2.2.2.1.3 Determination of IC_{50} value

The effective volume of coffee powder and samples required to scavenge DPPH radical by 50% (IC_{50} Value) was obtained by plotting between percentage inhibition and volume (ml). The results obtained from the DPPH scavenging activity were substituted into the regression equation, where the X-axis was the volume of coffee powder, and Y-axis was the percentage of DPPH scavenging activity.

Determination of IC_{50} from regression equation;

$$Y = aX + b \quad (2)$$

Notes: Y = Percentage of DPPH scavenging activity (IC_{50} dependent variabel); a =slope/gradient; x=volume of coffee (independent variabel); b=intercept.

2.2.2.2 Determination of the standard curve the total phenolic content

A total of 5 mg of gallic acid was weighed and then put in a 50 ml volumetric flask and added distilled water to the tera limit, which is referred to as a stock solution. Then the mother liquor is diluted into several concentrations namely 31.25 $\mu\text{g} / \text{ml}$, 62.50 $\mu\text{g} / \text{ml}$, 125 $\mu\text{g} / \text{ml}$, 250 $\mu\text{g} / \text{ml}$ and 500 $\mu\text{g} / \text{ml}$. The trick, the stock solution are piped to 0.3125 ml, 0.625 ml, 1.25 ml, 2.5 ml, and 5 ml and added distilled water up to 5 ml.

Then each solution was piped 0.1 ml and put in a different test tube, added 7.9 ml of distilled water, 0.5 ml of Folin-ciocalteu reagent and 1.5 ml of Na_2CO_3 20%, then homogenized with vortex. Let stand for 1.5 hours in a dark room. Then the absorbance was measured using a spectrophotometer and the result was a wavelength of 755 nm. From the results of the absorbance measurements a standard curve is made, namely a plot between the solution concentration (x) and absorbance (y). Figure 2. All the experiment was conducted in three replicates and the results was also expressed as gram of gallic acid equivalent (mgGAE) per gm of dried extract using following formula:

$$C = \frac{(c \times V)}{m} \quad (3)$$

Where C = total phenolic content of compounds, mg/g plant extract, in GAE, c = the concentration of gallic acid established from the calibration curve (mg/mL), V = the volume of extract in mL, and m = the dry weight of plant extract Gallic acid equivalence (GAE) per gram dry coffee beans.

2.2.2.3 Determination of the total content of the sample polyphenols

The sample was weighed as much as 10 μg into a 10 ml volumetric flask then methanol was added to the tera limit. Piped 0.1 ml of sample solution into a test tube and then added with 7.9 ml of distilled water, 0.5 ml of Folin-ciocalteu reagent and 1.5 ml of Na_2CO_3 20% into the test tube and homogenized with vortex. The solution is then left in a dark place for 1.5 hours and the test tube is wrapped in aluminum foil. Then the absorbance was measured using a spectrophotometer at a wavelength of 755 nm.

3. Result and Discussion

3.1 Total Phenolic Content

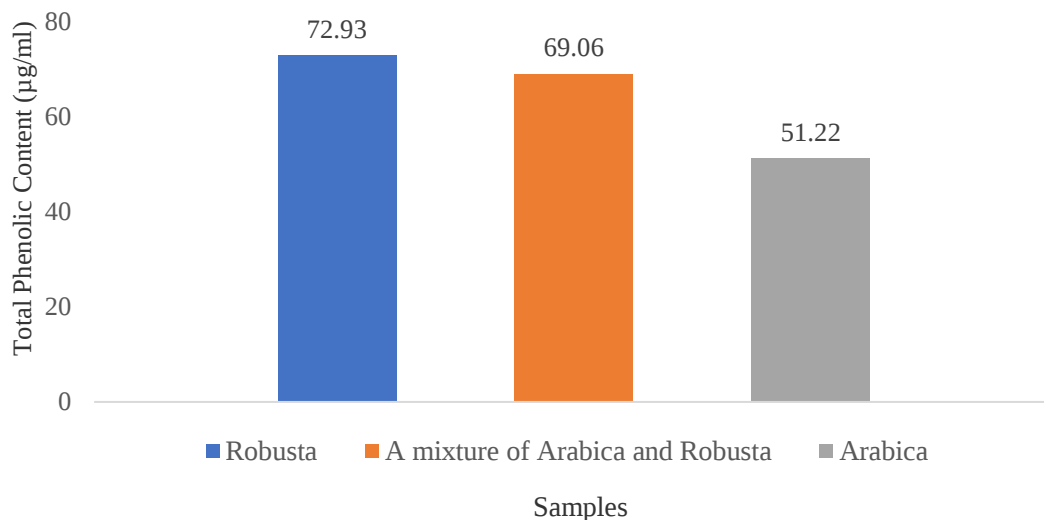


Figure 1. Effect of a mixture of coffee powder and red ginger and cocoa powder on the total phenolic content of coffee drinks.

Robusta coffee with a mixture of red ginger powder and coffee powder has a higher phenolic content of 72.94 mg / L while the lowest was in arabica coffee of 51.22 mg / L. [10] This compound is assumed to be dominated by 74% chlorogenic acid according to 74%. The content of phenol compounds in ginger has the ability to inhibit the growth of *E. coli* bacteria. The occurrence of inhibition is caused by damage to the structural components of bacterial cell membranes. Phenol in ginger also has the ability to denature proteins and damage cell membranes by dissolving fats found on dindingsel, because these compounds are able to migrate from the liquid phase to the fat phase [11].

3.2 Total Flavonoid Content

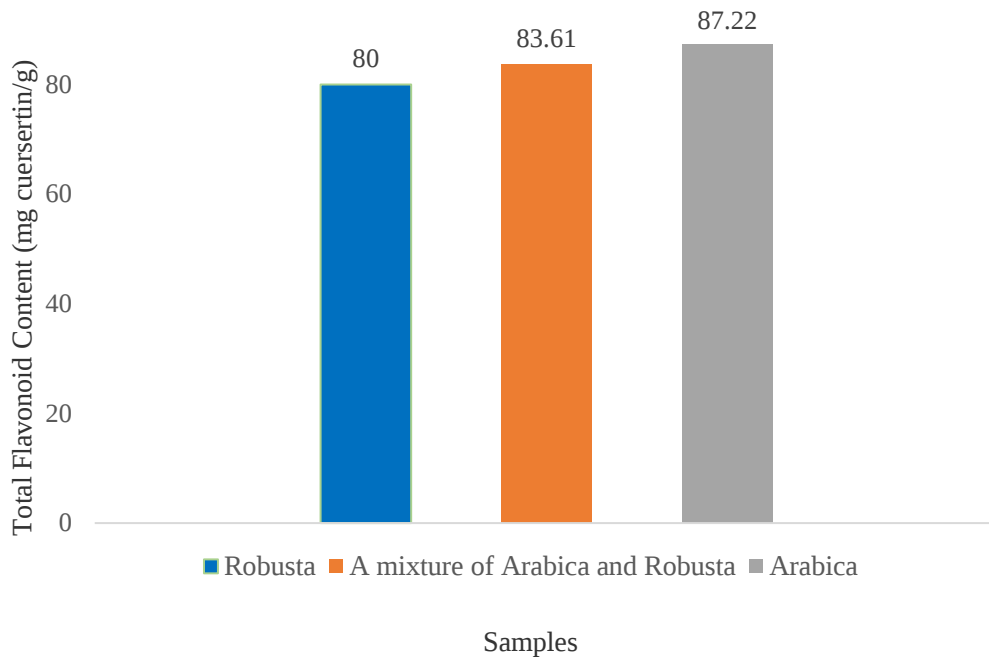


Figure 2. Effect of a mixture of coffee powder and red ginger and cocoa powder on the total flavonoid content of coffee drinks

Flavonoids are considered the most common, important and widely distributed substances in plants, with highly efficient antioxidants and phenolic substances. Flavonoids inhibit lipid oxidation by complexing with metal ions [12]. Robusta coffee, the combination of Arabica coffee and Robusta coffee, and Arabica coffee have different total flavonoid values. They were found to be 80.00, 83.61 and 87.22 (mg quercetin / g), respectively, as shown in Figure 10. Robusta coffee and the combination of Arabica coffee and Robusta coffee and the finished coffee, however, there is no significant difference between the types of coffee.

3.3 Antioxidant Activity (IC₅₀)

The effect of the type of mixture of red ginger powder and cocoa powder on coffee powder is shown in Figure 4. The type of coffee mixture on red ginger powder and cocoa powder gave a significantly different effect ($P < 0.05$) on the antioxidant activity of coffee drinks so the tukey test was continued. Based on Table 1 shows that the value of antioxidant activity (IC₅₀) of coffee drinks was in the range of 6.49 - 9.7 µg / ml which indicates that coffee drinks have very strong antioxidant activity. These results show that the materials (coffee powder) have a very strong antioxidant. [13] The IC₅₀ value of the material ≤ 10 µg / ml is a very strong antioxidant. Based on the results can be concluded that comparison of coffee powder, red ginger powder and cocoa powder (7: 2: 1) has a positive influence on antioxidant activity and the total phenolic content in coffee drinks and arabica coffee types is most preferred by panelists.

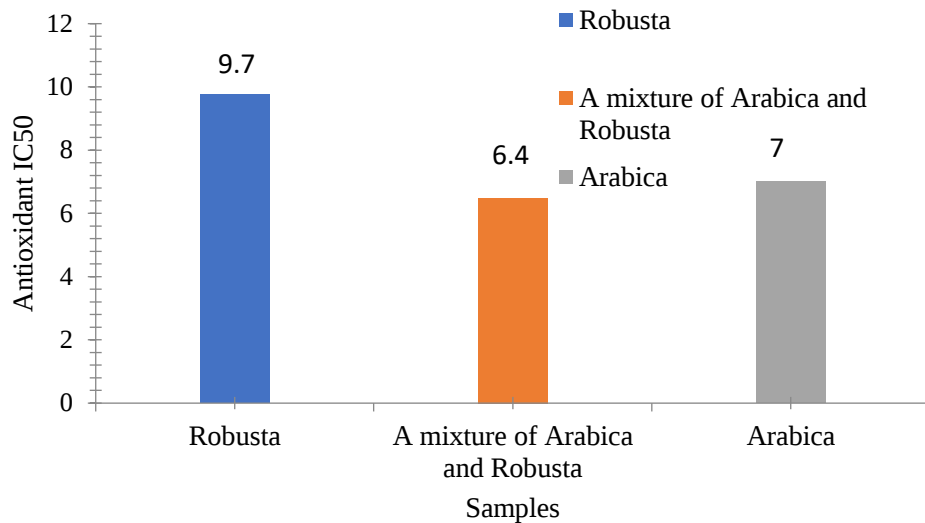


Figure 3. Effect of the type of mixture of red ginger powder and cocoa powder on antioxidant IC50 coffee drinks.

4. Conclusion

Robusta coffee with a mixture of red ginger powder and coffee powder has a higher phenolic content of 72.94 mg / L while the lowest was in arabica coffee of 51.22 mg / L. This compound is assumed to be dominated by 74% chlorogenic acid according to 74%. The content of phenol compounds in ginger has the ability to inhibit the growth of *E. coli* bacteria. The occurrence of inhibition is caused by damage to the structural components of bacterial cell membranes.

The value of antioxidant activity (IC50) of coffee drinks was in the range of 6.49 - 9.7 $\mu\text{g} / \text{ml}$ which indicates that coffee drinks have very strong antioxidant activity. These results show that the materials (coffee powder) have a very strong antioxidant. The IC50 value of the material $\leq 10 \mu\text{g} / \text{ml}$ is a very strong antioxidant. Based on the results can be concluded that comparison of coffee powder, red ginger powder and cocoa powder (7: 2: 1) has a positive influence on antioxidant activity and the total phenolic content in coffee drinks and arabica coffee types is most preferred by panelists.

The type of Arabica coffee powder is the favorite of the group members. The content of the coffee powder mixture will affect the properties of antioxidants and the activity of total phenols and flavonoids.

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