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Total phenolic acid contents in some commercial brands of coffee from Indonesia

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ABSTRACT

Coffee is a favorite drink in the world which has been consumed for centuries. Coffee has both positive and negative effects on human health, that is why scientists need to show concern for the volume of coffee that should be consumed daily. Coffee contains phytochemicals known as phenolic acids and are influenced by temperature. This study was aimed at knowing the total phenolic acid content in hot coffee from different commercial brands of coffee sold in Semarang market, Indonesia. At the beginning of the study, eight brands of coffee were subjected to scaling and each sample contained 5 g of coffee powder. The samples were put into beaker glasses and were coded 1 to 8. Thereafter, 100 ml of hot water was added to each beaker. The samples were then analyzed using Folin-Ciocalteu reagent. The mean of phenolic acid content in hot coffee from Robusta coffee brand was 46.27 mg/g and from Arabika, 37.3 mg/g. Mean of total phenolic acid content in the coffee brands was 42.9 mg/g.

INTRODUCTION

Coffee is a favorite drink in the world which has been consumed for centuries. It is one of alternative drinks favored by Indonesian people, as well as people from other countries, since the time of our ancestors coffee drinking has been the culture for generations. Their antioxidant content are of natural ingredients and are derived from plants in Indonesia (Rohman et al., 2006). Coffee contains complex compounds including caffeine (Lanchane, 2006) and chlorogenic acid (Nardini et al., 2002; Clifford et al., 2003). Caffeine is an alkaloid ($C_8H_{10}O_2N_4.H_2O$) with chemical identity of 1,3,7-trymethylxantine. It is diuretic, whereas chlorogenic acid is a polyphenol and functions as strong antioxidant (Natella et al., 2002; Johnston et al., 2003; Yanagimoto et al., 2004). A cup of 10 g Robusta coffee powder contains approximately 100 mg caffeine and 200 mg chlorogenic acid (Yanagimoto et al., 2004).

Coffee has both positive and negative effects on human health. In previous study, consumption of coffee could decrease the uric acid level in Hiperurikemi wistar rat blood (Lelyana et al., 2009). This resulting study is in line with another study performed in Japan, in which an individual who drinks 3 to 5 tea cups of coffee in one day has lower uric acid (Kiyohara et al., 1999) and also in line with other study (Lin et al., 2000; Choi et al., 2007). Another study concluded that coffee antioxidant contents, that is chlorogenic acid, could prevent oxidative damages (Choi et al., 2007). In several other reports, polyphenol compound within coffee (i.e. chhlorogenic acid) could prevent oxidative damages (Rice et al; 1996). It has capability of inhibiting xanthin oxidase enzyme activities so the uric acid level could decrease (Farah and Donangelo, 2006).

Water temperature is one of the factors that influence the extraction of polyphenolic acid in coffee powder. The study about the content of phenolic acid in hot water coffee has never been conducted in Indonesia. So, this study was undertaken to know the total phenolic acid content in a cup of hot water coffee from different brands of commercial coffee packing in Semarang markets.

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Table 1. The phenolic acid content of many brands coffee samples in Semarang, Indonesia markets.

No.	Coffee Sample	Absorbance	Phenolic content (mg/g coffee)
1	Arabica	1.481	34.2325
2	Arabica	1.633	38.0325
3	Robusta	1.937	45.6325
4	Robusta	1.936	45.6075
5	Arabica+Robusta	1.951	45.9825
6	Robusta	1.948	45.9075
7	Arabica	1.697	39.6325
8	Pure Robusta	2.030	47.9575

MATERIALS AND METHODS

Qualitative and quantitative analyst

Eight commercial brands of coffee, each containing 5 g coffee powder were subjected to scaling. Each of the sample were poured into beaker glass and marked with code of 1 to 8. Thereafter, 100 ml of hot water at 100°C were added to the samples.

Qualitative analysis of phenolic coumpound

About 2 ml of coffee mixture was poured into a plate and then drops of $AlCl_3$ reactant was added to the coffee mixture. Positive reaction of the phenolic compound was marked by the blue/violet colours.

Quantitative analysis of phenolic acid using Folin Ciocalteu Method

This investigation was aimed to determine the degree of phenolic compound contained within each of the eight coffee samples using a quantitative analysis. This experiment was performed using methanolic extract of the coffee powder and standardized galic acid.

Calibration of galic acid curve

To prepare the standard solution, 0.25 g galic acid and 5 ml 96% ethanol were poured into 50 ml volumetric flask and then were liquified with aquabides. Galic acid calibration curve was constructed according to Waterhouse method (Waterhouse, 2001). There were 6, 8, 10, 12 and 14 ml of standard solution with aquabides up to 100 ml, resulting in 300, 400, 500, 600 and 700 mg/l concentrations of galic acid. The 0.2 ml of each of these concentration groups was subject to a reaction with 15.8 ml aquabides and 1 ml Folin Ciocalteu reagent. The mixture was shaken and left to stand for 8 min. Then 3 ml 20% Na_2CO_3 was added, and the mixture was shaken again for homogenuity; and then left for another 2 h in a chamber temparature. Finally, an absorbance measurement was perform at 765 nm wave lenght using an UV-VIS spectrophotometry. The calibration curve was obtained from the relationship between galic acid concentration (mg/L) and absorbance.

Determination of total phenolic acid content

The phenolic acid contents of coffee samples were determined by using Folin C Reagent according to Orak method (Orak, 2006) and galic calibration curve of Waterhouse (Waterhouse, 2001). About 0.3 g methanolic extracts were liquified to obtain 10 ml mixture using methanol and water (1:1). Thereafter, 0.2 ml of the extracts were subject to a reaction with 15.8 ml aquabides and 1 ml Folin Ciocalteu reagent. The mixture was shaken and left to stand for 2 h in a chamber temperature. An absorbance measurement was then performed at 765 nm wave length with three replications. The phenolic acid content of the coffee was obtained by dividing galic acid (mg) with dry sample (g).

RESULTS

As shown in Table 1, coffee sample 8 (Pure Robusta) contained the highest phenolic acid content. This means that each 1 g of the coffee powder in a cup of hot coffee contained approximately 47.9575 mg phenolic acid or 479 mg/10 g. Previous study showed that polyphenol content of 10 g Robusta coffee before mixed with 200 ml hot water were 4.9% ~ 4.9 g/100 g coffee ~ 0.49 g/10 g = 490 mg/10 g. This has proven that phenolic acid content

of the coffee is higher (before being mixed with hot water) than after being mixed with hot water. However, previous study was limited to only one coffee brand (Robusta), having performed a phenolic acid test before mixed into hot water.

DISCUSSION

The study results are consistent with previous studies stating that the phenolic acid content of Robusta coffee is higher than Arabica coffee (Richelle et al., 2001; Daglia et al., 2000).

The dark color obtained was an indication of the levels of phenolic acids contained in coffee powders (Castillo et al., 2002). The brands of coffee powders used in this study to examine the levels of phenolic acid were processed coffee beans that were previously roasted. The differences in the levels of phenolic acids of each coffee bean may be as a result of the difference in roasting time as well as difference in the temperature of roasting during the roasting process. Roasting process is one of the important factors that influence the levels of antioxidants contained in the coffee powder products (Summa et al., 2007).

Conclusion

The mean value of phenolic content obtained from 5 g of coffee was 42.9 mg/g and the highest levels of total phenolic acid was obtained from Robusta coffee brand.

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