Effect Of Coffee Drinking Habit to Blood Pressure and Hemoglobin Levels on Women of Childbearing Age

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ABSTRACT

Background: Tenggerese people, especially women, have a habit of drinking coffee, and it has become a daily habit. Coffee is often associated with risk factors for diseases in the community such as anemia and hypertension. This study aims to determine the effect of coffee drinking quantity (1-2 cups, 3-4 cups, and ≥ 5 cups of coffee per day) on hemoglobin levels and blood pressure.

Subjects and Method: A quantitative study with a cross-sectional study design was done. This study population was women of reproductive age (15 to 49 years) in Ngadipuro Hamlet, Tengger, East Java, Indonesia. The independent variable of this study is the of daily coffee drinking per cup and the dependent variable of this study is the hemoglobin levels in women of childbearing age. The study instrument used was a questionnaire to screen for those who were a daily coffee drinker and a blood hemoglobin rapid test kit was used to measure the level of hemoglobin.The number of samples in this study was 193 respondents which was chosen using the random sampling technique. Analysis of the quantity of coffee drinking on hemoglobin levels by the Annova test while on blood pressure by the Kruskal Wallis test through SPSS software.

Results: The result showed that the quantity of coffee per day on hemoglobin levels had a significance $p<0.001$. While the quantity of coffee per day on blood pressure had a significance $p=0.361$.

Conclusion: It can be concluded that drinking 1-2 cups of coffee, 3-4 cups, and ≥ 5 cups of coffee daily simultaneously affects hemoglobin levels. In this case, the more quantity of coffee per day, the lower the hemoglobin level. However, the quantity of coffee had no significant effect on blood pressure.

Keywords: coffee, hemoglobin level, blood pressure

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BACKGROUND

The coffee consumption rate has been increasing over the years in Indonesia, Coffee has been consumed not because of its nutritional value that coffee has but because of its taste and physiological effect on the body that keeps the consumer awake and energized (Samoggia and Riedel, 2019). Coffee has become the favorite drink starting from youngsters to elders. Conversely, coffee use may elevate the likelihood of developing coronary heart disease and could potentially be linked to reduced hemoglobin levels, resulting in anemia (Kadry, 2018)

Anemia is a widespread condition that is particularly prevalent in developing nations and among socioeconomically disadvantaged people (Helliyana et al., 2019). Red blood cells function as oxygen transporters into cells and return carbon dioxide from the human body to the lungs to exchange carbon dioxide for oxygen, to function optimally red blood cells need a protein called hemoglobin (Barbalato and Pillarisetty, 2022) The typical range for hemoglobin levels is 14 to 18 g/dl for males and 12 to 16 g/dl for females (Wolde, 2014). Anemia is diagnosed when the patient has a low hemoglobin level (WHO, 2023).

The prevalence of Anemia worldwide is estimated at 1.32 Billion people or an estimated 25% of the human population, and Asia has the highest rate of Anemia. In 2015 it was estimated that 1.62 Billion people suffered from anemia and in May 2023 data from WHO shows that it was estimated that anemia had affected 40% of children that starts in early months of living, starting from 6-59 months, 37% of pregnant women, and 30% of women of childbearing age (15-49 years) are affected by anemia (WHO, 2023).

Iron deficiency Anemia is the most common type of anemia worldwide It happens due to a lack of iron supply for the body to do erythropoiesis (Kumera et al., 2018). Iron deficiency anemia if allowed to continue will have an irreversible delayed psychomotor development in children hence making them stunted (Cicero et al., 2023). Iron deficiency anemia is often associated with a prolonged habit of consuming coffee. Caffeine is present in any type of coffee bean and can break and disrupt the process of iron uptake throughout the body (Rodak et al., 2021). Caffeine can reduce blood hemoglobin levels throughout the body causing the body to not function properly in storing and transporting oxygen to the lungs and other parts of the body (Briawan, 2014).

The etiology of hypertension is associated with multiple risk factors. The prevalence of hypertension is higher in the elderly compared to younger populations (Oliveros et al., 2020). Caffeine in coffee could temporarily increase blood pressure due to its effects that promote sympathetic antagonism of adenosine receptors and results in the increase of systolic blood pressure by 3-14 mmHg and diastolic blood pressure (Gunec, 2023) and might be easily felt by those who are not coffee drinkers (Kujawska et al., 2021). An initial survey indicates that women in the Tenggerese Society who are of reproductive age have an increased susceptibility to anemia as a result of their coffee consumption habits (Iniesta and Dujaili, 2014). The objective of this study was to assess the impact of daily coffee consumption volume on hemoglobin levels and blood pressure.

SUBJECTS AND METHOD

1. Study Design
This study is a mixed-method study with a cross-sectional study design. The study's population consisted of women between the age range of 15 to 49 years old residing in Ngadipuro Hamlet, Tengger, East Java, Indonesia.

2. Population and Sample

The number of samples in this study was 193 respondents with the sampling technique which was chosen by using the random sampling technique. The target population in this research is women of childbearing age that has a habbit of drinking coffee.

3. Study Variables

This study dependent variables consists of level of Hemoglobin Levels in women of childbearing age and Blood pressure levels in women of childbearing age, and the independents variable of this study is the amount of daily Coffee servings per cup and types of coffee.

4. Operational Definition of Variables

Level of hemoglobin: a protein in red blood cells that carries oxygen throughout the body.

Blood pressure: is systolic pressure which indicates the pressure of the heart when blood is being pumped to the body, and diastolic pressure which indicates the pressure when the heart rests between beats.

Women of childbearing age: the age span of women that indicates the capability of giving birth to children.

Amount of coffee daily: the daily dose of coffee servings that was drunk frequently as a result of habit.

Types of Coffee: three types of coffee consist of decaffeinated, instant, and pure coffee.

5. Study Instruments

Types of Coffee and Amount of coffee daily were collected using a questionnaire. MCS (Medical Checkup Scales) were used to determine if the participant had anemia due to coffee-drinking habits and Sphygmomanometer was used to determine the blood pressure of the participant.

6. Data Analysis

Analysis of Coffee-drinking on hemoglobin levels was done using the ANOVA test while the effect of coffee-drinking habits on blood pressure was done using the Kruskal Wallis test through SPSS software version 27.

7. Research Ethics

This study was conducted without the use of any element of force verbally or physically. The researchers briefed the subject about the research and received informed consent. The ethical committee (Health Research Ethical Department) of Universitas Ciputra approved the research work with No. 072/EC/KEPK-FKUC/VII/2023.

RESULTS

1. Sample Characteristics

The subjects of this study were women of childbearing age in Ngadipuro Hamlet, Tengger, Indonesia. The research subjects were 193 women of childbearing age that had a coffee-drinking habit as the control group. The youngest participants of this study are women of childbearing age range from 17 years old to 40 years old, descriptive statistics show a mean of 28.59 and the participant has a mean value of 28.59 with a standard deviation of 6.556. the minimum and maximum values are greater than the standard deviation, indicating the normal result of data distribution hence not causing a bias.

Table 1. Characteristic sample of coffee drinking habit on blood pressure and hemoglobin levels in women of childbearing age (n= 193)

Characteristic	Category	Frequency (n)	Percentage (%)
Amount of coffee daily	Shorter than 6 months	57	29.54 %
	6-12 months	35	18.13 %
	More than 12 months	101	52,33 %
Types of Coffee	Decaffeinated	7	3.63 %
	Instant	65	33.68 %
	Pure	121	62.69 %

Characteristic	Category	Frequency (n)	Percentage (%)
Cups per day	1-2 cups per day	14	7.25 %
	3-4 cups per day	98	50.78 %
	≥ 5 cups per day	81	41.97 %

Based on the Descriptive statistics on types of coffee and their Effects on Blood Hemoglobin levels as shown in Table 2 it is proven that 7 participants of childbearing age in Ngadipuro Hamlet drank decaffeinated coffee, followed by 65 participants chose to drink instant coffee, and 121 participants chose to drink pure brewed coffee.

Table 2. ANOVA Tests of coffee drinking habit to hemoglobin levels

	Sum of Squares	dF	Mean Square	F	p
Between Groups	43.55	2	21.77	8.07	<0.001
Within Groups	512.71	190	2.69		

Table 3. ANOVA Tests in types of coffee and its effects on blood hemoglobin levels

	Sum of Squares	df	Mean Square	F	p
Between Groups	4.17	2	2.08	0.72	0.489
Within Groups	552.09	190	2.90		

2. Bivariate Analysis

ANOVA tests were done to measure the correlation between frequent coffee drinkers and blood hemoglobin levels. Frequent coffee drinkers categorized as women who drank 3-4 cups of coffee and ≥ 5 cups of coffee daily were tested for blood hemoglobin levels and later compared to those who drank only 1 cup of coffee daily. The findings indicate that women in their reproductive years who consume coffee regularly exhibit reduced levels of blood hemoglobin in comparison to those who do not consume coffee frequently.

As shown in Table 5 and Table 6, Bonferroni-Howell tests were done to determine the different levels in blood hemoglobin. The result shows that coffee drinkers in the 1-2 cups daily group show no significant difference in blood hemoglobin levels compared to the 3 to 4 cups daily group but those in the 3 to 4 cups daily group show a significant difference in blood hemoglobin levels compared to those who drink more than 5 cups of coffee daily. This study shows that those who consume 3 to 4 cups of coffee per day shows elevated hemoglobin levels in comparison to those who consume more than 5 cups of coffee daily. Based on the descriptive statistics on coffee drinking habits' effects on blood pressure as shown in Table 2, out of 193 participants 57 of the participants had been a coffee drinker for shorter than 6 months, followed by 35 participants that had been a coffee drinker for 6 to 12 months and 101 participants that had been a coffee drinker for more than 12 months.

As proved in Table 4 through the ANOVA test drinking different types of coffee does not show significant differences in blood hemoglobin levels. With a sig value of 0.489 (p > 0.05) Kruskal-Walis test was also used to determine correlations between coffee-drinking habits on blood pressure as shown in Table 4 which concluded that there were no correlations between coffee-drinking habits on blood pressure with p=0.361.

Table 4. Kruskal-Wallis Test coffee drinking habits effects on blood pressure

Blood Pressure	Blood Pressure
Kruskal-Wallis H	2.08
df	2
p	0.361

Table 5. Multiple Comparisons Between Groups of Coffee Drinker

	Number of cups per day (I)	Number of cups per day (J)	Mean Difference (I-J)	Std.Error	p	95% Confidence Interval	
						Lower Bound	Upper Bound
Bonferroni	1-2 cups/day	3-4 cups/day	-1.84	0.60	0.008	-3.31	-0.37
		≥ 5 cups/day	-0.77	0.56	0.507	-2.14	0.58
	3-4 cups/day	1-2 cups/day	1.84	0.60	0.008	0.37	3.31
		≥ 5 cups/day	1.06	0.29	0.001	0.34	1.78
	≥ 5 cups/day	1-2 cups/day	0.77	0.56	0.507	-0.58	2.14
		3-4 cups/day	-1.06	0.29	0.001	-1.78	-0.34

Table 6. Multiple comparisons between groups

	Number of cups per day (I)	Number of cups per day (J)	Mean Difference (I-J)	Std. Error	p	95% Confidence Interval	
						Lower Bound	Upper Bound
Games-Howell	1-2 cups/day	3-4 cups/day	-1.84	0.96	0.18	-4.49	0.80
		≥ 5 cups/day	-0.77	0.91	0.68	-3.38	1.82
	3-4 cups/day	1-2 cups/day	1.84	0.96	0.18	-0.80	4.49
		≥ 5 cups/day	1.06	0.35	0.01	0.21	1.91
	≥ 5 cups/day	1-2 cups/day	0.77	0.91	0.68	-1.82	3.38
		3-4 cups/day	-1.06	0.35	0.01	-1.91	-0.21

DISCUSSION

This study is a preliminary attempt to examine the impact of coffee consumption on blood hemoglobin levels in women who are of reproductive age, this study was done to educate, and alert women of childbearing age in Ngadipuro Hamlet that drinking too much coffee will have a negative impact on the body that might cause anemia An ANOVA test was used to determine the association between daily coffee-drinking habits on blood hemoglobin levels. As can be seen from the ANOVA test that all groups of coffee drinkers show lower hemoglobin levels. This was congruent with the findings of (Lee, 2022) In his study, he conducted research on women of reproductive age using the Fifth Korean National Health and Nutrition Examination Survey and concluded women who drink more than 2 cups of coffee daily significantly affects blood hemoglobin levels.

This study is also congruent with (Means, 2020).In his study, he concluded that maternal coffee intake could result in lower hemoglobin levels that may cause maternal anemia and if allowed to continue could cause stunting in newborn children (Means, 2020). This research shows that even though there is consumption of different coffee types, all types of coffee cause lower blood hemoglobin levels. This study is congruent with Wartiningsih who in her research, determined that the presence of polyphenols in coffee and tea, including caffeine and tannins, hinders the absorption of iron. As a result, individuals who consume coffee more frequently tend to have lower levels of hemoglobin compared to those who do not drink coffee (Wartiningsih et al., 2023). This study shows that there is no

statistically significant correlation between different types of coffee and anemia, as indicated by a (p= 0.489).

These findings align with the research of (Means, 2020) in study concluded that consumption of all types of coffee results in lower hemoglobin levels but drinking different types of coffee doesn't show a significant association with anemia. This study concludes that tea and coffee act as an iron-depleting beverage where tea inhibits absorption by 39 percent, in agreement with (Sung et al., 2018). In his study, he demonstrated that coffee consumption leads to iron deficiency anemia. However, his research suggests that there is no link between coffee and iron deficiency anemia when consumed precisely one hour before a meal, However, his research shows that coffee impeded iron absorption if one were to drink coffee exactly one hour after a meal.

This study is congruent with (Dasa and Abera, 2018) in his study he concludes that all drinks containing polyphenols are strong inhibitors of iron absorption (Dasa and Abera, 2018). The inhibitory effect of coffee on iron absorption is contingent upon the concentration of polyphenols present in the beverage (Means, 2020). This study shows that coffee-drinking habits have no significant association with blood pressure, in agreement with (Giorno et al., 2022) In her study she concludes that coffee has various effects on blood pressure, not all coffee drinkers show the same effect of coffee consumption, in agreement with (Han, 2022).

The research findings indicate that, after combining the data from multiple trials, there was a little increase in blood pressure of 2.4 mmHg systolic and 1.2 mmHg diastolic for individuals with a median coffee intake of 5 cups per day. However Iniesta stated during his trial's findings indicate that coffee drinking leads to a reduction in systolic blood pressure by 7 to 10 mmHg and 3 to 7 mmHg in males with pre-hypertension (Iniesta and Dujaili, 2014). The researcher's findings indicate that long-term studies on coffee consumption do not provide evidence to support the claim that coffee has negative effects on blood pressure. However, additional research is necessary to determine whether individuals who abstain from coffee have a lower or higher risk of developing cardiovascular diseases compared to those who consume coffee occasionally (1-2 cups per day). She determined that the relationship between occasional coffee use and hypertension is uncertain, as habitual coffee eaters build a tolerance to caffeine and do not experience an increase in blood pressure immediately after consuming coffee.

The existing study shows that the higher intensity of coffee drinking would result in lower blood hemoglobin levels, this study found that drinking any type of coffee would result in low blood hemoglobin levels but drinking coffee has no significant effect on the blood pressure of women in child-bearing age. The conclusions from existing research based on a descriptive-analytics study can pose limitations in inferring the true effect of coffee on women of child-bearing age due to different coffee effects that vary from person to person. Therefore, a further study should be designed to find associations between the daily activity of women of childbearing age and coffee drinking habits.

AUTHOR CONTRIBUTION

Minarni wartiningsih as a researcher who chose the topics, and performed experiments, and the main author, Tatas Hardo Panintingjati Brotosudarmo a researcher who was responsible for data taking and theories, Vincent Aurelius Gonaldy as a researcher who is responsible for data

collection, data analysis, and interpretation, and provided revisions to the scientific content of the manuscript, Ni Njoman Juliasih as a researcher who is responsible for providing stylistic and grammatical revisions, Hanna silitonga as a researcher who is also responsible for data collection, and May Fanny Tanzilia as a researcher who is responsible for data analysis and data interpretation.

CONFLICT OF INTEREST
There is no conflict of interest in this study.

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