



Blood Pressure and Sleeping Patterns of Adults Consuming Black Coffee, Café Latte, and Non-Caffeine Beverages

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Abstract. Coffee consumption can affect blood pressure and sleeping patterns because the caffeine content in the coffee may trigger adrenaline hormones and affect nerve cells. This study aims to determine the difference in blood pressure and sleeping patterns of adults consuming black coffee, café latte, and fruit juice. This study is cross-sectional with 60 samples taken purposively from Omah Coffee Shop. Blood pressure data was collected using a sphygmomanometer, and sleeping pattern data was taken by interviewing the sample using a PSQI questionnaire. The data obtained were analyzed using Wilcoxon's statistical test. The study showed a significant difference in systolic blood pressure in black coffee consumers ($p = 0.007$) and diastolic blood pressure ($p = 0.024$). This study also revealed the differences in sleeping patterns before and after consuming black coffee and café latte ($p = 0.000$ and 0.022 , respectively). Black coffee and café latte consumption increases blood pressure and disturbs sleeping patterns.

Keywords: Blood Pressure, Sleeping Pattern, Black Coffee, Cafe Latte, Fruit Juice.

1 INTRODUCTION

Coffee is one of the commodities in Indonesia that has the potential to increase exports every year [1]. The increase in coffee consumption aligns with the increasing number of coffee outlets and easier access to coffee anywhere. Nowadays, coffee consumption has become an everyday habit. Data from 2023 shows that 79% of Indonesians drink coffee, with the lowest frequency being once a day. The age range of coffee drinkers varies from teenagers to the elderly [2].

Caffeine, as one of the most well-known ingredients of coffee, has both favorable and unfavorable effects. A study showed that increasing of coffee consumption may have a neuroprotective effect of HIV patients [3]. Conversely, caffeine may also trigger adrenaline production, which increases blood pressure and disturbs sleeping patterns [4]. A study form 300 undergraduate students aged 18-24 years showed that there was a significant correlation between caffeine intake and sleep quality [5].

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The effect of caffeine on blood pressure and sleeping patterns is related to the metabolism of caffeine in the body. Caffeine is absorbed 99 percent after 45 minutes of drinking. After oral intake, peak plasma concentration happens 15-120 minutes later. The half-life of caffeine varies wildly, depending on both endogenous and exogenous factors, and it can be anywhere from 2 to 10 hours [6,7]. Caffeine then acts antagonistically to the adenosine receptors expressed in the central nervous system (CNS). On the mechanism of sleep disturbances, Caffeine enhances dopaminergic receptor responses and the neurotransmitter release, including norepinephrine, dopamine, and serotonin, as well as impacts on alertness and mental focus/attention [4]. On the blood pressure mechanism, caffeine may trigger the release of corticosteroids, activate the renin-angiotensin-aldosterone system, and affect the cardiovascular system [4,8].

Adults typically sleep for seven to nine hours every night. The National Sleep Foundation (2018) reports that approximately 67% of late teens and adults in Indonesia suffer from insomnia, with mild insomnia accounting for 55.8% of cases and moderate insomnia for 23.3% of cases [9]. Both increasing blood pressure and poor sleeping patterns may have an impact on health problems and the emergence of several diseases. This study aims to determine the difference in blood pressure and sleep patterns before and after consuming black coffee, cafe latte and non-caffeine.

2 METHOD

This study is an observational study with a Cross-Sectional approach. It was conducted in June 2023 at the Kedai Kopi Omah Bandungrejo Kecamatan Mranggen, Kabupaten Demak. The sample in this study was 60 Coffee Customers. The sample was determined using a purposive sampling technique, which was selected according to the criteria needed by the researcher, namely being willing to be a respondent aged 21-25 years, consuming one of the black coffee drinks, cafe latte, or fruit juice. The independent variables in this study are black coffee and café latte, while the control variable is non-caffeine, and the dependent variables used are blood pressure and sleep patterns. The data collected by researchers were by measuring blood pressure before and after 30 minutes of consuming black coffee, cafe latte, and fruit juice using a tensiometer and then, through direct interviews before consuming and WhatsApp calls to find out sleep patterns after consuming black coffee, cafe latte and fruit juice using the PSQI questionnaire by examining seven components, namely sleep duration (No. 2), sleep duration (No. 1 & 3), sleep quality (No. 9), sleep habit efficiency (No. 4), sleep disorders (No. 5), use of sleeping pills (No. 6), and impaired body function (No. 7 & 8) and the score category is good <5 and bad ≥ 5 . This study has obtained Ethical Clearance with No. 007 / KE / 04/2023.

3 RESULTS AND DISCUSSION

Most of the subjects in this study are male (76.7%), and they vary in age, mostly 22 years old. Almost 50% of the subjects are employees and have BMI in the normal range (18.5-22.9 kg/m²) (Table 1).

Table 1. Subject Characteristics

Characteristics		n	%
Sex	Male	46	76.7
	Female	14	23.3
Age (years old)	21	10	16.7
	22	19	31.7
	23	13	21.7
	24	11	18.3
	25	7	11.7
Education	High School	44	73.3
	Undergraduate	16	26.7
Occupation	Employees	28	46.7
	Undergraduate Student	22	36.7
	Others	10	16.7
Nutritional Status (BMI, kg/m ²)	Underweight (< 18,49)	7	11.7
	Normal (18,5 – 22,9)	34	56.7
	Overweight (23 – 24,9)	10	16.7
	Obesity 1 (25 -29,9)	7	11.7
	Obesity 2 (>30)	2	3.3

Black coffee is considered a strong drink and gives men masculine and physical traits. Therefore, women consider black coffee to be identical to men. This is based on society's stereotype that black coffee is a drink for working men or those who act as heads of households. In addition, men who drink black coffee also look dashing and powerful [10].

Table 2. Subject's Blood Pressure Before and After Black Coffee, Cafe Latte, and Non-caffeinated beverage

Variable	Blood Pressure (Mean ± SD)		<i>p</i> ^a	
	Sistolic (mmHg)	Diastolic (mmHg)	Sistolic (mmHg)	Diastolic (mmHg)
Black Coffee				
Pre	121.0±11.8	75.8±8.7	0.007*	0.024*
Post	127.2±11.9	80.0±9.0		
Δ Blood Pressure	6.25	4.20		
Cafe Latte				
Pre	116.9±12.5	76.95±7.8	0.687	0.86
Post	119.0±10.7	79.6±8.6		

Δ Blood Pressure	2.1	2.65		
Non-caffeinated beverage (fruit juice)				
Pre	112.9 \pm 11.6	71.6 \pm 8.8		
Post	112.8 \pm 7.9	73.7 \pm 5.8	0.559	0.197
Δ Blood Pressure	- 0.1	2.1		

^a*Wilcoxon test for pre-post difference; *significant*

According to Table 2, both systolic and diastolic blood pressure are increasing in the black coffee and cafe latte groups. Black coffee consumers increased blood pressure more than the café latte group. The highest increment was found in black coffee consumers' systolic blood pressure (6.25 mmHg; 5% of increasing). The increase in blood pressure in the black coffee group was found to be significant ($p < 0.05$).

The maximum amount of caffeine that can be found in food and beverages is 150 mg per day and 5 mg per serving, respectively. The FDA (Food and Drug Administration) allows 100–200 mg daily doses. As one of the caffeine sources, coffee intake may have acute consequences on systolic and diastolic blood pressure. The average result of systolic blood pressure increases after 300 mg of caffeine ingestion or 2-3 cups of coffee by 3-14 mmHg and increases diastolic blood pressure by 4-13 mmHg within 15 minutes. This effect will last in the body for 2 hours [11,12].

These results followed a cross-sectional study with a cross-over design that found after ingestion of 200 ml Robusta Coffee, the blood pressure of the intervention group significantly elevated around eight mmHg [13]. Several mechanisms explain the relationship between caffeine and blood pressure. Caffeine is an inotropic agent that induces muscular contractions that work acutely after 30 minutes to 2 hours. This implied intracellular calcium concentration, norepinephrine release, and the sensitization of dopamine receptors, an essential regulator of electrolyte balance and blood pressure [14,15]. Caffeine also stimulates the synthesis of catecholamines, such as adrenaline and norepinephrine, that may narrow blood arteries and increase heart rate and contractility. This mechanism causes an increase in blood pressure [16].

These results differ from previous studies on consuming coffee and its relationship with blood pressure in young adults because coffee does not affect blood pressure for a reasonably long amount and only takes a little time before it returns to normal [17].

Cafe latte consumers did not have a significant difference, namely with systolic blood pressure results ($p = 0.687$) and diastolic ($p = 0.86$). The average difference between systolic blood pressure before and after consuming cafe latte was 2.1 mmHg, and diastolic blood pressure after and before consuming café latte was 2.65 mmHg.

Café Latte has a different composition. Café latte contains a mixture of milk and coffee. Stomach acid causes milk to coagulate when coffee and milk are combined to make cappuccinos and lattes, but casein cannot be absorbed during this process. When milk or cream is added to coffee, casein interacts with the acid in the coffee to prevent the same reaction in the stomach during digestion as when coffee is consumed without milk or cream. This will prevent the body from absorbing caffeine for an extended period, hence lowering the amount of maximum stimulation that caffeine can provide [18].

Consuming milk and coffee together reduce the quality of nutritional value of coffee and phenolic compounds (especially chlorogenic acid). At the same time, the addition

of milk also does not significantly reduce the nutritional content in coffee beans but depends on several factors, such as the proportion of milk to coffee, the temperature of the drink before and after adding milk, and the type of milk added [19].

In non-caffeinated drinks, there was also no significant difference in systolic blood pressure results ($p = 0.559$) and diastolic ($p = 0.197$). Fruit juice contains lots of vitamins and natural fiber, which are beneficial for health. Respondents' fruit juices include avocado, strawberry, dragon fruit, and mango. These fruits contain many antioxidants, are suitable for preventing cardiovascular disease, and contain fiber, which can lower blood pressure in people with hypertension [20–22]. Dragon fruit contains some antioxidant properties, such as vitamins, fibers, betacyanins, and betalains, that help combat oxidative stress and inflammation, thus protecting against dyslipidemia and cardiovascular disease [23]. Another study found that dragon fruit intervention on overweight and obese subjects has a beneficial effect on lowering blood glucose and blood pressure [24]. Fiber can lower blood pressure because it is related to bile acids. Dietary fiber can reduce cholesterol levels circulating in blood plasma, because dietary fiber can bind bile salts, prevent cholesterol absorption in the intestine, and increase the excretion of bile acids through feces, thereby increasing the conversion of plasma cholesterol to bile acids [25]. The potassium content in avocados can lower blood pressure due to decreased vascular resistance. Vascular resistance is caused by dilation of blood vessels and increased body water and sodium loss. Potassium can lower blood pressure by vasodilation, causing decreased total peripheral retention and increasing cardiac output [26].

Table 3. The difference Differences in Sleep Patterns Before and After Consuming Black Coffee, Caffe Latte and Non-Caffeinated Drinks

	Black Coffee		PSQI Score Caffe Latte		Non-Caffeine	
	Pre	Post	Pre	Post	Pre	Post
Median	6	7	4	4.5	4	4
Min	3	4	2	3	3	3
Max	8	10	6	9	7	6
p^a	<0.01*		0.022*		0.83	

Based on table 3. The results of the Wilcoxon test analysis show that in the group of black coffee and cafe latte consumers, there is a significant difference between before and after consuming black coffee or cafe latte. However, black coffee or cafe latte worsens sleep patterns more than cafe latte, as shown by the average difference in sleep pattern scores after and before consuming black coffee of 1.7, while in the cafe latte group, it is 1.1. This is due to the caffeine content in coffee which can affect the sleep quality for both black coffee and cafe latte. This is supported by research conducted by Triantara on the difference in sleep quality of consumers of various coffee drinks, and espresso has worse sleep quality than cappuccino and cafe latte drinks [18]. The caffeine content of black coffee is more dominant than cafe latte which has been added with milk or creamer. The milk content in cafe latte can reduce the content in coffee

beans so that the sleep patterns of cafe latte consumers do not have a significant difference. Previous studies have also stated that coffee affects sleep quality because the adenosine neuromodulator system is blocked, and the receptor system contributes to sleep regulation due to caffeine [27]. The effect of poor sleep patterns is due to the mechanism of caffeine as an adenosine antagonist. The binding of adenosine receptors causes an increase in adenosine levels in plasma and will stimulate sympathetic circulating chemoreceptors. Increased catecholamines, peripheral vascular resistance, and renin secretion characterize this. The release of norepinephrine due to Adenosine receptor blockade and increased dopaminergic activity due to receptor blockade provides a stimulant effect characterized by difficulty sleeping after consuming caffeine [27,28]. The results of interviews conducted by researchers show that some of them have problems doing assignments, and many of them play online games until late at night, which makes their sleep patterns bad. Research conducted by Liveina in 2014 found various reasons why respondents consumed coffee, including not sleeping the night before (9.5%), habit or to increase energy (7.1%), approaching exams or completing assignments (55.2%), recreational (25.3%) and others (2.9%).

The test results on non-caffeinated beverages, namely fruit juice, showed no significant difference ($p = 0.083$). The results of the difference in sleep pattern scores before and after consumption, with a score of 0.0, mean that the sleep patterns of fruit juice consumers before and after remained the same. This is because the content of fruit juice does not contain substances that can interfere with a person's sleep quality. Conversely, studies found that fruit juice may improve sleep quality. Fruit juice also reduces serum kynurenine to tryptophan ratio and prostaglandin E2, resulting in an increase in sleep time and sleep efficiency according to the PSQI score [29,30]

4 CONCLUSION

Consuming black coffee triggers a significant increase in systolic and diastolic blood pressure. Both black coffee and café latte consumption may disturb sleeping patterns.

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