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Research Article

Correlation Between Consumption Pattern of Caffeinated Beverages and HDL Level in Elderlies in GKJ Gondokusuman Yogyakarta

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Abstract

Background and Objective: Non-infectious disease is one of the main causes of death globally, with more proportion in the elderly. The most frequent non-infectious disease that affected the elderly is coronary heart disease. HDL has an important role in reducing the risk of coronary heart disease. Caffeinated beverages affected the level of HDL. This study determine the correlation between the consumption pattern of caffeinated beverages and HDL level in elderlies in GKJ Gondokusuman. **Materials and Methods:** This study is an analytical observational study with a cross-sectional method. The population was the elderlies in GKJ Gondokusuman, Yogyakarta, with a total sample of 52 people consisting of 36 females and 16 males. The consumption pattern of caffeinated beverages was assessed using the food frequency questionnaire, while the HDL level was measured using a blood sample with a reagent and automatic machine for chemical assessment in the laboratory. **Results:** The data assessed by Spearman correlation analysis showed no correlation between consumption pattern of caffeinated beverages and HDL level ($p = 0.492$, $R = -0.003$) and there was no correlation between HDL level and age ($p = 0.126$, $R = 0.162$). Data analysis using Mann-Whitney found a correlation between HDL level and coronary heart disease ($p = 0.002$) and between HDL level and gender ($p = 0.017$) in elderlies in GKJ Gondokusuman. **Conclusion:** There was no correlation between the consumption pattern of caffeinated beverages and HDL level in elderlies in GKJ Gondokusuman, Yogyakarta.

Key words: HDL, caffeine, coronary heart disease, elderlies, Yogyakarta

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Competing Interest: The authors have declared that no competing interest exists.

Data Availability: All relevant data are within the paper and its supporting information files.

INTRODUCTION

Non-communicable diseases comprise a group of major causes of death globally where according to the World Health Organization (WHO), approximately 36 M people die each year from non-communicable diseases and this number is expected to continue to rise, especially in developing countries¹. The proportion of deaths from non-communicable diseases is greater in the elderly or above 60 years population. One type of non-communicable disease that is often suffered by the elderly is Coronary Heart Disease (CHD)².

Caffeine is the most commonly consumed psychoactive substance by 80% of the world's population as an alkaloid compound found in a wide variety of beverages such as tea, coke, chocolate milk, energy beverages and coffee³. Coffee has a higher percentage of caffeine content compared to the other aforementioned beverages. Coffee consumption among Indonesians increases at a rate of around 8.22% annually⁴. Coffee contains an acid content comprising of quinic acid, citric acid, chlorogenic acid, phosphoric acid and acetic acid. The content of these acids in coffee has a good impact on coronary heart disease through an increase in the reverse cholesterol transport process mediated by High Density Lipoprotein (HDL) cholesterol⁵.

HDL is the smallest lipoprotein subtype which contains 20% cholesterol, <5% triglyceride, 30% phospholipid and 50% protein (apoprotein A, C and E, I and apoprotein II). HDL level is influenced by several factors such as age, sex, physical activity, drugs and food or beverages consumption patterns⁶. Foods that can potentially increase HDL levels include those containing mono-unsaturated fatty acids (MUFA). While one of the beverages that can increase HDL level is coffee⁷. This study aimed to determine the correlation between the consumption pattern of caffeinated beverages and HDL level in elderly in GKJ Gondokusuman.

MATERIALS AND METHODS

Study area: This study was performed in an observational analytical approach using the cross-sectional method and was conducted at GKJ Gondokusuman Yogyakarta.

Research protocol: This study included the elderly residing at GKJ Gondokusuman Yogyakarta. The data was collected using a total sampling technique of which a total of 52 subjects were enrolled. HDL levels were measured by chemical examination performed at Parahita Laboratory and Clinic using blood samples collected from each participant. The pattern of caffeinated beverage consumption was measured using Food Frequency Questionnaire.

Statistical analysis: Statistical analysis was performed using Spearman correlation and Mann-Whitney U test. The level of statistical significance used in this study was $p < 0.05$.

RESULTS

Table 1 presents the characteristics of female participants ($n = 36$) in this study. The majority of female participants in the 60-74 years age group had normal HDL levels ($n = 16$). The majority of women in the 75-90 years age group had normal HDL levels ($n = 4$). Among subjects in the 60-74 years age group, a higher proportion reported low intake of caffeinated beverage (<2 times/day) which consisted of 18 subjects. Similar results were also obtained from subjects in the 75-90 years age group, where 4 subjects reported low daily caffeinated beverage consumption.

Table 2 demonstrates the characteristics of male participants ($n = 16$) in this study. The majority of participants in the 60-74 years age group had normal HDL levels ($n = 9$). The majority of subjects in the 75-90 years age group had normal HDL levels ($n = 2$) as well. Among subjects in the 60-74 years age group, a higher proportion reported a high intake of caffeinated beverages (>2 times/day) which consisted of 9 subjects. Conversely, in the 75-90 years age group, most of the subjects ($n = 2$) reported low daily caffeinated beverage consumption (<2 times/day).

According to the results of the Spearman correlation test, the R-value obtained is close to 0 indicating a very weak correlation between caffeinated beverage consumption pattern and HDL levels. The analysis also resulted in a p-value ($p > 0.05$) showing that there is no significant relationship between the consumption pattern of caffeinated beverages and HDL levels as seen in Table 3.

Based on the Spearman correlation test in Table 4, the $R = 0.162$ with the category of very weak correlation strength. While, the $p = 0.126$ indicates that there is no significant relationship between HDL levels and age because $p > 0.05$.

Table 5 presents the results of the Mann-Whitney U test showing that there was a clinically significant difference in the mean rank between men and women. The difference in the HDL levels between men and women was statistically significant indicated by the p-value of 0.017 ($p < 0.05$).

Table 6 presents the results of the Mann-Whitney U test showing that there was a clinically significant difference in the mean rank of HDL levels between subsets with and without a history of CHD. The difference in the HDL levels between the two subsets was statistically significant indicated by the p-value of 0.002 ($p < 0.05$).

Table 1: Characteristics of female participants

	HDL				Pattern of caffeinated beverage consumption			
Age	Low (<40 mg dL ⁻¹)	Normal (41-59 mg dL ⁻¹)	High (≥60 mg dL ⁻¹)	Total	Low (<2 times/day)	High (>2 times/day)	Total	
60-74 years	6	16	7	29	18	11	29	
75-90 years	1	4	2	7	4	3	7	
Total	7	20	9	36	22	14	36	

Table 2: Characteristics of male participants

	HDL				Pattern of caffeinated beverage consumption			
Age	Low (<40 mg dL ⁻¹)	Normal (41-59 mg dL ⁻¹)	High (≥60 mg dL ⁻¹)	Total	Low (<2 times/day)	High (>2 times/day)	Total	
60-74 years	5	9	0	14	5	9	14	
75-90 years	0	2	0	2	2	0	2	
Total	5	11	0	16	7	9	16	

Table 3: Results of Spearman correlation test

Pattern of caffeinated beverage consumption	HDL levels
r = 0.98	r = 0.162
p = 0.244	p = 0.126

Table 4: Spearman correlation test findings

n = 52	HDL levels
Age	r = 0.162
	p = 0.126

Table 5: Results of Mann-Whitney U test assessing the relationship between gender and HDL levels

	Gender		p-value
	Male (n = 16)	Female (n = 36)	
Median (Min.-Max.)	44.00 (32-52)	49.50 (31-93)	0.017

*Mann-Whitney U test mean rank of male subjects = 19.00, female subjects = 29.83, Min: Minimum and Max: Maximum

Table 6: Results of Mann-Whitney U test assessing the relationship between HDL levels and coronary heart disease

	History of coronary heart disease		p-value
	Yes (n = 15)	No (n = 37)	
Median (Min.-Max.)	39.00 (32-53)	50.00 (31-93)	0.002

*Mean rank for patients with a history of CHD = 6.23, without a history of CHD = 30.66, Min: Minimum and Max: Maximum

DISCUSSION

The results of this study indicate that there is no relationship between consumption patterns of caffeinated beverages and HDL levels. This is consistent with the theory that the diterpenes compound in coffee consists of cafestol and kahweol as well as the caffeine content such as caffeine acid, polyphenols, monomethylxanthine and flavonoids, can increase HDL levels. However, the manner in which the coffee is processed and taken with cream, milk or sugar is believed to cause a fall in HDL levels⁸.

In this study, the results showed that there was no relationship between age and HDL levels. This requires further research using different methods because until now there is

no definite theory regarding the relationship between age and HDL levels. However, some factors can influence them, such as controlling triglyceride levels, waist circumference, low-calorie diet, not consuming alcohol and doing physical activity^{9,10}.

Based on the results of this study, it was found that there was a significant relationship between gender and HDL levels, where HDL levels tended to be higher in women. According to the theory, a woman will experience a decrease in HDL levels due to menopause but several factors that can affect HDL levels in postmenopausal women where those who never has a history of smoking and alcohol consumption as well as those with ideal body mass index and those who engage with regular physical activity, could maintain their HDL levels post-menopause¹¹.

The study results showed a significant relationship between CHD and HDL levels. In the light of the current theory, a person suffering from CHD tend to have lower HDL levels¹². HDL has a role in reverse cholesterol transport which process occurs in the liver through several stages. The first stage begins with the Nascent HDL containing apolipoprotein A-1 which is considered one of the important components in reverse cholesterol transport which will take up the free cholesterol in macrophages. Furthermore, the free cholesterol will be converted into cholesterol esters through the esterification process by Lecithin Cholesterol Acyltransferase (LCAT). Subsequently, the cholesterol ester will be transported through two pathways, the first pathway will transport it directly to the liver, while in the second pathway, cholesterol esters in HDL will be exchanged with triglycerides from VLDL and IDL through Cholesterol Ester Transfer Protein (CETP) to be transferred back to the liver. Thus, both of these pathways will eventually convert cholesterol esters into HDL, the process of which occurs in the liver. In addition, to reverse cholesterol transport, the other role of HDL is to facilitate cytokine production as well as lipid oxidation, the role that makes HDL a protective agent against atherosclerosis. Atherosclerosis is

the initial process of coronary heart disease. Consequently, if the HDL levels are dropped, it may increase the risk of developing CHD¹³.

Many studies have suggested that the consumption of caffeinated beverages is beneficial for some cardiovascular outcomes including lower cardiovascular mortality. Limitation on the long-term effects evaluation of caffeine caused by self-reported caffeine intake, which has a substantial margin of error¹⁴. Studies of recent caffeine drinking may not necessarily apply to habitual caffeine consumption but may rather account for the discrepancies between clinical studies and epidemiological studies of caffeine-containing beverages and cardiometabolic health¹⁵.

CONCLUSION

According to the results of this study, it was found that there was no significant relationship between the consumption patterns of caffeinated beverages and HDL levels in elderly patients at GKJ Gondokusuman, there was no significant relationship between age and HDL levels, there was a significant relationship between gender and HDL levels and there was a significant relationship between a history of CHD and HDL levels.

For further research, it is recommended to measure the quantitative levels of caffeine using interventional methods as an alternative to the questionnaire of caffeine consumption patterns. In addition, the investigators should also consider the variation in the type of caffeinated beverages consumed in the analyses. For example, it should not only refer to the standard grouping for the caffeinated beverage but must also clarify the types of caffeinated beverages as well as the quality of caffeinated beverages consumption.

SIGNIFICANCE STATEMENT

This study discovered that the gender and history of CHD linked to HDL level in elderlies can be beneficial for the management of cardiovascular risks. This study will help the researchers to uncover the critical areas of factors related to HDL level in elderlies that many researchers were not able to explore. Thus a new theory on the effects of dietary and other factors of HDL level in elderlies may be arrived at.

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