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Abstract: Coffee is a drink that is commonly consumed by Indonesian people. Coffee contains caffeine, cafestol, and kahweol which can increase lipid levels, including increasing triglyceride levels. Triglycerides are substances consisting of glycerol linked to fatty acid groups. The purpose of this study was to describe blood triglyceride levels in coffee addict students at Anwar Medika University using the GPO-PAP method. This study uses a quantitative descriptive design with a cross-sectional survey approach. This research was conducted in May 2023. The research sample consisted of 48 samples which were determined using a purposive sampling technique which was taken at random. The univariate analysis used is the distribution of frequencies and percentages which describe the presentation of data for one variable. This research test obtained an average triglyceride level of 158.7 mg/dl. Based on age category, maximum triglyceride levels were 204.73 mg/dl with an average of 152.26 mg/dl. Based on lifestyle, the maximum triglyceride level is 189.93 mg/dl with an average of 166.43 mg/dl. Based on the frequency of coffee consumption, the maximum triglyceride level is 160.64 mg/dl with an average of 158.51 mg/dl. Based on physical activity, the maximum triglyceride level is 173.88 mg/dl with an average of 160.60 mg/dl. Based on the type of coffee consumed, the maximum triglyceride level was 166.76 mg/dl with an average of 164.57 mg/dl. So, it can be concluded that excessive coffee consumption can increase triglyceride levels in the body

Keywords: Coffee, Triglycerides, College Students.

INTRODUCTION

Coffee is a drink commonly consumed by Indonesian people. The distinctive aroma of coffee has its attraction for consumption. Indonesia is the third largest coffee-producing country in the world after Brazil and Vietnam with a total production of 748 thousand tons or 6.6% of world coffee production in 2016. From 2016 to 2019 the level of coffee consumption in Indonesia increased every year. It is predicted that this increase will increase by an average of 8.22% every year.[1] The increase in coffee consumption in Indonesia is due, in part, to people's lifestyles which have made processed coffee drinks a daily activity for their daily needs. However, the amount of coffee consumption in Indonesia still reaches 300 thousand tons and is still far below other countries.[2]

The habit of drinking coffee has spread and become a culture in various regions, including among students, from urban to rural areas on the island of Java. Students also have a large level of coffee consumption due to internal and external

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factors. One of them is students who work while studying with heavy physical activity, then need coffee to prevent drowsiness and refresh the body. This causes the level of coffee consumption among young people to remain very high.[3]

The ingredients contained in coffee consist of more than a thousand molecules of different substances, including phenolic compounds, vitamins, minerals, and alkaloids which can increase lipid levels. The caffeine, cafestol, and kahweol compounds contained in coffee can also increase triglyceride levels.[4] Kalel et al.'s 2020 research on the effect of coffee consumption on serum lipid profiles in adults concluded that individuals who drink coffee show a higher risk of developing dyslipidemia.[5]

Triglycerides are a type of fat that is transported in the blood and stored in the body's fat tissue. Triglycerides are the main constituent of lipids in the body. Triglycerides are used by the body to provide energy in metabolic processes, small amounts of triglycerides are also used throughout the body to form cell membranes. Triglyceride levels are an indicator of body health, excessive triglycerides in the body can narrow blood vessels and increase the risk of heart attack.[6] Several factors that can influence triglyceride levels include age, gender, lifestyle, frequency of coffee consumption, hormone levels, and obesity. Triglyceride levels in the body can be controlled with a healthy lifestyle and avoiding foods or drinks that can increase lipid levels.[7] This research aims to determine the description of triglyceride levels in the blood of students who are coffee addicts at Anwar Medika University using the GPO-PAP method.

MATERIAL AND METHOD

This research uses a quantitative descriptive method with a cross-sectional survey approach. The sampling technique in this research was purposive sampling which was taken randomly. Triglyceride examination uses the GPO-PAP (Glycerol Peroxidase Phosphate Acid) enzymatic colorimetric method. The principle of the GPO-PAP method is that triglycerides will be enzymatically hydrolyzed as glycerol and free acids with specific lipase to form a colored complex whose levels can be measured using a photometer. The intensity of the color formed can be determined by measuring the absorbance in the wavelength range 480-550 nm.[8,9] This research was carried out in May 2023, at the Medical Biology Laboratory on the 4th floor of Anwar Medika University.

The tools used in this research were a tourniquet, red vacuum tube, 3cc syringe, micro lab 300 photometer, yellow and blue tip, 500-1000 ul and 50-5 ul micropipette, serology tube, and serology tube rack. The materials used in this research were 70% alcohol, blood serum/plasma samples, GPO-PAP triglyceride reagent, tissue, and labels/labels.

The procedure of this research was:

1. Pre-analytical, including sample preparation, labeling, venous blood sampling,
2. Analytical, including making serum/plasma and checking triglyceride levels as follows:

	Blanko	Test
Reagen	1000ul	1000µl
Sample	-	10µl

- Pipette 1000µl of triglyceride reagent with a micropipette into a serology tube then pipette 10µl of serum sample.
- Homogenize, then incubate for 5-10 minutes.
- Read on the Microlab 300 instrument and record the results.

3. Post-analytic, including interpreting the results according to the reference value for triglyceride examination and recording the results then continuing with data analysis

The data analysis used in this research is manually using a Microsoft Excel computer with univariate analysis to analyze each variable from a study. The univariate analysis used is frequency and percentage distribution which describes the presentation of data for one variable.[10]

RESULTS AND DISCUSSION

Based on the research that has been carried out, it is known that several characteristics of research subjects are presented in Table 1.

Table 1. Research Subject Characteristic

Characteristic	Total	
	N	%
Age (tahun)		
18-19	9	17
20-21	13	23
22-23	11	26
24-25	15	34
Drinking Coffee Frequency		
< 3 glasses/day	23	49
> 3 glasses/day	25	51
Physics Activities		
Usually, physics activities	30	47
Seldomphysics activities	18	53
Lifestyle		
Smoker	16	57
Non-Smoker	32	43
The amount of triglycerides		
Normal <150 mg/dl	28	58
High >150 mg/dl	20	42

Based on Table 1, the characteristics of the 48 research subjects based on triglyceride levels were divided into the normal category (<150 mg/dl) for 48 (58%) respondents and the high category (≥150 mg/dl) for 28 (42%) respondents. Age characteristics are categorized as ages ranging from 18-25 years with a frequency of coffee consumption of <3 cups/day and >3 cups/day as well as physical activity and lifestyle which are categorized into groups of regular exercise, rarely exercise, smoking, and non-smoking.

Tabel 2. Statistic Distribution of the amount of Triglycerides

Variable	N	Mean	SD	Min	Max
The amount of triglycerides (mg/dl)	48	158.7	67.089	62	304

Based on Table 2, the results of the statistical analysis of triglyceride levels in this study showed that the average triglyceride level was 158.7 mg/dl with the lowest triglyceride level being 62 mg/dl and the highest triglyceride level being 304 mg/dl. This can be caused by factors such as age, physical activity, frequency of daily coffee consumption, lifestyle, and the type of coffee consumed. Increasing age affects the decline in the function of the hormones estrogen and testosterone in distributing fat, thus allowing fat to accumulate in the body.[7] Consuming coffee over a long period can also cause an increase in lipids in the body, the compounds

in coffee can speed up the process of narrowing and blockage of blood vessels which function to carry oxygen to the heart. Excessive levels of caffeine, cafestol, and kahweol compounds in the body will disrupt and inhibit triglyceride metabolism in the blood, causing lipid build up in blood vessels. Free fatty acids released due to excessive lipid accumulation can inhibit lipogenesis and will inhibit serum triacylglycerol clearance, resulting in increased blood triglyceride levels or hypertriglyceridemia.[11,12]

Examination of triglyceride levels is an important parameter in the lipid profile which can help diagnose a disease or determine risk factors for coronary heart disease and detect metabolic syndrome, as well as monitor the effectiveness of lipid-lowering therapy. Based on analysis of the results of research conducted by researchers, an overview of triglyceride levels in coffee addicted students at Anwar Medika University was obtained with an average triglyceride level of 158.7 mg/dl. This can be caused by factors such as age, physical activity, frequency of daily coffee consumption, lifestyle and the type of coffee consumed. Consuming coffee over a long period of time can cause an increase in lipids in the body, the compounds in coffee can speed up the process of narrowing and blockage of blood vessels which function to carry oxygen to the heart. The habit of consuming coffee is closely related to the emergence of lipid disorders, including increased triglyceride levels.[13]

Table 3. The Distribution of the amount of triglyceride based on the coffee type

Coffee Type	The amount of trigliseride		Mean of trigliseride (mg/dl)
	<150 mg/dl	≥150 mg/dl	
Black coffee	10	9	166.76
Sachet coffee	13	16	162.38
Total	48		164.57

Based on Table 3, the results of the analysis of triglyceride levels in students who are coffee addicts based on the type of coffee consumed, namely black coffee and sachet coffee, showed that the average triglyceride level was 164.57 mg/dl. black coffee and sachet coffee. both contain caffeine, cafestol, and kahweol, but in different amounts or levels.[14,15] Consuming black coffee tends to have higher triglyceride levels compared to those consuming sachet coffee.[16,17] This is because black coffee has a caffeine content of 85-185 mg/cup, kahweol 6-12 mg/cup, and cafestol 4-6 mg/cup. Sachet or instant coffee has a caffeine content of 30-90 mg/coffee sachet in 150 ml of water, kahweol 0.2-0.6 mg/cup, and cafestol 0.1 mg/cup.[4,7,18,19]

Triglycerides in the body will be converted into fatty acids and glycerol which are stored in adipose tissue and then absorbed through the intestines and distributed widely throughout the body. Excessive free fatty acids in the blood, some will be used as an energy source and some will be taken to the liver as raw material for the formation of triglycerides. Free fatty acids will become triglycerides again and become part of VLDL (Very Low-Density Lipoprotein) because there has been a process of inhibiting the beta oxidation mechanism in the liver so that the lipids produced will be very rich in triglycerides. Excessive levels of caffeine, cafestol and kahweol compounds in the body will disrupt and inhibit triglyceride metabolism in the blood, causing lipid buildup in blood vessels. Free fatty acids released due to excessive lipid accumulation can inhibit lipogenesis and will inhibit serum triacylglycerol clearance, resulting in an increase in blood triglyceride levels or hypertriglyceridemia. In addition, the accumulation of lipids will cause adipose cells to be unable to store triglycerides adequately, which will trigger an increase

in LDL (Low Density Lipoprotein) and ultimately an increase in triglyceride levels in the body. Caffeine is a central nervous system stimulant which can increase heart rate and contribute to the occurrence of supraventricular tachycardia (heart rhythm disturbance). The caffeine compound content in coffee has the function of stimulating nervous system activity and increasing heart function, but if caffeine is consumed in excess, caffeine will be toxic by inhibiting nervous system mechanisms and can increase triglyceride levels. Kahweol is a compound usually found in coffee that can cause the degradation of toxic substances and is protective against aflatoxin B1 if consumed in excess. The cafestol compound contained in coffee can also increase triglyceride levels by inhibiting the beta oxidation mechanism, preventing the breakdown of triglycerides into energy so that triglyceride levels in the blood will increase.[20-22]

The picture of triglyceride levels increasing in the 24-25year age category is triglyceride levels. This is because with increasing age the function of the body's organs will decrease due to aging which is a risk factor for functional disorders. The age factor will make a person less physically active and increase the risk of developing more functional disorders compared to a younger age. Increasing age significantly increases the risk of degenerative diseases in both men and women. As we age, there will be a decline in the function of various body organs, making it difficult to achieve balance in triglyceride levels. An increase in lipids in the blood is associated with a decrease in the elimination of lipids as bile salts and a decrease in receptors that mediate the clearance process of LDL. This can result in triglyceride levels tending to increase more easily. Age factors influence the deterioration of body functions, including stiffness of blood vessels (shrinking and aging). In men, serum triglyceride concentrations increase to a peak in middle age, while in women they continue to rise until the age of 70 years. Increasing age also affects the decline in the function of the hormones estrogen and testosterone in distributing fat, thus allowing fat to accumulate in the body. The danger is that if this fat buildup sticks to the walls of blood vessels, it will narrow blood flow, especially if the blood vessels are old. This condition will result in blocked blood vessels and increased triglyceride levels which can cause a decrease in HDL.[23,24]

The limitation of this research is that this research was carried out semi-quantitatively using a Microlab 300 type photometer so that the measurement results were less accurate because they were influenced by several factors, including the pipetting angle being less precise so that the ratio of reagent and blood volumes was not appropriate because pipetting was still done manually outside of the tool for reacting the sample. with reagents so that it will affect the results of measuring falsely low or high triglyceride levels. The cleanliness factor of the tube can also influence the results of measuring triglyceride levels because the researchers did not use disposable tubes so it is possible that when washing the tube it was not clean enough so that soap residue was still attached to the walls of the tube which will affect the results of measuring triglyceride levels because triglyceride examination tends to be sensitive compared to lipid profile examination. other. Contamination during the reaction or incubation process can also be a factor in the high or false results of measuring triglyceride levels because this research still uses semi-quantitative methods where the process is still carried out outside the equipment which allows contamination to occur. Future researchers are expected to be able to develop this research by using more sophisticated tools to obtain more accurate research results and avoid several limitations.[25]

Control efforts that can be made to monitor triglyceride levels are by paying more attention to health, for example having regular check-ups at least once every 3 months to determine body condition including triglyceride levels, in addition to maintaining diet, lifestyle, and increasing physical activity and reducing the habit of consuming coffee every day. so that health problems do not occur, for example increasing triglyceride levels in the body.[12,13,26-28]

CONCLUSION

Based on the research results obtained, it can be concluded as follows, examination of high triglyceride levels ≥150 mg/dl with a percentage of 58% and triglyceride levels which are classified as normal, namely <150 mg/dl with a percentage of 42%. The average triglyceride level was 158.7 mg/dl with the lowest triglyceride level being 62 mg/dl and the highest triglyceride level being 304 mg/dl. High triglyceride levels in many respondents were caused by several factors including age, physical activity, frequency of daily coffee consumption, lifestyle, and type of coffee consumed. Excessive coffee consumption can increase triglyceride levels in the body.

AUTHORS' CONTRIBUTIONS

Amellya Octifani: designed the protocols, and executed the protocols. Tarisa Suci Novianti: prepared the samples, and data collection. Farida Anwari: data analytics and visualization statistically. Arif Rahman Nurdianto: wrote the draft manuscript. Fery Setiawan, Arif Rahman Nurdianto, and Rizal Fauzi Nurdianto: reviewed and supervised the manuscript, and wrote the final manuscript. All authors have read and approved the final manuscript.

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DATA AVAILABILITY STATEMENT

The utilized data to contribute in this research are available from the corresponding author on reasonable request.

DISCLOSURE STATEMENT

The views and opinions expressed in this article are those of the authors and do not necessarily reflect the official policy or position of any affiliated agency of the authors. The data is the result of the author's research and has never been published in other journals.

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