



Analysis Of Blood Triglyceride Levels In Active Smokers Based On Smoking Duration At Muhammadiyah Clinic Garut

Ghina Yuliana*, Nursalam Sri Julianti B. Salampessy

*Medical Laboratory Technology Study Program, Politeknik Piksi Ganesha, Indonesia

Abstract

Cigarettes are processed tobacco products containing addictive substances that are consumed by burning and inhaling the smoke. Long-term smoking can trigger cardiovascular disease, one mechanism of which is hyperlipidemia resulting from elevated blood triglyceride levels. Triglycerides are the primary lipids found in fat deposits and dietary sources. This study aimed to analyze differences in blood triglyceride levels among active smokers based on smoking duration at Muhammadiyah Clinic Garut. A quantitative cross-sectional design was used, involving 20 male smokers registered as patients at the clinic who underwent triglyceride testing. Triglyceride levels were measured using the GPO-PAP method. The Shapiro-Wilk test indicated normally distributed data ($p > 0.05$), followed by Levene's test, ANOVA, and Tukey post hoc analysis. Mean triglyceride levels were 153.3 ± 4.2 mg/dL in the <1-2-year group, 187.3 ± 18.8 mg/dL in the 3-5-year group, and 320.6 ± 69.5 mg/dL in the >10-year group. Shapiro-Wilk p-values were 0.910, 0.231, and 0.648, while Levene's test indicated homogeneous variance ($p = 0.051$). ANOVA demonstrated significant differences in triglyceride levels according to smoking duration ($p < 0.001$), and Tukey testing showed significant differences between all groups ($p = 0.002$ and $p < 0.001$). These findings demonstrate significant differences in triglyceride levels based on smoking duration.

Keywords: Smokers, Triglycerides, Cardiovascular Disease

Correspondent Author: Ghina Yuliana

E-mail: ghinayuliana017@gmail.com

Received : 09 Oktober 2026

Revised : 13 Oktober 2026

Accepted : 14 Oktober 2026

Published : 14 Oktober 2026





1. Introduction

Cigarettes are processed tobacco products containing addictive substances and are consumed by burning and inhaling the smoke. To date, smoking remains a public health problem that is difficult to overcome because it has become integrated into daily activities. The long-term effects of smoking can trigger cardiovascular disease. One mechanism is hyperlipidemia caused by increased blood triglyceride levels. Ideally, people should maintain normal triglyceride levels as an indicator of cardiovascular health. However, the prevalence of hyperlipidemia in Indonesia reaches 27.9% according to the Ministry of Health (2018), with high triglyceride levels as a dominant component. Smoking is one of the contributing factors, with 34.5% of the population aged >15 years being active smokers according to WHO (2024).

Cigarettes are processed tobacco products wrapped in paper and used by burning and inhaling the smoke. The Ministry of Health categorizes cigarettes as addictive substances that can cause dependence and serious health hazards to smokers and people around them. Cigarettes are made from *Nicotiana tabacum*, *Nicotiana rustica*, or their synthetic forms. An active smoker is an individual who routinely or daily consumes cigarettes. A person is categorized as a smoker if they have smoked every day for more than six months at the time of the survey.

Cigarettes contain various chemicals that are harmful to the body. When burned, a cigarette produces many toxic chemicals. These include nicotine, an addictive substance that causes dependence. Nicotine can also stimulate adrenaline, thereby increasing heart rate. Its content in cigarettes is approximately 0.5-3 mg per cigarette. Nicotine stimulates the liver to produce triglycerides and contributes to insulin resistance, thereby increasing blood lipids. Tar is a collection of solid, sticky particles that accumulate in the lungs and gradually reduce pulmonary function. Tar contains carcinogenic substances and is present at approximately 0.5-35 mg per cigarette. Carbon monoxide (CO) is a toxic combustion gas that binds to hemoglobin approximately 200 times more strongly than O₂, thereby reducing the blood's oxygen-carrying capacity. One cigarette can produce 3%-6% CO, and this gas can be inhaled by anyone. Some CO-containing smoke enters the body and some is exhaled by the smoker. Individuals who smoke for a long period have a higher risk of various diseases because greater quantities of cigarette constituents are inhaled (WHO, 2021).

Nicotine has addictive and psychoactive effects and can inhibit ciliary activity in the lungs. Nicotine can stimulate adrenaline, increasing heart activity and blood pressure. This may contribute to hypertension because the heart is continuously stimulated and blood pressure rises. Tar in cigarettes can cause cancer. Carbon monoxide may cause narrowing of blood vessels because it binds hemoglobin approximately 200 times more strongly than oxygen; cells deprived of oxygen may undergo spasm. If this process continues, blood vessels become more susceptible to damage and narrowing (CDC, 2024).

Triglycerides are esters of glycerol and three fatty acids that function as the body's main energy reserve (Nelson & Cox, 2021). When cells require energy, lipase enzymes in adipose cells break triglycerides down into glycerol and fatty acids and release them into





the bloodstream. These components are then utilized by cells that require them and are metabolized to produce energy and carbon dioxide (CO₂) (OpenStax, 2022).

Triglycerides are the major lipids in fat stores and in food. An increase in triglyceride levels above the normal limit is referred to as hyperlipidemia. Many people overlook the negative effects of smoking on smokers themselves and on nonsmokers (van der Plas et al., 2023).

Blood triglyceride levels are influenced by several factors, including age, because metabolic function decreases with increasing age and may alter lipid synthesis. Physical activity such as exercise is also relevant because insufficient physical activity may increase triglyceride levels, whereas exercise contributes to energy expenditure involving triglycerides. Irregular dietary patterns, including low-fiber and high-fat food intake, may also increase triglyceride levels (Nelson & Cox, 2021).

Smoking can cause health disorders such as cardiovascular disease through its effects on lipid profiles. One cigarette constituent is nicotine, which is rapidly distributed in the blood and liver. Nicotine increases adrenaline secretion, promoting an increase in free fatty acid concentrations that stimulate hepatic cholesterol synthesis and secretion, including hepatic VLDL secretion, resulting in increased blood triglyceride levels. In addition, carbon monoxide and free radicals trigger lipolysis in adipose tissue, increase the release of free fatty acids to the liver, and stimulate VLDL production (Behl et al., 2022).

Because smoking is difficult to eliminate from community life, the researcher was interested in investigating increased triglyceride levels among active smokers, as long-term smoking is associated with various health problems, including elevated blood triglycerides. Many people remain unaware of the effect of smoking on triglyceride levels, particularly when cigarette consumption is high and smoking duration is long. This study is expected to support early detection of triglyceride abnormalities among smokers. Data on triglyceride levels among smokers at Muhammadiyah Clinic were previously limited, even though such data are important for specific interventions.

2. Research Methods

This quantitative cross-sectional study examined serum triglyceride levels among male smokers at Muhammadiyah Clinic Garut. The study was conducted from April to August 2026, with sample collection in April 2026. The population comprised 50 male patients scheduled for triglyceride testing, of whom 20 were selected through purposive sampling. Inclusion criteria were active smoking of more than one cigarette daily for at least six months, fasting for 8–12 hours, willingness to provide informed consent, and scheduled triglyceride examination. Exclusion criteria included alcohol consumption, non-smoking status, failure to fast, and concurrent medical therapy for triglyceride-related conditions.

Primary data included serum triglyceride levels and respondent characteristics collected through questionnaires and guided interviews, covering age, occupation, smoking duration, cigarette consumption, and fasting history. Venous blood (3 mL) was collected after confirming fasting status, labeled, and centrifuged at 3,000 rpm for 10 minutes using an Oregon LC-04S centrifuge. Serum triglycerides were measured using a Mindray BA-88A semi-automatic chemistry analyzer. The procedure used the GPO-PAP method





according to the reagent SOP, with 10 μ L serum and 1,000 μ L reagent, incubation at 37°C for 10 minutes, and absorbance measurement at 546 nm.

Data were analyzed statistically using the Shapiro–Wilk test for normality, Levene’s test for homogeneity of variance, analysis of variance (ANOVA), and Tukey’s post hoc test. The analysis was intended to evaluate differences in triglyceride levels according to the study variables.

3. Results and Discussion

a. Result

Table 1. Shapiro-Wilk Test of Blood Triglyceride Levels Based on Smoking Duration

Smoking Duration (years)	N	Mean $\pm$ SD (mg/dL)	Shapiro-Wilk	Interpretation
<1-2	6	153.2 $\pm$ 4.2	0.910	Normal
3-5	9	187.3 $\pm$ 18.8	0.231	Normal
>10	5	320.6 $\pm$ 69.6	0.648	Normal

Based on the Shapiro-Wilk normality test, all p-values were >0.05 ; therefore, triglyceride data were considered normally distributed. Subsequent analysis used Levene's test and ANOVA.

Table 2. Levene's Test

Variable	n	F	df1	df2	p-value	Interpretation
Smoking Duration	20	3.56	2	17	0.051	Homogeneous

Levene's test produced a p-value of 0.051 ($p>0.05$), indicating homogeneous variance.

Table 3. ANOVA Test

Variable	n	F	df	p-value	Interpretation
Smoking Duration	20	32.47	2,17	0.001	Significant

The ANOVA test yielded a p-value of 0.001 ($p<0.05$), indicating significant differences in triglyceride levels among the smoking-duration groups.

Table 4. Tukey Post Hoc Test

Comparison	Mean Difference	Tukey p	Interpretation
<1-2 years vs 3-5 years	-34.2	0.002	Significant
<1-2 years vs >10 years	-167.4	<0.001	Significant
3-5 years vs >10 years	-133.3	<0.001	Significant

The Tukey test showed that all three group comparisons were significantly different, indicating that triglyceride levels increased as smoking duration increased.





b. Discussion

This study aimed to examine blood triglyceride levels among active smokers according to smoking duration. Normality testing was performed first and showed that the data were normally distributed. ANOVA, which is appropriate for data meeting the normality assumption, was then conducted. The ANOVA results demonstrated significant differences in blood triglyceride levels according to smoking duration. These results indicate that differences in smoking duration were accompanied by increases in blood triglyceride levels.

Table 1 shows Shapiro-Wilk p-values of 0.910 for smokers with a smoking duration of <1-2 years, 0.231 for those with 3-5 years, and 0.648 for those with >10 years, indicating normally distributed data. Table 2 shows a Levene p-value of 0.051 ($p>0.05$), indicating homogeneous variance. Table 3 shows an ANOVA p-value of 0.001, demonstrating significant differences in triglyceride levels among smokers based on smoking duration. Table 4 shows significant differences in all Tukey pairwise comparisons, indicating that triglyceride levels increased with longer smoking duration.

Increased blood triglyceride levels are not influenced only by smoking habits but also by diet, physical activity, age, body mass index, and the number of cigarettes consumed. Age is relevant because metabolic function changes with increasing age and can affect lipid synthesis. Physical activity such as exercise influences triglyceride levels because insufficient activity can contribute to increased triglycerides, whereas exercise contributes to energy expenditure. Irregular dietary patterns, such as low-fiber and high-fat food consumption, can also increase triglyceride levels. A high BMI, including overweight or obesity, is closely associated with visceral fat accumulation around the abdomen, which disrupts normal lipid metabolism and can markedly increase triglyceride levels. Furthermore, smoking duration does not fully represent the magnitude of exposure to cigarette constituents. Differences in the number of cigarettes smoked each day can result in different levels of toxic exposure among individuals.

Sugyantari (2025) demonstrated a significant effect of cigarette consumption on triglyceride levels. Two individuals with the same smoking duration may have different levels of cigarette exposure. Cigarette constituents can affect lipid metabolism through several mechanisms, including the effects of nicotine on lipid metabolism. However, these mechanisms do not always result in significant differences between smoking duration and blood triglyceride levels because individual metabolic responses vary and triglyceride levels are also influenced by other factors. These factors were not investigated in the present study and therefore constitute study limitations.

The findings are consistent with Prima et al. (2020), who reported high blood triglyceride levels among smokers who had smoked for more than 10 years and consumed 1-2 packs of cigarettes per day. Nicotine increases adrenaline secretion, which raises free fatty acid concentrations and stimulates hepatic cholesterol synthesis





and secretion, including hepatic VLDL secretion, thereby increasing blood triglyceride levels. The findings are also supported by Athala et al. (2024), who reported mean differences in triglyceride levels among active smokers, although that study compared active and passive smokers.

According to Nurpalah et al. (2021), high triglyceride levels were found among smokers. Long-term cigarette consumption can trigger increased triglyceride levels because nicotine increases free fatty acid concentrations that influence triglyceride levels.

Thus, among the smokers examined in this study, smoking duration was significantly associated with blood triglyceride levels. In this study, smoking duration was a factor statistically related to triglyceride levels. These findings are expected to contribute new knowledge and provide a basis for future studies incorporating other variables, such as daily cigarette consumption, diet, or physical activity, to obtain a clearer understanding of the relationship between smoking habits and increased blood triglyceride levels.

4. Conclusion

Based on the examination of blood triglyceride levels among active smokers, significant differences in triglyceride levels were found according to smoking duration. ANOVA across all smoking-duration groups yielded $p < 0.05$, indicating significant differences in increased triglyceride levels according to smoking duration. However, further studies should examine blood triglyceride levels among smokers in relation to other factors such as age, daily cigarette consumption, physical activity, and dietary patterns.

5. Compliance with Ethical Standards

Acknowledgements

The source manuscript does not provide a specific acknowledgement statement.

Disclosure of conflict of interest

The source manuscript does not state a conflict-of-interest declaration.

Statement of informed consent

The source manuscript states that willingness to participate and signed informed consent were inclusion criteria.

References

- Athala, S. A. A., Sulistiyowati, R., Sudarsono, T. A., & Dhanti, K. R. (2024). Perbedaan kadar trigliserida pada perokok aktif dan pasif di Terminal Bulupitu Purwokerto. *Journal of Medical Laboratory and Science*, 4(2), 2-6. <https://doi.org/10.36086/medlabscience.v4i2.1922>
- Behl, T. A., Stamford, B. A., & Moffatt, R. J. (2022). The effects of smoking on the diagnostic characteristics of metabolic syndrome: A review. *American Journal of Lifestyle Medicine*, 17(3), 397-412. <https://doi.org/10.1177/15598276221111046>
- Centers for Disease Control and Prevention. (2024). Health effects of cigarettes: Cardiovascular disease. National Center for Chronic Disease Prevention and Health Promotion, Office on Smoking and Health. <https://www.cdc.gov/tobacco/about/cigarettes-and-cardiovascular-disease.html>





- Kementerian Kesehatan Republik Indonesia. (2018). Laporan nasional Riset Kesehatan Dasar (Riskesdas) 2018. Badan Penelitian dan Pengembangan Kesehatan, Kementerian Kesehatan Republik Indonesia. <https://repository.badankebijakan.kemkes.go.id/>
- Nelson, D. L., & Cox, M. M. (2021). *Lehninger principles of biochemistry* (8th ed.). W. H. Freeman/Macmillan Learning.
- Nurpalah, R., Rosdiana, R., & Putri, A. A. (2021). Gambaran kadar trigliserida pada perokok aktif usia remaja. *Journal of BTH Medical Laboratory Technology*, 1(1), 30-32.
- OpenStax. (2022). *Anatomy and physiology 2e: 4.3 Lipid metabolism*. Rice University. <https://openstax.org/books/anatomy-and-physiology-2e/pages/4-3-lipid-metabolism>
- Prima, S. I., Ansori, W. A., & Sinta, S. (2020). Penentuan kadar trigliserida pada perokok usia 20-50 tahun di Rumah Sakit Umum Avisena. *Jurnal Kesehatan Rajawali*, 10(1), 98-99.
- Sugyantari, P. P., Prihatiningsih, D., & Cahyani, A. A. A. E. (2025). Pengaruh konsumsi rokok terhadap kadar trigliserida pada pria di Banjar Dalem Argantaka. *Innovative: Journal of Social Science Research*, 5(4). <https://doi.org/10.31004/innovative.v5i4.20918>
- van der Plas, A., Antunes, M., Pouly, S., de La Bourdonnaye, G., Hankins, M., & Heremans, A. (2023). Meta-analysis of the effects of smoking and smoking cessation on triglyceride levels. *Toxicology Reports*, 10, 367-375. <https://doi.org/10.1016/j.toxrep.2023.03.001>
- World Health Organization. (2021). WHO report on the global tobacco epidemic 2021: Addressing new and emerging products. <https://www.who.int/publications/i/item/9789240032095>
- World Health Organization. (2024). Global Adult Tobacco Survey Indonesia report 2021. <https://cdn.who.int/media/docs/default-source/ncds/ncd-surveillance/data-reporting/indonesia/gats2021-indonesia-report.pdf>

