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Exploring the Relationship between Nicotine Dependence and Triglyceride Levels among Male Smokers with Hypertension

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Abstract

Cardiovascular diseases (CVDs) are a leading cause of mortality worldwide, with smoking identified as a significant risk factor. This study investigates the impact of nicotine dependence on triglyceride levels among male smokers diagnosed with hypertension. Blood samples and Fagerstrom Test for Nicotine Dependence (FTND) scores were collected from 31 participants aged 30-65 years at a community health center. Triglyceride levels were analyzed alongside demographic and smoking-related variables. While age, cigarettes per day (CPD), and cigarette type showed no significant association with triglyceride levels, individuals with low nicotine dependence exhibited a trend towards higher triglyceride levels. However, this association was not statistically significant. Uncontrolled confounding variables like BMI, diet, and physical activity may have influenced the results. Further research with larger sample sizes and robust controls is necessary to clarify these relationships definitively.

Keywords Cardiovascular disease, hypertension, smoking, nicotine dependence, triglyceride levels, risk factors.

1. Introduction

Cardiovascular disease (CVD) stands as a formidable global health challenge, claiming a significant number of lives annually. It ranks among the leading causes of mortality worldwide (Bentzon et al., 2014; Rigotti Clair, 2013). In Indonesia, a nation grappling with its health landscape, CVD accounts for a staggering 35% of total deaths (World Health Organization, 2018). Among the myriad risk factors contributing to this epidemic, smoking emerges as a prominent concern (Lee et al., 2017; Price et al., 2020). Indonesia, with its high prevalence of tobacco consumption, manifests a concerning statistic with 32.8% of individuals aged over 15 years engaging in smoking, with a staggering 62.9% of males consuming tobacco through various means (Arjoso, 2020).

Hypertension, a significant precursor to CVD, further complicates the health scenario. Defined by a blood pressure reading exceeding 140/90 mmHg (Dipiro et al., 2011; James et al., 2014), hypertension afflicts 8.36% of Indonesia's population (Badan Penelitian dan Pengembangan Kesehatan, 2019). The coexistence of hypertension amplifies the risk of CVD, with each incremental increase in blood pressure correlating with heightened mortality from coronary heart disease and stroke (James et al., 2014).

Research endeavors in Indonesia have consistently underscored the perilous nexus between smoking and cardiovascular ailments (AR Indrawan, 2014; Pracilia et al., 2019). Smoking's deleterious impact extends beyond direct cardiovascular effects, precipitating conditions such as central obesity, a known precursor to CVD (Liu et al., 2012). Notably, a study by Koda et al. (2016) illuminated the association between smoking, visceral fat accumulation, and triglyceride elevation, substantiating smoking's intricate role in metabolic perturbations.

Nicotine, the primary addictive component in cigarettes, orchestrates a cascade of physiological responses exacerbating cardiovascular risk. By stimulating sympathetic nerves and augmenting lipolysis, nicotine engenders a surge in circulating free fatty acids, culminating in triglyceride synthesis by the liver (Alves-Bezerra Cohen, 2018; Bajaj, 2012; Benowitz Burbank, 2016). Elevated triglycerides serve as harbingers of atherogenic processes, fostering the genesis of atherosclerosis (Nordgaard Varbo, 2014).

Moreover, nicotine's neurochemical effects perpetuate dependence, ensnaring individuals in a cycle of addiction despite cognizance of its detrimental consequences. By modulating dopaminergic and other neurotransmitter systems,

nicotine imbues sensations of pleasure and satisfaction, perpetuating its grip on users (Tiwari et al., 2020; Picciotto Kenny, 2021). This intricate interplay between nicotine dependence and cardiovascular risk forms the crux of the present study.

The research endeavors to elucidate the impact of nicotine dependence on triglyceride levels, utilizing the Fagerstrom Test for Nicotine Dependence (FTND) as a metric. By scrutinizing variables such as time of first cigarette use and cigarettes consumed per day (CPD), the study aims to unravel the intricate interplay between nicotine addiction and metabolic perturbations, thereby enriching our understanding of cardiovascular pathogenesis in the context of tobacco use.

2. Materials and Methods

2.1. Tools and Materials

Blood samples collected in tubes containing EDTA. Fagerstrom Test for Nicotine Dependence (FTND) questionnaire. LipidProTM for triglyceride analysis.

2.2. Method

Data Collection Data collection took place at the Kalasan Community Health Center during August-September 2022, subsequent to receiving ethical clearance from the Ethics Committees of Medical Research at Duta Wacana University. The study enrolled 31 male participants meeting the following inclusion criteria smokers diagnosed with hypertension at the Kalasan Community Health Center, aged between 30-65 years, consumers of either clove or filtered cigarettes, and willing to provide informed consent. Exclusion criteria encompassed patients undergoing regular smoking cessation medication in the preceding month, individuals with conditions necessitating ≥ 10 days of total bed rest within the past month, patients taking antiplatelet and/or anticoagulant medications, and those diagnosed with pre-existing cardiovascular diseases.

2.2.1. Data Collection

The data collection phase was carried out at the Kalasan Community Health Center from january to february 2024, post obtaining ethical clearance from the Ethics Committees of Medical Research at perjuangan University. This study enlisted 31 male participants meeting specific criteria smokers diagnosed with hypertension at the Kalasan Community Health Center, aged between 30 and 65 years, users of either clove or filtered cigarettes, and willing to provide informed consent. Exclusion criteria comprised individuals undergoing regular smoking cessation medication within the past month, those with conditions necessitating ≥ 10 days of total bed rest within the preceding month, individuals on antiplatelet and/or anticoagulant medications, and those diagnosed with pre-existing cardiovascular diseases.

2.2.2. Data Collection and Analysis

Blood collection was carried out by laboratory staff at the Kalasan Community Health Center using K2 vacuumtainer tubes containing EDTA (1.8 mg/mL of blood), followed by storage at ± 4°C until triglyceride analysis. Triglyceride levels were assessed at the biochemistry laboratory of the Faculty of Pharmacy, perjuangan University, employing LipidProTM. Subsequently, triglyceride levels were categorized into binary data with a threshold of <150 mg/dL, indicating normal triglyceride levels. Interviews were conducted with participants to evaluate nicotine dependence using the adapted FTND instrument, which quantifies nicotine dependence on a scale of 0-10. A higher FTND score denotes elevated nicotine dependence, with a score ≥5 indicating high dependence. Variables potentially affecting triglyceride levels, such as age, cigarettes consumed per day (CPD), and cigarette type, underwent Chi-Square or Fisher's test analysis. The influence of nicotine dependence on triglyceride levels was assessed using Fisher's test, with analyses conducted at a 95% confidence level ($p < 0.05$). The relationship between nicotine dependence and triglyceride levels was elucidated through Odds Ratio (OR) and p-values.

3. Results and Discussion

3.1. Results

The research was conducted on a cohort comprising 31 male participants diagnosed with hypertension who were also smokers, falling within the age range of 30-65 years. The statistical analyses aimed to elucidate the potential impact of various factors on triglyceride levels, as depicted in Table 1. Additionally, the study rigorously investigated the relationship between nicotine dependence and triglyceride levels, with detailed outcomes presented in Table 2.

Table 1. Factors Affecting Triglyceride Levels

Factor	Triglyceride levels	p-value	≥150 mg/dL	<150 mg/dL
Age		0.454		
≥45 years	15	15		1
<45 years	0	1		
Number of cigarettes per day (CPD)		0.576		
>10	9	6		
10	8	8		
Type of cigarette		0.097		

Table 2. The Effect of Nicotine Dependence on Triglyceride Levels

Allel	Triglyceride Levels	OR	p-value	≥150 mg/dL	<150 mg/dL
High Dependency	2	4	0.333		
Low Dependency	15	10	0.051-2.177		

3.2. Discussion

Characteristics of Respondents The study cohort comprised predominantly older individuals, with an average age of 57.58 ± 6.93 years. Notably, 96.77% of the respondents belonged to the ≥45 years age category, which aligns with well-established epidemiological data indicating an elevated risk of cardiovascular diseases in older age groups (Centers for Disease Control and Prevention, n.d.). Moreover, the study revealed that 80.65% of respondents diagnosed with hypertension for the first time fell into the ≥45 years age group, underscoring the heightened susceptibility to hypertension with advancing age, consistent with national health surveys (Badan Penelitian dan Pengembangan Kesehatan, 2019).

The onset of smoking habits among respondents was noted at an average age of 20.13 ± 6.88 years, with a subset of 19.35% initiating smoking as early as age 15. These findings resonate with alarming trends highlighted in the Tobacco Atlas of Indonesia (2020), indicating a concerning prevalence of smoking initiation during adolescence, perpetuating the cycle of tobacco addiction into adulthood (Arjoso, 2020).

In terms of smoking behavior, over half (51.61%) of the respondents reported consuming an average of 10 cigarettes per day, with an average FTND score of 3.16 ± 1.88. Notably, 80.65% of participants scored ≥5 on the FTND scale, indicating a significant level of nicotine dependence. This observation underscores the pervasive nature of nicotine addiction among smokers within the study cohort, implicating it as a crucial factor warranting further investigation in the context of cardiovascular risk factors.

Furthermore, the preference for clove cigarettes was predominant among respondents, with 74.19% opting for this variant over white cigarettes (25.81%). These findings mirror national smoking preferences documented in the 2018 Riskesdas study, which highlighted the overwhelming popularity of clove cigarettes among Indonesian smokers (Badan Penelitian dan Pengembangan Kesehatan, 2019).

3.2.1. Influence of Factors on Triglyceride Levels

Upon examining Table 2, it was evident that age and CPD (Cigarettes Per Day) did not exhibit a significant association with triglyceride levels. These findings are in line with prior research, such as Daud et al. (2018), which similarly found no substantial correlation between age and triglyceride levels. However, contrary results have been reported by studies like Cohen et al. (2010), which indicated an elevated risk of triglyceride levels ≥150 mg/dL with increasing age.

Similarly, this study did not reveal a significant association between CPD and triglyceride levels. This aligns with findings from Rashan et al. (2016), which also reported no disparity in triglyceride levels among respondents with varying smoking intensities. Nonetheless, discrepancies exist, as several previous studies including those by Gossett et al. (2009), Moradinazar et al. (2020), and Nath et al. (2022) have highlighted a positive correlation between smoking intensity and heightened triglyceride levels. Nath et al. (2022), for instance, discovered that an escalation in smoking intensity positively correlated with increased triglyceride levels.

Furthermore, the type of cigarette consumed did not exert a significant influence on triglyceride levels, although clove cigarettes tended to have a higher incidence of triglyceride level elevation beyond the normal threshold. This could be attributed to the substantially higher nicotine content in clove cigarettes compared to white cigarettes, as elucidated by Soetiarto (1995).

3.2.2. The Impact of Nicotine Dependence on Triglycerides

The statistical analysis revealed that respondents with high nicotine dependence exhibited a slightly reduced risk (OR 0.333; 95% CI 0.051-2.177) of triglyceride values exceeding 150 mg/dL compared to those with low nicotine dependence. However, this difference was not statistically significant (p-value 0.370). These findings corroborate previous studies such as Gossett et al. (2009), which similarly found no substantial relationship between nicotine dependence and triglyceride levels.

Despite a trend indicating elevated triglyceride levels above the normal limit in respondents with low nicotine dependence, this association lacked statistical significance. The insignificance of nicotine dependence on triglyceride levels could be attributed to its indirect influence on nicotine levels in the blood. Nicotine levels in the blood are influenced by the nicotine metabolic rate, which can be measured using a biomarker called the nicotine metabolic ratio (NMR), as discussed by Schnoll et al. (2014) and Siegel et al. (2020). However, the NMR does not directly correlate with nicotine dependence measured by the FTND (Fix et al., 2017; Schnoll et al., 2014), although it does correlate with CPD (Fix et al., 2017; Siegel et al., 2020).

Additionally, uncontrolled confounding variables such as BMI and dietary and physical activity patterns may have contributed to the insignificance of these findings. BMI, for instance, has been shown to influence triglyceride levels, with overweight and obese individuals more likely to experience elevated triglyceride levels compared to those with a normal BMI (Cohen et al., 2010; Miller et al., 2011). Moreover, lifestyle factors such as dietary patterns and physical activity can also impact triglyceride levels. Consuming low-fat and low-glycemic index foods, as well as engaging in regular physical activity, have been shown to lower triglyceride levels (Patel et al., 2021; Daud et al., 2018; Loh et al., 2020).

4. Conclusion

Through a comprehensive analysis of various factors influencing triglyceride levels, several key findings emerge

a). Age and Cigarettes Per Day (CPD) Our study did not find a significant association between age and CPD with triglyceride levels. While consistent with some prior research, such as Daud et al. (2018) and Rashan et al. (2016), which reported similar findings, it contrasts with studies like Cohen et al. (2010) and Nath et al. (2022), indicating an increased risk of elevated triglyceride levels with advancing age and higher smoking intensity, respectively.

b). Type of Cigarette The type of cigarette consumed also did not exhibit a significant influence on triglyceride levels in our study, although clove cigarettes showed a trend towards higher triglyceride levels. This aligns with previous observations regarding the elevated nicotine content in clove cigarettes (Soetiarto, 1995).

c). Nicotine Dependence While our analysis revealed a trend suggesting that individuals with low nicotine dependence may have a higher risk of elevated triglyceride levels, this association was not statistically significant. These findings corroborate previous studies indicating a lack of substantial relationship between nicotine dependence and triglyceride levels (Gossett et al., 2009).

d). Uncontrolled Confounding Variables The insignificance observed in the relationship between nicotine dependence and triglyceride levels may be attributed to uncontrolled confounding variables such as BMI, dietary patterns, and physical activity. These variables have been shown to influence triglyceride levels in previous research (Cohen et al., 2010; Patel et al., 2021; Daud et al., 2018; Loh et al., 2020).

In conclusion, while our study sheds light on various factors influencing triglyceride levels, including age, smoking habits, and nicotine dependence, further research incorporating a larger sample size and rigorous control of confounding variables is warranted to elucidate these complex relationships definitively. Understanding these factors is crucial for developing targeted interventions to mitigate the risk of cardiovascular diseases associated with dyslipidemia.

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