



## Relationship Between Demographic Characteristics and Central Obesity with Dyslipidemia among Adult Population in Indonesia

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### ABSTRACT

**Background:** One of the main risk factors for cardiovascular disease and the leading cause of death worldwide, including in Indonesia, is dyslipidemia. The purpose of this study is to examine the relationship between demographic characteristics and central obesity with dyslipidemia among adults in Indonesia.

**Methods:** This study used national Basic Health Research data from 2018. Study design is cross sectional. This study was conducted in September 2024. The study population consisted of individuals aged 25–45 years in Indonesia. Initially, the sample size included 305,457 respondents, but after data cleaning, 12,796 respondents with complete data remained. The analysis was conducted univariately using frequency distribution and percentages, bivariately using chi-square tests, and multivariately using multiple logistic regression.

**Results:** The results of bivariate analysis showed a significant relationship between age ( $p=0.000$ ,  $OR=1.46$ ), gender ( $p=0.000$ ,  $OR=1.53$ ), central obesity ( $p=0.000$ ,  $OR=1.79$ ) and dyslipidemia. There was no relationship between level of education and dyslipidemia ( $p=0.283$ ). Central obesity showed the strongest association in multivariate analysis

**Conclusion:** In conclusion, the variables associated with dyslipidemia are age, gender, and central obesity. Central obesity emerged as the strongest predictor of dyslipidemia in the multivariate analysis. Management of central obesity such as dietary improvements and increased physical activity should be considered to decrease risk of dyslipidemia.



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## INTRODUCTION

The rising prevalence of cardiovascular diseases in Indonesia has become a serious concern in recent years. Data from the Basic Health Research (Riskesdas) survey indicates a significant increase in the prevalence of cardiovascular diseases from 2013 to 2018. Specifically, the prevalence of stroke rose from 7.0% to 10.9%, hypertension from 25.8% to 34.1%, and heart disease from 1.5% to 1.6% (Kemenkes, 2013, 2018). Numerous studies have shown that

dyslipidemia is a modifiable risk factor that plays a critical role in cardiovascular diseases (J. S. Lee et al., 2017; Pikula et al., 2015).

Dyslipidemia is characterized by an imbalance in blood lipid profiles, marked by elevated levels of triglycerides, total cholesterol, and LDL cholesterol, as well as low levels of HDL cholesterol (Berberich & Hegele, 2022). WHO revealed that elevated total cholesterol is a significant contributor to the global disease burden both in the developed and developing countries as a risk factor for ischemic heart disease and stroke. In 2008, the worldwide prevalence of elevated total cholesterol among adults was 39% (37% in males and 40% in females) (World Health Organization (WHO), 2016). According to the 2018 Basic Health Research, the prevalence of hypercholesterolemia among individuals aged > 15 and above was 35.9%, with high LDL cholesterol levels at 15.8%, low HDL cholesterol levels at 22.9%, and high triglycerides at 13.3% (Kemenkes, 2018).

LDL cholesterol is recognized as a contributing factor in the development of cardiovascular disease. When LDL particles in the blood increase, particularly after undergoing oxidation, these particles are taken up by macrophage receptors in the arterial wall, leading to the formation of foam cells that contribute to atherosclerotic plaque formation. The oxidation of LDL in the arterial wall also triggers the production of cytokine signals and cellular inflammation, further contributing to atherogenesis. If these plaques rupture, blood flow can be obstructed, resulting in a heart attack, stroke, or circulation disorders in the limbs (Berberich & Hegele, 2022).

Research shows that there are several factors associated with dyslipidemia, including age, gender, education and central obesity (Kamsu, 2007; Widyasari, 2017). Obesity, a widespread issue in the contemporary world, is closely linked to dyslipidemia, which is primarily influenced by the effects of insulin resistance and pro-inflammatory adipokines. However, recent findings indicate that dyslipidemia resulting from obesity is not a singular pathophysiological condition, but rather possesses specific characteristics that vary based on numerous individual factors (Vekic et al., 2019). One of the main modifiable risk factors for a large number of non-communicable diseases is central obesity. The prevalence of central obesity in Indonesia rose from 26.6% in 2013 to 31% in 2018 (Kemenkes, 2013, 2018).

A study revealed a link between self-reported dyslipidemia, advancing age, and higher BMI (Ali et al., 2022). Among individuals with dyslipidemia, 72% were classified as overweight or obese, compared to 51.2% of those without dyslipidemia. Similarly, a study utilizing multivariate logistic regression analysis found that factors such as increasing age (in females), abdominal obesity, being overweight or obese, hypertension, and diabetes significantly elevated the risk of dyslipidemia (Ebrahimi et al., 2016). Additionally, research conducted in Ethiopia identified being over 64 years old, being between 40–64 years old, and being overweight or obese as major predictors of dyslipidemia (Gebreegziabihier et al., 2021).

Therefore, it is crucial to identify the risk factors associated with dyslipidemia in order to prevent and manage the burden of cardiovascular diseases. The purpose of this study is to examine the relationship between demographic characteristics and central obesity with dyslipidemia and the most significant factor associated with dyslipidemia among adults in Indonesia.

## **METHODS**

This study was conducted in September 2024 by utilizing national survey Basic Health Research 2018 data that has cross-sectional study design. The data used comes from the National Institute of Health Research and Development, Ministry of Health of the Republic of Indonesia, which can be accessed under certain conditions and procedures through the website [www.badankebijakan.kemkes.go.id](http://www.badankebijakan.kemkes.go.id). Population of Basic Health Research 2018 data is all households in Indonesia, Basic Health Research 2018 sample uses SUSENAS 2018 sampling frame conducted in March 2018. The sample target visited is about 300,000 households from 30,000

SUSENAS census block conducted by the Central Bureau of Statistics with probability proportional to size method and using linear systematic sampling with two stage sampling.

The population used in this study consists of all individuals aged 25-45 years in Indonesia. The sample for this research includes all adult residents aged 25-45 years recorded in the 2018 Riskesdas report, which will be taken using a total sampling method, meaning all respondents who meet the inclusion criteria. The inclusion criteria for the sample in this study are adult residents aged 25-45 years who have complete research variables. The study began with an initial sample of 305,457 respondents, which was reduced to 12,796 after data cleaning to include only those with complete information.

This study utilized data on gender, education, waist circumference, total cholesterol, triglycerides, LDL cholesterol, and HDL cholesterol levels. The waist circumference of the respondents was used to determine central obesity, with males classified as having central obesity if their waist circumference is > 90 cm and females if it is > 80 cm. Respondents whose HDL cholesterol levels < 40 mg/dl, LDL cholesterol levels > 130 mg/dl, triglyceride levels > 150 mg/dl, and total cholesterol levels > 200 mg/dl indicate dyslipidemia (Perkeni, 2021). Subsequently, both of univariate, bivariate, and multivariate analyses were used for analyzing the data. Univariate analysis was employed to present the frequency distributions and percentages of each variable. Bivariate relationships were examined using logistic regression and chi-square tests. For multivariate evaluation, multiple logistic regression was applied. All data analyses were performed with SPSS software.

## RESULTS

### Result of Univariate Analysis

The analysis revealed that 7,849 respondents (61.3%) had dyslipidemia, with 62.2% of these individuals, amounting to 7,965, being over 35 years old. The majority of respondents were female, accounting for 7,708 (60.2%). Based on education level, more respondents had completed elementary school or equivalent compared to other education levels, with 3,841 respondents (30.0%). Additionally, there were 5,289 respondents (41.3%) who experienced central obesity. For more details, please refer to Table 1.

**Table 1.** Frequency Distribution of Demographic Characteristics, Central Obesity, and Dyslipidemia (n=12,796)

Variables	n	%
<b>Dyslipidemia</b>		
No	4947	38.7
Yes	7849	61.3
<b>Age</b>		
< 35 Years Old	4831	37.8
> 35 Years Old	7965	62.2
<b>Sex</b>		
Male	5088	39.8
Female	7708	60.2
<b>Education Level</b>		
Bachelor degree or equivalent	603	4.7
Associate degree	366	2.9
Senior high school or equivalent	3552	27.8
Junior high school or equivalent	2887	22.6
Elementary school or equivalent	3841	30.0
Not completed elementary school or equivalent	1247	9.7
No school	300	2.3

Variables	n	%
<b>Central Obesity</b>		
No	7507	58.7
Yes	5289	41.3

### Result of Bivariate Analysis

The bivariate analysis results indicate that the variables significantly associated with dyslipidemia are age ( $p = 0.000$ ), gender ( $p = 0.000$ ), and central obesity ( $p = 0.000$ ). Respondents over 35 years old are 1.46 times more at risk of dyslipidemia compared to those under 35 years old. Male respondents are 1.53 times more at risk of dyslipidemia compared to female respondents. There was no significantly relationship between level of education and dyslipidemia ( $p=0,283$ ). Education level is a preventive factor for dyslipidemia, as indicated by the odds ratio (OR) of less than 1. Meanwhile, respondents with central obesity are 1.79 times at risk of dyslipidemia compared to those without central obesity. For more details, please refer to Table 2.

**Table 2. Relationship between Sociodemographic Factors and the Incidence of Dyslipidemia in Indonesia (n=12,796)**

Variables	Dyslipidemia				OR (95% CI)	p-value
	No		Yes			
	n	%	n	%		
<b>Age</b>						
< 35 Years Old	2140	44.3	2691	55.7	1.46	0.000
> 35 Years Old	2807	35.2	7849	61.3	(1.36-1.57)	
<b>Gender</b>						
Male	3284	42.6	4424	57.4	1.53	0.000
Female	1663	32.7	3425	67.3	(1.42-1.65)	
<b>Education Level</b>						
Bachelor degree or equivalent	213	35.3	390	64.7	1.03 (0.77-1.37)	0.283
Associate degree	142	38.8	366	61.2	0.89 (0.65-1.22)	
Senior high school or equivalent	1381	38.9	3552	61.1	0.88 (0.69-1.13)	
Junior high school or equivalent	1135	39.3	2887	60.7	0.87 (0.69-1.11)	
Elementary school or equivalent	1512	39.4	3841	60.6	0.87 (0.68-1.11)	
Not completed elementary school	456	36.6	1247	63.4	0.98 (0.75-1.27)	
No school	108	36.0	300	64.0	Ref	
<b>Central Obesity</b>						
No	3322	44.3	4185	55.7	1.79	0.000
Yes	1625	30.7	3664	69.3	(1.66-1.93)	

### Multivariable Analysis

In the bivariate analysis, the education variable had a p-value greater than 0,25, so it could not be included in the multivariate analysis modeling.

**Table 3. Multivariate analysis**

Variables	B	P-value	OR	95% CI
Age	0.32	0.0005	1.38	1.28-1.48
Gender	0.78	0.0005	2.17	2 - 2.36
Central Obesity	0.87	0.0005	2.39	2.20-2.59

Multivariate analysis revealed that age, gender, and central obesity were significantly associated with dyslipidemia. Among these, central obesity showed the strongest association. The odds ratio

(OR) for central obesity was 2,39, indicating that individuals with central obesity were 2,39 times more likely to develop dyslipidemia compared to those without central obesity.

## **DISCUSSION**

### **Interpretation of Key Findings**

This study found that the variables significantly associated with dyslipidemia are age, gender, and central obesity. Central obesity exhibited the strongest link to dyslipidemia in the multivariate analysis. With an odds ratio of 2,39, this indicates that those with central obesity were 2,39 times more prone to dyslipidemia than those without central obesity. Previous studies have also shown a relationship between gender and age with dyslipidemia status (Qi et al., 2015; Xi et al., 2020).

Research among adults aged  $\geq 35$  years in northern China also showed that the prevalence of dyslipidemia increases with age but decreases in the 65-75 age group. A similar trend was observed in the levels of LDL cholesterol and triglycerides. The study also found that dyslipidemia is significantly higher in men compared to women (Xi et al., 2020). As age increases, body fat mass rises while muscle mass decreases. Body fat mass increases during middle age and then declines in older age. Muscle mass loss begins around age 50 years old and accelerates after 60 years old, while body fat continues to increase until about age 75 years old (Syafiq et al., 2020).

Advanced age has long been recognized as a critical factor contributing to dyslipidemia. Research from both cross-sectional and longitudinal studies has shown that total cholesterol (TC), low-density lipoprotein cholesterol (LDL-C), and triglyceride (TG) levels tend to increase with age, while high-density lipoprotein cholesterol (HDL-C) levels exhibit a significant decline (Katulanda et al., 2018). These correlations hold true across different ethnicities, races, and various other risk factors. Our findings align with established lipid trends associated with biological aging. For instance, national data from Korea demonstrated that average serum lipid levels in women continued to rise with age, eventually exceeding those of men after their 60s (Y. ho Lee et al., 2014). Current guidelines for treatment and monitoring emphasize the importance of addressing elevated lipid levels, particularly in middle-aged and older women (Graham et al., 2017). Furthermore, older individuals are often less aware of optimal blood pressure and cholesterol targets, highlighting a gap in recognizing cardiovascular risks and the need for timely management.

This study also found that respondents with central obesity are 2.39 times at risk of dyslipidemia compared to those without central obesity. Research conducted on employees of Tarumanagara University who visited the Faculty of Medicine Polyclinic during the period from November 2016 to April 2017 also demonstrated a significant relationship between central obesity and dyslipidemia (Sutanto & Karjadidjaja, 2019). Obesity can lead to metabolic system disorders such as hypercholesterolemia. Research indicates a relationship between central obesity and total blood cholesterol levels in women aged 45-54 years in Plalangan Village, Gunungpati District, Semarang City. In central obesity, disturbances in fatty acid regulation can occur, resulting in increased triglyceride and cholesterol ester levels. The rise in blood cholesterol can also be attributed to elevated cholesterol found in very low-density lipoprotein (VLDL) and low-density lipoprotein (LDL), which occurs secondary to a significant increase in triglycerides in circulation when there is excessive fat accumulation in the body (Listiyana et al., 2013).

A recent study highlighted a significant rise in deaths and disability-adjusted life years (DALYs) linked to obesity (Dai et al., 2020). Research consistently shows that being overweight or obese is a major cardiometabolic risk factor (Koliaki et al., 2019). Analysis of data from 97 prospective cohorts involving 1.8 million participants revealed that obesity increases the risk of coronary heart disease by 31% and stroke-related mortality by 8%, primarily due to elevated blood pressure and cholesterol levels (Lu et al., 2014). Consequently, managing lipid levels effectively could help lower mortality rates from metabolic diseases. This study found that both general and

central obesity were strongly associated with higher rates of dyslipidemia compared to individuals without obesity. The most common forms of dyslipidemia in obese individuals include low HDL-C and elevated triglycerides, consistent with findings from other studies. This is likely due to excess visceral fat increasing triglycerides and Apo lipoprotein B levels, alongside reduced HDL-C production caused by liver inhibition (Xi et al., 2020). Central obesity, in particular, has been strongly linked to metabolic risk factors, cardiovascular events, and dyslipidemia (Sangrós et al., 2018). Additionally, higher body mass index (BMI) and waist circumference are well-established predictors of abnormal lipid profiles, with their impact varying by gender and age. Elevated BMI and waist circumference are clearly key contributors to the development of metabolic diseases.

### **Implications for Public Health**

The results of the study show a significant correlation age, gender, and the prevalence of dyslipidemia. Therefore, there is a need for more targeted interventions based on these demographic risk factors. Individuals over 35 years old have an increased risk of dyslipidemia (OR=1.46). Given that age and gender significantly impact dyslipidemia risk, primary healthcare facilities should be more responsive in identifying high-risk age groups. Routine screening for individuals in the elderly group, especially men, is necessary. This can aid in the early detection of dyslipidemia and prevent more serious complications, as dyslipidemia is one of the risk factors for non-communicable diseases (J. S. Lee et al., 2017). Besides that, the prevention of dyslipidemia should begin as early as possible, even from childhood, through a balanced nutrition approach, regular physical activity, weight management, avoiding smoking, getting sufficient rest, effective stress management, and health education (Kusteviani, 2015; Puspitasari, 2018). A healthy lifestyle established from a young age will become a positive habit into adulthood and significantly reduce the risk of cardiovascular diseases. Additionally, a significant relationship was found between central obesity and dyslipidemia (OR=1.79). Regular monitoring of waist circumference at community health centers, integrated health posts, or other healthcare facilities is essential for the early detection of central obesity risk. Obesity not only increases the risk of dyslipidemia but also several non-communicable diseases. Therefore, the government needs to strengthen health campaigns aimed at controlling obesity.

### **Limitations**

The researchers acknowledge several limitations in this study. First, there were many incomplete data available. The data obtained from the National Institute of Health Research and Development of the Ministry of Health of the Republic of Indonesia included 30,801 respondents, but only 12,796 respondents had complete data, meaning that only 41.5% could be analyzed. Second, the study design is cross-sectional, which means that both dependent and independent variables were examined simultaneously. Therefore, this study cannot provide explanations regarding causal relationships; the relationships observed only indicate correlations or associations.

### **Recommendations for Future Research**

Recommendations for future research suggest analyzing more risk factors that influence the occurrence of dyslipidemia in Indonesia. Additionally, it is crucial to determine the most significant risk factors for dyslipidemia, so that information related to dyslipidemia in Indonesia can be more comprehensive in order to develop prevention and control efforts for cardiovascular diseases in the country.

### **CONCLUSION**

The results of this study showed that 61.3% of respondents had dyslipidemia. Variables significantly associated with dyslipidemia were age ( $p = 0.000$ ), gender ( $p = 0.000$ ), and central

obesity ( $p = 0.000$ ). Central obesity emerged as the strongest predictor of dyslipidemia in the multivariate analysis. Meanwhile, education was not significantly associated with dyslipidemia. These findings underscore the immediate need for the development and implementation of targeted intervention programs to manage risk factors and establish routine screening initiatives in Indonesia. Additionally, raising public awareness about these risk factors and promoting effective therapeutic approaches—such as nutritional guidance, physical activity, and behavioral strategies is essential.

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