# ANALYSIS OF DYSLIPIDEMIA FACTORS AS PREDICTORS OF HYPERTENSION IN PATIENTS AGED ≥40 YEARS AT BENU-BENUA PUBLIC HEALTH CENTER, KENDARI CITY

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*Hypertension remains a major cause of morbidity and mortality in Indonesia, with prevalence increasing alongside aging and lifestyle changes. Dyslipidemia, a disorder of lipid metabolism, contributes significantly to its development through mechanisms such as atherosclerosis and arterial stiffness. This study aimed to analyze the role of dyslipidemia, particularly total cholesterol and triglyceride levels, as predictors of hypertension in patients aged ≥40 years at Benu-benua Public Health Center, Kendari City. The study employed a cross-sectional quantitative approach, involving 91 respondents selected through simple random sampling (74 hypertensive and 17 non-hypertensive Data were obtained through laboratory examinations of total cholesterol and triglyceride levels using spectrophotometric methods and blood pressure measurements using a digital sphygmomanometer. Correlation analysis showed a significant association between total cholesterol and both systolic (r=0.243; p=0.020) and diastolic blood pressure (r=0.270; p=0.010). Triglycerides were also significantly correlated with systolic (r=0.369; p=0.000) and diastolic blood pressure (r=0.265; p=0.011). Logistic regression showed that high total cholesterol was a significant predictor of hypertension (OR=1.021; 95% CI=1.002-1.041; p=0.003), indicating that each 1 mg/dL increase in total cholesterol raised the risk of hypertension by 1.021 times, whereas triglycerides were not significant. These findings highlight the importance of routine cholesterol screening in individuals aged ≥40 years as part of early detection and hypertension prevention efforts. The results also emphasize the need to integrate dyslipidemia screening into primary healthcare services and to promote lifestyle modifications as part of non-communicable disease control policies. Future Research is recommended to explore the role of other lipid fractions, such as HDL and LDL, and to examine lifestyle factors more comprehensively.*

***Keywords: Dyslipidemia, Hypertension, Cholesterol, Triglyceride, Non-Communicable Diseases***

## 1. Introduction

Hypertension remains one of the most pressing global health challenges, classified as a non-communicable disease (NCD) with an ever-increasing prevalence due to aging, lifestyle changes, and rapid urbanization (Sulastri & Astuti, 2020). The World Health Organization (WHO) reported that the global number of people with hypertension has doubled over the past three decades, increasing from 650 million in 1990 to more than 1.3 billion in 2019, with the greatest burden occurring in developing countries. In Southeast Asia, hypertension is estimated to affect more than 294 million individuals and contributes to approximately 2.4 million deaths annually (WHO, 2024). This condition makes hypertension one of the leading causes of morbidity and mortality, with broad implications for productivity and economic burden.

The 2023 Indonesian Health Survey reported a national hypertension prevalence of 29,2% based on blood pressure measurements among individuals aged ≥15 years, while in Southeast Sulawesi Province the prevalence reached 27,5% (SKI, 2023). In Kendari City, hypertension ranked third among the ten most common diseases in 2023, with a total of 71,101 cases (Dinkes Kota Kendari, 2023). These findings indicate that hypertension is not only a global concern but also a local public health priority, requiring effective and evidence-based control strategies.

One of the metabolic factors involved in the pathogenesis of hypertension is dyslipidemia, a lipid metabolism disorder characterized by elevated levels of total cholesterol and triglycerides, as well as alterations in other lipid fractions (Karwiti et al., 2024). This condition can trigger atherosclerosis, reduce arterial elasticity, and increase vascular resistance, thereby contributing to elevated blood pressure (Lukitaningtyas & Cahyono, 2023). The World Health Organization (WHO) reported in 2016, as cited by Gantoro et al. (2025), that the prevalence of high cholesterol among adults reached 37% in men and 40% in women. In Indonesia, the 2023 Health Survey reported a dyslipidemia prevalence of 19,7% for total cholesterol levels >200 mg/dL and 13,9% for triglyceride levels >150 mg/dL (SKI, 2023). These data indicate that dyslipidemia is an important risk factor that may accelerate the development of hypertension and its cardiovascular complications.

Empirical evidence has consistently demonstrated the link between dyslipidemia and hypertension.. (2022) reported that individuals aged ≥40 years with high cholesterol levels were 37.5 times more likely to develop hypertension than those with normal cholesterol levels. (2023) found a significant association between triglyceride levels and hypertension (p=0.000). Meanwhile, a study by Purwanto et al (2022) in North Sulawesi Province reported that 79.5% of hypertensive patients had dyslipidemia, highlighting its high prevalence among this population. Although these findings consistently demonstrate the relationship between dyslipidemia and hypertension, most studies remain limited to simple analyses, focusing on a single lipid parameter, or lacking age-stratified assessments. This indicates a research gap, particularly in predictive analyses that comprehensively assess lipid parameters within the context of primary healthcare. Considering that individuals aged 40 years and above are at higher risk of both lipid metabolism disorders and hypertension, this population is of particular importance for investigation.

Benu-benua Public Health Center in Kendari City is one of the primary healthcare facilities with a steadily increasing number of hypertension cases. In 2015, hypertension ranked first among non-communicable diseases (NCDs) at this health center, with 1,453 recorded cases, and this figure increased to 2,901 cases in 2024 (Puskesmas Benu-benua, 2024). However, no in-depth analysis has yet been conducted to examine the role of dyslipidemia as a contributing factor to the occurrence of hypertension in this area.

Therefore, this study aims to analyze the predictive role of dyslipidemia, particularly total cholesterol and triglyceride levels, in the development of hypertension among patients aged ≥40 years at Benu-benua Public Health Center in Kendari City. The Research hypothesis is that dyslipidemia (elevated total cholesterol and triglycerides) is a significant predictor of hypertension among patients aged ≥40 years and above.

## 2. Methodology

This study employed a quantitative, cross-sectional design and was conducted at Benu-benua Public Health Center, Kendari City, Southeast Sulawesi Province, from June 24 to July 18, 2025. The study population consisted of all hypertensive patients aged ≥40 years who visited the health center in April 2025, totaling 90 individuals. From this population, 91 respondents were obtained using a simple random sampling technique (74 hypertensive and 17 non-hypertensive patients who met the inclusion criteria). The inclusion criteria were patients aged ≥40 years who provided written informed consent, while the exclusion criteria were patients aged <40 years, those without blood pressure measurements, and those unwilling to participate.

Data were collected through blood pressure measurement using a digital sphygmomanometer, lipid profile testing (total cholesterol and triglycerides) by spectrophotometry with a BioSystems BA400, and structured interviews with medical record reviews for additional variables (age, sex, smoking, obesity, physical activity). Data analysis included univariate statistics, Spearman Correlation to examine relationships between lipid profile and blood pressure, and Binary Logistic Regression to assess dyslipidemia as a predictor of hypertension, while adjusting for confounders. Ethical approval was obtained from the Health Research Ethics Committee of Mega Buana University. Participants were fully informed about the study, and only those who signed a written consent were included. Principles of autonomy, confidentiality, and participant safety were strictly maintained.

## 3. Results

The univariate analysis showed that among 91 respondents, the majority had grade 1 hypertension, totaling 49 individuals (53,8%). Metabolic disorders were also prevalent, with hypercholesterolemia in 82 respondents (90,1%) and hypertriglyceridemia in 55 respondents (60,4%), reflecting a high level of dyslipidemia in this population. In terms of demographics, most respondents were aged 46–65 years (59,3%) and female (85,7%). A relatively healthy lifestyle was observed, as indicated by the low proportions of smokers (2,2%), obesity (34,1%), and insufficient physical activity (3,3%). Nevertheless, the prevalence of both dyslipidemia and hypertension remained high, indicating that age and metabolic conditions play an important role in increasing the risk of hypertension and potential cardiovascular complications.

**Table 1.** Univariate Descriptive Analysis of Research Variables

| Variable | Min-Max | Median/Mean | SD/Interquartile |
|---|---|---|---|
| Age (Years) | 40 - 80 | 59,78 | 9,3 |
| Cholesterol Level (mg/dL) | 139 - 391 | 234,00 | 46 |
| Triglyceride Level (mg/dL) | 61 - 925 | 180,00 | 116 |

The mean age of respondents was 59,78 years (SD = 9,3; range 40–80), indicating that most participants were older adults with relatively homogeneous age characteristics. Total cholesterol levels ranged from 139 to 391 mg/dL, with a median of 234,0 mg/dL (IQR=46), reflecting a predominance of mild to severe hypercholesterolemia. Triglyceride levels ranged from 61-925 mg/dL, with a median of 180.0 mg/dL (IQR=116), indicating that the majority of respondents had hypertriglyceridemia with wide variability in distribution.

**Table 2.** Bivariate Analysis of the Association Between Cholesterol and Triglyceride Levels with Systolic and Diastolic Blood Pressure

| Variable | Systolic Blood Pressure (mmHg) | | Diastolic Blood Pressure (mmHg) | |
|---|---|---|---|---|
| | ***Rho Coefficient*** | ***P value*** | ***Rho Coefficient*** | ***P value*** |
| Cholesterol Level (mg/dL) | 0.243 | 0.020 | 0.270 | 0.010 |
| Triglyceride Level (mg/dL) | 0.369 | 0.000 | 0.265 | 0.011 |

Bivariate analysis using Spearman's correlation showed significant positive associations between total cholesterol and triglyceride levels and both systolic and diastolic blood pressure ($p<0,05$). Triglycerides demonstrated a stronger correlation with systolic blood pressure ($p=0.000$; $r=0.369$; moderate strength) than total cholesterol, which showed

weaker associations. These findings suggest that elevated triglyceride levels may play a more prominent role in blood pressure elevation among adults aged ≥40 years.

**Table 3.** Multivariate Analysis of Dyslipidemia as a Predictor of Hypertension

| Variable | Sig. (*p-value)* | Exp (B) (OR) | 95% CI | |
|---|---|---|---|---|
| | | | Lower | Upper |
| Constant | 0.999 | 6.070 | | |
| Cholesterol Level (mg/dL) | 0.003 | 1.021 | 1.002 | 1.041 |
| Triglyceride Level (mg/dL) | 0.148 | 1.006 | 0.998 | 1.015 |
| Age (Years) | 0.917 | 0.997 | 0.938 | 1.059 |
| Gender | 0.999 | 0.000 | 0.000 | . |
| Smoking | 1.000 | 0.832 | 0.000 | . |
| Obesity | 0.807 | 1.179 | 0.316 | 4.397 |
| Physical Inactivity | 0.999 | 0.000 | 0.000 | . |

Multivariate analysis using binary logistic regression showed that only total cholesterol was significantly associated with hypertension (p=0.003). The odds ratio (OR) was 1.021, indicating that each 1 mg/dL increase in cholesterol level was associated with a 1.021 times higher risk of hypertension (95% CI: 1.002–1.041). Other variables, including triglycerides, age, sex, smoking, obesity, and physical inactivity, were not significantly associated with hypertension.

## 4. Discussion

This study found that the majority of respondents aged ≥40 years and above had grade 1 hypertension (53,8%), consistent with the 2017 ACC/AHA guidelines, which identify stage 1 hypertension as the most common form among middle-aged and older adults (Whelton et al., 2018). These findings highlight the importance of early detection and non-pharmacological interventions in primary care to prevent disease progression. The prevalence of dyslipidemia was also high, with hypercholesterolemia in 90,1% and hypertriglyceridemia in 60,4% of respondents. This is consistent with. (2022), who reported that most hypertensive patients had dyslipidemia, underscoring the urgency of routine lipid screening and community-based nutrition education to reduce the cardiometabolic disease burden. Most respondents were aged 46–65 years (59,3%), a group physiologically vulnerable to metabolic and vascular changes (WHO, 2024). Fitriana (2018) reported that the risk of hypertension doubles after the age of 45 years, emphasizing the elderly as a priority population for hypertension and dyslipidemia prevention. Women comprised the majority (85,7%). Although men are at higher risk during their productive age, hypertension prevalence rises among postmenopausal women due to decreased estrogen, which normally provides cardiovascular protection (Hapielda et al., 2024). This, combined with women's more active health-seeking behavior, may explain the higher detection of hypertension in this group. Although the proportion of smokers was low, smoking was still associated with a higher prevalence of hypertension, in line with Umbas et al (2019). Obesity was also common and strongly linked to hypertension through metabolic mechanisms, consistent with Fitri et al (2025). While many respondents reported adequate physical activity, inactivity was still associated with increased hypertension risk due to metabolic disturbances, as supported by Armi et al (2024). These findings collectively emphasize the need for comprehensive lifestyle interventions, including promoting physical activity, weight control, and anti-smoking campaigns, at both the primary care level and in community settings.

Bivariate analysis showed significant associations between total cholesterol and triglycerides and both systolic and diastolic blood pressure ($p<0,05$). These findings indicate that elevated lipid levels, particularly cholesterol, contribute to higher blood pressure among populations aged ≥40 years. This result is consistent with Yusvita et al (2022), who reported a strong correlation between cholesterol and blood pressure, supporting the role of atherosclerosis and arterial stiffness in the pathogenesis of hypertension (Lukitaningtyas & Cahyono, 2023). In contrast, (2024) found no significant association between triglycerides and blood pressure, likely due to a smaller sample size and a younger age range. Nevertheless, physiologically, triglycerides may still contribute by increasing oxidative stress, endothelial dysfunction, and insulin resistance, which promote sodium retention and vasoconstriction (Tangkau et al., 2025). Therefore, triglyceride assessment remains important in identifying hypertension risk, particularly among individuals with central obesity and metabolic syndrome.

Logistic regression analysis revealed that total cholesterol was a significant predictor of hypertension among patients aged ≥40 years, with an OR of 1.021 (95% CI: 1.002–1.041; $p=0.003$). This indicates that each 1 mg/dL increase in total cholesterol raises the risk of hypertension by 1,021 times. These findings are consistent with those of Permatasari et al. (2022), Purnama et al. (2023), and Yogeswara et al. (2023), who also reported a strong association between hypercholesterolemia and hypertension. Biologically, elevated cholesterol promotes atherosclerosis, endothelial dysfunction, and reduced nitric oxide, all of which increase vascular resistance and blood pressure (Lukitaningtyas & Cahyono, 2023). This underscores the critical role of total cholesterol as a predictor of hypertension and a risk factor for cardiovascular complications. Accordingly, lipid profile assessment should be integrated into routine screening in primary care for populations aged ≥40 years. In contrast, triglycerides were not significantly associated with hypertension ($p=0.148$), although most patients with elevated triglycerides also had high blood pressure. This aligns with the findings of. (2024) but differs from those of Karwiti et al., who reported a strong association. Such discrepancies may reflect population heterogeneity, differences in sample sizes, or variations in measurement methods. Clinically, triglycerides may contribute to hypertension risk over the long term through progressive atherosclerosis, but their effects can be influenced by transient factors such as diet, alcohol consumption, or fasting compliance. Additionally, the limited sample size and the dominant role of cholesterol in the multivariate model may have obscured the effect of triglycerides.

From a public health perspective, this study highlights the need to integrate lipid profile screening into early hypertension detection in primary care, especially for adults aged 40 and older. Community-based interventions such as nutrition education (low saturated fat, high fiber), promotion of physical activity, and strengthening of community health posts should be optimized, along with ecological approaches that ensure access to healthy food and spaces for exercise. The findings support biological evidence that dyslipidemia, particularly elevated total cholesterol and triglycerides, is an early metabolic marker of hypertension. In practice, they reinforce the importance of routine lipid screening from the pre-hypertensive phase onward. This study provides valuable evidence from Eastern Indonesia, using both bivariate and multivariate analyses of laboratory-based data. Limitations include its cross-sectional design, small sample size, and exclusion of other lipid parameters (LDL, HDL, cholesterol/HDL ratio). Future longitudinal Research is needed to confirm causality, assess broader lipid markers, and evaluate the effectiveness of community-based interventions in reducing the burden of hypertension.

## 5. Conclusion

Total cholesterol is a significant predictor of hypertension among adults aged ≥40 years, highlighting the need for lipid screening in primary care as part of early prevention strategies.

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