

CORRELATION BETWEEN TOTAL CHOLESTEROL AND HYPERTENSION SEVERITY IN ELDERLY PATIENTS: A STUDY FROM SOUTH DENPASAR, INDONESIA

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Abstract

Background: High cholesterol levels contribute to the formation of atherosclerotic plaques in blood vessels, which can lead to the narrowing of these vessels and increased vascular resistance, which in turn increases blood pressure.

Objective: This study aims to investigate the relationship between total cholesterol levels and the degree of hypertension among the elderly at UPTD Puskesmas 1 South Denpasar.

Methods: This research employs an analytical observational design with 43 respondents selected using a consecutive sampling technique. Data were collected through interviews, total cholesterol levels were measured using a Point Of Care Testing (POCT) device, and hypertension was assessed with a sphygmomanometer.

Results: Showed that of the 43 respondents, 67.4% were female, and 53.7% were aged 54-59 years. Total cholesterol levels showed that 30.2% of respondents were in the high category, 44.2% had grade 1 hypertension. Based on the chi-square test analysis, it shows that from 43 respondents, $p = 0.000$ ($p < 0.05$), show there is a significant relationship between total cholesterol levels and the degree of hypertension in the elderly.

Conclusions: The study concludes that there is a significant correlation between total cholesterol levels and the degree of hypertension in the elderly.

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INTRODUCTION

Hypertension, commonly known as high blood pressure, is a chronic medical condition characterized by persistent arterial pressure. It involves disorders of the cardiovascular system, including the heart, which is responsible for pumping blood, the blood vessels to circulate blood, and the condition of the blood (1). It represents a major global health challenge due to its high prevalence and its role in cardiovascular disease (2).

The multifactorial etiology of hypertension includes genetic predisposition, lifestyle factors, and metabolic abnormalities, among which dyslipidemia, particularly elevated total cholesterol levels, has garnered significant attention (3). Hypertension (high blood pressure) is a major risk factor for both heart disease and stroke. Even modest increases in blood pressure significantly raise the risk of these conditions compared to individuals with normal blood pressure. The risk of stroke rises more sharply than the risk of heart disease as blood pressure increases (4,5).

High blood pressure (hypertension) is a major global health issue, affecting a significant portion of both adult and youth populations. Prevalence rates vary by region, age, and diagnostic criteria, but the overall trend shows a high and sometimes increasing burden, especially in low- and middle-income countries. The global prevalence of raised blood pressure among adults is substantial, with some regions (South Asia, Central Asia, Middle East, North Africa) showing the highest rates. In Ethiopia, 15.8% of adults aged 15–69 have high blood pressure, with higher rates in females (16.3%) than males (15.5%) (6,7). The Ministry of Health (MOH) estimates that about 80% of the increase in high blood pressure problems is mainly in our country. (8). Target organs that are often damaged in patients with high blood pressure include enlargement of the left heart muscle, heart attack, heart failure, transient ischemic attack, kidney problems, arterial disease in the legs, and eye problems (9–11).

Elevated cholesterol contributes to atherosclerosis, marked by lipid plaque buildup that narrows arteries and increases vascular resistance, leading to higher blood pressure (12). High total cholesterol and LDL cholesterol are strong risk factors for heart attacks in both men and women (13). The prevalence of hypercholesterolemia in Indonesia is 9.3% among individuals aged 25–34 years, increasing to 15.5% in those aged 55–64 years (14). Studying the link between cholesterol and hypertension severity is crucial for improving clinical care and reducing cardiovascular risks.

In our previous study, from January to December 2022, there were 500 records examining cholesterol levels in older people. Of these, 274 patients had high cholesterol levels, while 123 had normal cholesterol levels. On the other hand, from January to November 2022, there were 3,834 patients diagnosed with hypertension.

Therefore, this research seeks the correlation between total cholesterol concentrations and the degree of hypertension, contributing to the growing body of evidence that supports integrated approaches to cardiovascular risk reduction.

MATERIALS AND METHODS

The type of research was analytic observational, cross sectional methods. This research was conducted with strict adherence to ethical principles and guidelines. The study protocol was reviewed and approved by Ethics Committee of Poltekkes Kemenkes Denpasar, No. DP.04.02/F.XXXII.25/0533/2024.

The research was conducted at UPTD Puskesmas 1 South Denpasar from January to March 2024. The population in this study is Elderly (45-90 years old) who are diagnosed with hypertension, with a sample size of 43 samples, using the sampling technique of consecutive sampling. Data was collected by observation, interview, and measuring blood pressure and total cholesterol using the POCT method (autocheck). Data were analyzed using a correlation test, namely the chi-square test

RESULTS AND DISCUSSIONS

Results

1. Research site conditions

Based on the Denpasar City Statistics Agency in 2020, the population in the South Denpasar Health Center I working area in 2020 was 79,703 people; the male population was 39,697, and the female population was 40,006. Sesetan Village has the largest population of 39,397 people, Panjer Village with 23,228 people, and Sidakarya Village with 17,078 people. The number of visits by Puskesmas I South Denpasar in 2020 amounted to 14,835 people, consisting of 6,657 men and 8,178 women, whereas the number of visits by pregnant women in 2020 was 2,464. Profil Kesehatan Provinsi Bali 2023

Puskesmas I South Denpasar consists of the main Puskesmas, with emergency and laboratory capabilities, and two units of auxiliary Puskesmas, namely Puskesmas Panjer and Puskesmas Sidakarya. Easier community access to emergency services is expected to contribute to the reduction of MMR and IMR, such as integrated service posts (posyandu) in 36 banjars, village health posts (poskesdes), and integrated coaching posts (posbindu). The health center also has several medical personnel such as general practitioners, dentists, general nurses, dental nurses, midwives, nutritionists, health analysts, environmental health, pharmaceutical personnel, pharmacists, and non-medical personnel such as drivers, medical waste officers, janitors, office guards, PPTI, IT personnel, and field officers.

2. Characteristics of research subjects

Of the 43 participants included in this study, 29 are female (64.7 %), and 32.6% are male. The majority of the age group (53.7%) is 45-59 years old.

Table 1. Elderly characteristics based on gender

	Gender	Total (person)	Percentage (%)
1.	Male	14	32,6
2.	Female	29	67,4
	Total	43	100

Based on Table 1, it was found that the female gender was more, namely 67.4%.

Table 2. Elderly characteristics based on gender

No.	Age	Total (person)	Percentage (%)
1.	45-59	23	53,7
2.	60-74	18	42,1
3.	75-90	2	4,6
	Total	43	100

Based on Table 2, it was found that the age of 45-59 years was 53.7%.

1. Total cholesterol level

The total cholesterol data of older people can be seen in Table 3

Table 3. Total cholesterol data in the elderly

No.	Total Cholesterol	Total (person)	Percentage (%)
1.	Normal	14	32,6
2.	Threshold	16	37,2
3.	High	13	30,2
	Total	43	100

Based on Table 3, respondents with high levels of total cholesterol are 30.2%, threshold 37.2%, and normal as much as 32.6%.

2. Degree of hypertension

The degree of hypertension data can be seen in Table 4

Table 4. Data on the degree of hypertension

No.	Degree of hypertension	Total (person)	Percentage (%)
1.	1st degree	19	44,2
2.	2nd degree	16	37,2
3.	3rd degree	8	18,6
Total		43	100

Based on Table 4, respondents who suffered from grade 1 hypertension were 44.2%, grade 2 hypertension was 37.2%, and grade 3 hypertension was 18.6%.

3. The correlation between senior citizens' levels of cholesterol and the severity of their hypertension.

The correlation between senior citizens' levels of cholesterol and the severity of their hypertension can be seen in the color below. The analysis showed that of the 43 respondents with normal cholesterol levels, most had grade I hypertension, totaling 13 respondents, 92.9%. The results obtained in the chi-square test analysis showed that out of 43 respondents, a significant value of 0.000 ($p < 0.05$) was obtained, meaning that H_0 was rejected and H_1 was accepted. This indicates a strong correlation between the degree of hypertension and total cholesterol levels.

Discussion

1. Total Cholesterol levels in the elderly

Based on Table 6, it can be seen that the proportion of hypertensive patients obtained the total cholesterol levels, with a threshold of 16 people (37.2%). In comparison, total cholesterol with high results was 13 people (30.2%), and normal total cholesterol levels were 14 people (32.6%). This shows that in this study, hypertensive patients tend to experience more increases in cholesterol levels. Total cholesterol levels are often found in hypertensive patients. Higher total cholesterol is positively correlated with increased arterial stiffness (measured by pulse wave velocity) and higher systolic blood pressure. Nearly half of the effect of cholesterol on systolic blood pressure is mediated through increased arterial stiffness (14).

In this study, 13 respondents had high total cholesterol levels. Female respondents, as many as eight respondents, had high cholesterol levels. This shows that women are more likely to have high total cholesterol levels than men. Research on the picture of cholesterol in gender shows that the female sex has a risk of hypercholesterolemia compared to male

respondents. This is due to the aging process, which causes the body's metabolism and mobility to slow down, which causes fat accumulation in the body. Where it is predicted that women get 2 times more every 10 years of age, so this process causes an increase in cholesterol (16).

In this study, if age is correlated with cholesterol levels, out of 43 respondents, eight had high cholesterol levels with an age range of 45-59 years. This shows that an increase in total cholesterol levels tends to occur more often after the age of 45 years. Increasing age is also one of the causes of high cholesterol caused by the decline in organ function. This is by research that found that hypercholesterolemia is more common in older people than other age groups (17).

As we age, body functions also decline due to loss of muscle mass (18), and the metabolic rate of older adults decreases (19). Scientifically, muscles do use more energy than fat tissue, so the decrease in muscle mass due to aging can cause a slowdown in metabolism and fat to accumulate more easily in the body. The accumulation of fat, especially LDL cholesterol, plays an important role in the formation of atherosclerosis, which is the accumulation of fat in the walls of blood vessels that can cause narrowing and stiffness of the arteries, as well as increase the risk of cardiovascular disease and cardiac arrhythmias as you age (20,21).

2. Degree of hypertension in the elderly

From this study, the proportion of people with hypertension is mainly in the 1st-degree hypertension group, namely 19 people (44.2%), 16 people (37.2%) with 2nd-degree hypertension, and eight people (18.6%) with 3rd-degree hypertension. This study shows that about 19 respondents had grade 1 hypertension, with the most gender characteristics being female, as many as 11 respondents. This is in line with research where it was found that the majority of women with hypertension were 54 people (58.7%) compared to men as many as 36 people (41.3%) (22).

From this study, 19 respondents with grade 1 hypertension had the most age, namely the age range 45-59 years, as many as 11 respondents. This shows that the higher a person's age, the higher the risk of experiencing high blood pressure also increases. In line with increasing age, their blood vessels undergo structural changes that contribute to a higher prevalence of hypertension. These changes include thickening and stiffening of the arterial walls, increased collagen deposition, and reduced elasticity, particularly in large arteries like the aorta, which leads to increased systolic blood pressure and pulse pressure (23-26).

3. Correlation between total cholesterol levels and the degree of hypertension in the elderly
The degree of hypertension and total cholesterol levels were significantly correlated among the 43 respondents. Statistical analysis using the chi-square test revealed a p-value < 0.001, meaning H_0 is rejected and H_1 is accepted. This implies a significant relationship between total cholesterol levels and the degree of hypertension. Based on the results of the research in Table 8, it can be seen that out of 43 respondents, the highest degree of hypertension was

degree 1 with 19 respondents (44.2%) and a high total cholesterol level with 13 respondents (30.2%). This suggests that an increase in blood pressure goes hand in hand with a rise in cholesterol levels. Hypertension patients commonly experience high blood cholesterol levels. High levels of cholesterol can lead to plaque build-up in the articular wall. This causes the diameter of the blood vessels to shrink. If there is an obstruction in the blood vessel, the blood vessel will narrow, and the blood vessel wall's elasticity will decrease, which will raise blood pressure (27).

The increased blood pressure is due to the incidence of cholesterol on the dilated blood vessel wall. Cholesterol in the overflowing blood will build up inside the blood vessel wall and cause atherosclerosis, which is the narrowing or widening of the blood vessel; this is a precursor to heart disease and stroke (28).

According to a cross-sectional model study on the relationship between blood pressure and cholesterol levels in diabetic patients in Sidomulyo village, Jombang, there is a correlation between the two, which is consistent with the findings of this study that there is a correlation between blood pressure and cholesterol levels and the severity of hypertension (8).

CLINICAL IMPLICATION

The findings of this study demonstrate a significant correlation between total cholesterol levels and the severity of hypertension among elderly patients. Clinically, this underscores the importance of incorporating routine lipid profile screening in the management of elderly patients with hypertension. Early identification of elevated cholesterol levels can help healthcare providers implement timely interventions to reduce cardiovascular risk, such as dietary counseling, physical activity promotion, and pharmacological treatment when necessary. These results also support a more integrated approach to managing cardiovascular risk factors in primary healthcare settings, especially in aging populations.

LIMITATIONS

This study is subject to several limitations. First, its cross-sectional design does not allow for conclusions about causality between cholesterol levels and hypertension severity. Second, the sample size was relatively small (43 participants) and limited to a single primary healthcare facility in South Denpasar, which may restrict the generalizability of the findings. Third, the study did not account for confounding variables such as dietary habits, physical activity, medication use, and genetic predisposition, which may influence both cholesterol levels and blood pressure. Lastly, the use of Point-of-Care Testing (POCT) for cholesterol measurement, while practical, may have lower accuracy compared to standard laboratory methods.

CONCLUSIONS

This study is subject to several limitations. First, its cross-sectional design does not allow for conclusions about causality between cholesterol levels and hypertension severity. Second, the sample size was relatively small (43 participants) and limited to a single primary healthcare facility in South Denpasar, which may restrict the generalizability of the findings. Third, the study did not account for confounding variables such as dietary habits, physical activity, medication use, and genetic predisposition, which may influence both cholesterol levels and blood pressure. Lastly, the use of Point-of-Care Testing (POCT) for cholesterol measurement, while practical, may have lower accuracy compared to standard laboratory methods.

CONFLICT OF INTEREST

The authors declare that there is no conflict of interest regarding the publication of this article.

AUTOR CONTRIBUTIONS

All Authors have accepted responsibility for the entire content of this manuscript and approved its submission.

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