THE RELATIONSHIP OF CALCIUM LEVELS IN SERUM AND TOTAL CHOLESTEROL IN SUFFERING ELDERLY HYPERTENSION DISEASE

HUBUNGAN KADAR KALSIUM DALAM SERUM DENGAN KOLESTEROL TOTAL PADA LANSIA YANG MENDERITA PENYAKIT HIPERTENSI

Fifi Mufiana Nurrahma[1], Juliana Christiyaningsih[2], Lully Hanni Endarini[3]

[1] Department of Medical Laboratory Technology, Health Polytechnic of Surabaya, Indonesia

[2] Department of Medical Laboratory Technology, Health Polytechnic of Surabaya, Indonesia

[3] Department of Medical Laboratory Technology, Health Polytechnic of Surabaya, Indonesia

[1]fifimn03@gmail.com, [2]juliana_analis@yahoo.co.id, [3]Lendarini@poltekkesdepkes-sby.ac.id

ABSTRACT

Background: Hypertension is a disease that is closely related to the elderly. Hypertension can appear without symptoms or signs so that many people are not aware of it, therefore it is often called a "silent killer". Plaque buildup due to high levels of calcium and cholesterol will stick to the arteries, causing the blood vessels to narrow (vasoconstriction) and hypertension.

Purpose: This study aims to analyze the relationship between serum calcium levels and total cholesterol in elderly people with hypertension.

Method: Analytical observational research with a cross-sectional approach. The population of this study was elderly people suffering from hypertension at the Abiyoso Polkesbaya Posyandu with a purposive sampling technique and 38 samples were obtained. Calcium and Total Cholesterol examinations were conducted at the Surabaya City Public Health Laboratory Center (BBLK).

Result: Data analysis using the Spearman correlation test between serum calcium and total cholesterol obtained a p-value of 0.358.

Conclusion: There was no significant relationship between serum calcium levels and total cholesterol.

Keywords: Hypertension, Elderly, Calcium, Total Cholesterol

ABSTRAK

Latar Belakang: Hipertensi merupakan penyakit yang erat kaitannya dengan lansia. Hipertensi bisa muncul tanpa gejala atau tanda-tanda sehingga banyak orang yang tidak menyadari, oleh sebab itu sering disebut juga "*silent killer*". Tumpukan plak akibat tingginya kadar kalsium dan koleterol akan menempel pada pembuluh darah arteri sehingga menyebabkan pembuluh darah menyempit (vasokonstriksi) dan terjadinya hipertensi.

Tujuan: Penelitian ini bertujuan untuk menganalisis hubungan kadar kalsium dalam serum dengan kolesterol total pada lansia yang penderita penyakit hipertensi.

Metode: Penelitian observasional analitik dengan pendekatan cross sectional. Populasi penelitian ini yaitu lansia yang menderita penyakit hipertensi di Posyandu Abiyoso Polkesbaya dengan teknik purposive sampling dan didapatkan 38 sampel. Pemeriksaan Kalsium dan Kolesterol Total dilakukan di Balai Besar Laboratorium Kesehatan Masyarakat (BBLK) Kota Surabaya.

Hasil: Analisis data menggunakan uji korelasi Spearman antara Kalsium dalam serum dengan Kolesterol Total didapatkan p-value sebesar 0,358.

Kesimpulan: Tidak terdapat hubungan yang signifikan antara kadar kalsium dalam serum dan kolesterol total.

Kata kunci: Hipertensi, Lansia, Kalsium, Kolesterol Total

INTRODUCTION

Hypertension is a condition where a person's blood pressure increases above normal values which can cause an increase in the level of illness and can also cause death (Hariawan & Tatisina, 2020). The Ministry of Health estimates that 31.7% of Indonesians suffer from hypertension. Only 7.2% of the 31.7% population are aware of hypertension and it turns out that only 0.4% of people take hypertension medication (Ainurrafiq et al, 2019). The results of the 2018 Riskesdas, the prevalence of hypertension sufferers in East Java Province was 36.3%. Dominance increases with age.

A person over the age of 60 is considered elderly or called "elderly". (Ministry of Health of the Republic of Indonesia, 2019). Hypertension is a disease that is closely related to the elderly (Nisak et al., 2018). Hypertension can appear without symptoms or signs so that many people are not aware of it, therefore it is often called a "silent killer" (Ariyanti et al., 2020).

The main cause of hypertension in the elderly is high levels of cholesterol in the body. High levels of cholesterol can cause blockage of blood vessels in the arteries. Cholesterol deposits will cause the arteries

to clot, narrow, lose flexibility and become stiff, which causes the cells in the muscles of the arteries to experience a decrease in their ability to regulate blood pressure. What causes hypertension (Handayani et al., 2020).

Calcium intake is very important for people with hypertension. The function of calcium according to (Putri, 2020) includes the formation of bones and teeth, is responsible for growth and also as a supporting material for biochemical reactions in the body. However, the habit of consuming foods high in calcium can also cause heart attacks due to high blood pressure. Calcium levels in the arteries can leave marks and form plaque calcification, which causes hardening, and can cause heart attacks (Devi, 2018). Based on this introduction, research is needed to determine and analyze the relationship between serum calcium levels and total cholesterol in the elderly who suffer from hypertension.

MATERIAL AND METHOD

The population of this study was elderly hypertensive who participated in the activities of the Abiyoso Poltekkes Surabaya Elderly Health Post in March 2024 and the number of samples that met the inclusion criteria was 38 elderly. The inclusion criteria for this study were elderly who suffered from hypertension at the Abiyoso Poltekkes Surabaya Health Post, had blood pressure in the form of systolic >120 mmHg and diastolic >80 mmHg, were 60 years of age and over and were willing to be research subjects. If the respondent's consent has been obtained, venous blood will be drawn using a 3cc syringe. The blood samples that have been obtained will be examined for calcium and total cholesterol levels at the BBLK Surabaya City using the Automated Clinical Analyzer TMs 50i Superior tool.

The data obtained in this study, especially serum calcium and total cholesterol levels, will be processed and analyzed using SPSS software with the Spearman correlation test. This study has obtained ethical approval from the Health Research Ethics Commission, Health Polytechnic, Ministry of Health, Surabaya, Indonesia. Number EA/2073/KEPK-Poltekkes_Sby/V/2024.

RESULT

This study contains data on respondent characteristics based on gender, age, BMI, and frequency of calcium and total cholesterol levels. Table 1 displays respondent characteristic data. Of the 38 elderly respondents examined, it can be seen that there are more elderly respondents with hypertension who are female, totaling 29 people (76%). Dominated by the age of 60-65 years, totaling 17 elderly (45%). Those who fall into the normal BMI category (18.5 - 25.0) totaling 20 elderly (52%).

Table 2 contains the frequency distribution of calcium levels. It can be seen that out of 38 elderly people, 1 elderly person (3%) had an increased calcium level, 30 elderly people (79%) had normal calcium levels, and 7 elderly people (18%) had low calcium levels. Table 3 contains the frequency distribution of total cholesterol. There were 7 elderly people (18%) in the high category (>240 mg/dL), 16 elderly people in the slightly high/borderline category (200-239 mg/dL), and 15 elderly people in the normal category (<200 mg/dL).

Table 4 shows the results of the Spearman Correlation Test. The results of the correlation between Calcium Levels and Total Cholesterol Levels have a significance test value (Sig.) of $0.358 > 0.05$, which means there is no significant relationship between the variables. This value means that an increase in total cholesterol levels is not always followed by an increase in calcium levels, or vice versa.

Table 1. Data characteristic of participants

Category	Total participants	
	Frequency	Percentage (%)
Gender		
Male	9	24
Female	29	76
Age (years old)		
60-65	17	45
66-70	6	16
70-75	8	21
76-80	4	10
81-85	3	8
Body Mass Index (BMI)		
Very Thin (< 17,0)	1	3
Thin (17,0 – < 18,5)	0	0
Normal (18,5 – 25,0)	20	52
Fat (>25,0 – 27,0)	5	13
Obese (> 27,0)	12	32

Table 2. Frequency Distribution of Calcium Levels

Calcium levels					
Category	Frequency	Percentage (%)	Minimun	Maximum	Mean
High (> 10,3)	1	3%			
Normal (8,6 – 10,3)	30	79%	8.2	11.3	8.8
Low (< 8,6)	7	18%			
Total	38	100%			

Table 3. Frequency Distribution of Total Cholesterol

Total Cholesterol					
Category	Frequency	Percentage (%)	Minimun	Maximum	Mean
High (>240 mg/dL)	7	18%			
Threshold (200-239 mg/dL)	16	42%	150	260	213
Normal (<200 mg/dL)	15	40%			
Total	38	100%			

Table 4. Correlation of Calcium levels with Total Cholesterol

Spearman Correlation	
Calcium Levels with	p-value
Total Cholesterol	0.358

DISCUSSION

Based on the results of the study, there are characteristic data in the form of gender, age, and BMI. Respondent data based on gender, the most female respondents were 29 elderly. This study is in accordance with (V.N. Amalia & Sjarqiah, 2023) the majority of 45 elderly women (54.9%) that there are fewer elderly men with hypertension than women. This is because menopause causes a decrease in estrogen hormone levels. Premenopausal women have sufficient estrogen levels to increase HDL cholesterol levels and thus protect against atherosclerosis. (Riyadina, 2019). Age is also a factor that plays a role in the risk of health problems in the elderly. Respondent data based on age, the most respondents were in the age category (60-

65 years) totaling 17 respondents. This study is in line with (Akbar et al., 2020) elderly aged 60-70 years are more dominant in experiencing hypertension. The causes in the elderly include changes in the structure of the aortic wall, decreased heart value, then stiffness, the heart's ability to pump blood in hypertension decreases causing its volume to shrink and contractions occur. Loss of flexibility/strength of blood vessels causes low oxygen capacity of peripheral blood vessels and increased blood vessel volume (Mulyadi, 2019).

Age is also a factor that plays a role in the risk of health problems in the elderly. Respondent data based on age, obtained the most respondents in the age category (60-65 years) which amounted to 17 respondents. This study is in line with (Akbar et al., 2020) elderly aged 60-70 years are more dominant in experiencing hypertension. Causes in the elderly include changes in the structure of the aortic wall, decreased heart rate values, then stiffness, the ability of the heart in hypertension to pump blood decreases which causes its volume to shrink and contractions occur. Loss of flexibility/strength of blood vessels causes low oxygen capacity of peripheral blood vessels and increased blood vessel volume (Mulyadi, 2019).

Respondent data based on BMI obtained respondents with a very thin BMI category of 1 elderly, a normal category of 20 elderly, obese as many as 5 elderly, and obese as many as 12 elderly. This study is in accordance with (Putra & Febianingsih, 2019) in the examination of BMI elderly more dominated BMI with a normal category of 16 elderly (55.2%). This is not in line with the study conducted by (Somantri, 2016) which was dominated by BMI with a fat category of 21 elderly (26.2%) and obese as many as 22 respondents.

However, in these studies there were also respondents who fell into the obese to obese category. In the elderly, body mass index (BMI) characterizes lower fat and carbohydrate needs due to decreased metabolism and increasing age. Decreased metabolic activity during aging can cause obesity because body activity decreases and more calories are converted into fat, causing obesity. (Renovaldi & Afrijiyah, 2022). What is experienced by obese people, they need more blood supply to carry oxygen and nutrient intake to the body. Making an increase in the amount of blood supply flowing through the blood vessels, increasing the heart rate, and ultimately increasing blood pressure (Herdiani, 2019).

The results of the examination of serum calcium levels in 38 elderly hypertensive respondents in this study, the average serum calcium level was 8.8 mg/dL with a normal category. This study is in line with previous research conducted by (Limawan, 2020) that of the 26 elderly respondents, the results of laboratory tests in this study showed that more than half (80.8%) or 21 elderly had serum calcium levels in the normal range. One possible reason for the low calcium levels in this study is that most of the participants were elderly who were more exposed to sunlight. A fairly important source of vitamin D is from the sun.

Adequate vitamin D for the body can be obtained from sunlight. Exposure to the sun on the face, hands and feet for 5-30 minutes at 10 am at least twice a week provides adequate vitamin D for the body.

The results of this study do not match research conducted in the United States by (Hua et al., 2021) which found that total serum calcium was positively correlated with the prevalence of hypertension. Scientifically, high serum calcium can directly affect vasoconstriction through the entry of calcium into arterial smooth muscle, which can increase muscle contracture, increase vascular resistance, and therefore cause hypertension.

The results of cholesterol level examinations in 38 elderly hypertensive patients who were respondents in this study, the average total cholesterol level was 208 mg/dL., which indicates a relatively high group or above the threshold. The results of this study are in line with research conducted by (Swastini, 2021) which found that respondents with a fairly high total cholesterol category dominated, amounting to 45 elderly people. And also in line with the study (Z. Arifin & Sayekti, 2024) of 30 elderly people, 15 elderly people had total cholesterol levels in the fairly high category or on the threshold.

The occurrence of atherosclerosis will not be separated from hypertension. The formation of plaque on the surface of the artery walls due to increased cholesterol. The cause of the lumen/hole of the blood vessels narrowing then the artery walls become stiff and there is an increase in blood pressure is a blockage of the blood vessels. Too much cholesterol in the body will accumulate on the walls of blood vessels and also cause a disease that is often called atherosclerosis, namely hardened and narrowed blood vessels (Lesar et al., 2023).

Based on the Spearman Correlation test of calcium levels with total cholesterol, the results obtained were $r = 0.153$, $p = 0.358$ which showed a significance value of $P > 0.05$, so it can be concluded that there is no significant relationship between calcium levels in serum and total cholesterol. This value also shows that an increase in total cholesterol levels is not always followed by an increase in calcium levels, or vice versa.

This study turned out to be inconsistent with other researchers in Southern Italy (Gallo et al., 2016) who showed a positive relationship between serum calcium and total cholesterol. Marked by significantly increased calcium levels as well as increased total cholesterol in men and postmenopausal women. High calcium levels in the heart can also indicate coronary artery disease. This is because some of the calcium left in the blood in the arteries tends to produce fat or cholesterol, causing plaque to form in the arteries. (Handari et al., 2023).

Scientifically, an increase in intracellular sodium will also stimulate the sodium and calcium exchanger (Na^+ / Ca^{2+}) on the membrane in smooth muscle cells which plays a role in transporting calcium into cells. This causes cytosolic calcium to increase which can also trigger contractions in smooth muscle in blood vessels and cause high blood pressure (Anggraini et al., 2016). The reactivation of blood vessels to vasoconstrictors by angiotensin II can increase blood pressure and is compounded by the presence of plaque caused by bad fats originating from high levels of calcium and cholesterol. Serum calcium can directly affect vasoconstriction through the entry of calcium into arterial smooth muscle (Hua et al., 2021). In the arteries, cholesterol will precipitate if it is excessive (Permatasari et al., 2022). The cause of blood vessel narrowing (vasoconstriction) and hypertension is plaque buildup in the arterial blood vessel system.

These different research results may occur due to confounding factors such as differences in the number of respondents with previous studies, the accuracy of parameters in the examination, and other factors influencing calcium and total cholesterol levels in elderly hypertensives. Cross-sectional is the approach method used in this study, where with this approach the researcher has limitations when exploring information about the daily lives of the elderly which can also affect the results of calcium and total cholesterol levels in elderly hypertensives.

CONCLUSION

Based on the result, there is no significant relationship between serum calcium levels and total cholesterol in elderly people suffering from hypertension the overall results of the study. However, this does not mean that total calcium and cholesterol are not relevant in the context of elderly hypertension. The conclusion of this study only shows that in the samples studied there was no relationship between the two variables. The researcher argues that the diverse research findings are an important part of a scientific process that must be carried out in order to develop an understanding of the topic being discussed.

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