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Association between cholesterol and blood pressure examination in Sampangan, Semarang City: a preliminary study

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Abstract

Purpose: This study aims to determine the baseline prevalence and association between blood pressure and cholesterol examination. **Method:** This preliminary study used a cross-sectional design to analyze the secondary blood pressure and cholesterol levels data in the Sampangan sub-district, Semarang City. The total sampling technique covered those enrolled in the metabolic syndrome screening from January to April 2023. The logistic regression test was used in data analysis. **Results:** 58 respondents took blood pressure checks, while only 40 had cholesterol checks. The probability of males getting changes in cholesterol levels was higher than that of females (OR = 8.69; p-value = 0.01). However, neither (female nor male) had a significant relationship, and there was no difference in the chances of changes in blood pressure (OR = 1.43; p = 0.72). Respondents above 60 years had a significant association with changes in blood pressure compared to those under 60 years (OR = 0.09; p = 0.007). **Conclusion:** This study revealed males of a certain age experience higher changes in cholesterol levels compared to females. People over 60 years old tend to have higher blood pressure compared to those under 60 years old. These findings propose an outreach strategy for health screening for patients with limited mobility, transportation access, and finances for routine checkups at public or government healthcare facilities.

Keywords: blood pressure; cholesterol; lipid; metabolic syndrome; screening

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INTRODUCTION

Metabolic syndrome is a risk factor that is interconnected and can increase the risk of cardiovascular disease (CVD). In Asia, the prevalence range for metabolic syndrome is between 11.9% to 37.1% [1].

The incidence of CVD is closely associated with various risk factors, such as uncontrolled blood pressure and cholesterol levels [1]. Blood pressure is one of the clinical indicators most often measured in supporting clinical decisions for patients' treatment [1, 2]. Patients with abnormal blood pressure conditions are at risk of endothelial dysfunction. Endothelial dysfunction can cause organ damage and clinical prognoses, such as stroke. Moreover, in blood vessels, the endothelial cells develop, maintain, and repair damaged blood vessel tissue [2].

In line with blood pressure, another metabolic syndrome that is a major health problem today is cholesterol [2]. The main sterol that the human body produces is cholesterol. Cholesterol is also an important component of cell membranes as a precursor to steroid hormones, vitamin D, and bile acids. Cholesterol has a function in controlling its physical properties, which in turn affects the function of plasma membrane proteins and vesicle formation and fusion [2].

People with high cholesterol conditions or hyperlipidemia generally have excess lipid levels [2, 3]. This condition is attributed to lipid accumulation in the blood vessels, which later combine with other substances in the blood to form plaque or fatty deposits [3].

Globally, high blood pressure, or hypertension, contributes to 41% of disability-adjusted life years [3, 4] (DALYs) and causes 2.6 million deaths [3, 4]. This number is estimated to increase from 135.6 to 145.2 per 100,000 people, with most suffering from age >25 years [4]. In 2019 there were about 85% of people with cardiovascular disease who had high blood cholesterol levels [4].

Indonesia is one of the countries in Southeast Asia that is facing a trend of increasing prevalence rates of metabolic syndrome [4]. Hypertension has increased from 26.5% in 2013 to 34.1% in 2018 [4]. The latest study by Herningtyas et al. (2019) highlighted that cholesterol is a component of the metabolic syndrome with the highest prevalence (66.41%), followed by hypertension with a prevalence of 64.45% [4]. These conditions are estimated to be increasingly untreated due to 20% of the Indonesian population not being aware of the hypertension treatment, and there were 70% of the patients who did not get the appropriate diagnosis by general practitioners [4]. Cholesterol distribution is related to ethnicity and location of residence in Indonesia. The Javanese are among the four ethnic groups in Indonesia with the highest cholesterol levels [5].

However, several studies have found that not all age groups are aware of screening, and insufficient information is available concerning the epidemiological clusters of metabolic syndrome distribution [6].

This study aims to determine the baseline prevalence and association between blood pressure and cholesterol.

METHODS

Design and sample

This preliminary study was conducted using a cross-sectional design to analyze the secondary data [7]. The secondary data was collected from the information on the metabolic syndrome screening register consisting of blood pressure and cholesterol levels from the Sampangan sub-district, Semarang City, Central Java Province residents. The sampling technique used was quota sampling, with 58 participants enrolled in the metabolic syndrome screening from January to April 2023.

Measurement procedures and results reading

Blood pressure and cholesterol levels were measured using a digital tensimeter and a fingerstick cholesterol test by the clinician or trained health workers. Information on clinical and demographic factors such as age, gender, and the presence or absence of a history of hypertension and cholesterol levels was recorded in the patient register data.

The blood pressure measurement was conducted following the standard examination procedures, consisting of patients being asked to relax for 5–10 minutes before the blood pressure examination, sit with their knees uncrossed, and have their arms positioned parallel to the heart's position. The blood pressure measurements were done twice to ensure consistency in the measurement results. Repeating measurements were carried out at 30–60 seconds [8].

Cholesterol level measurements were conducted using the Fingerstick Cholesterol Test. The results were confirmed and validated, referring to the normal standard of cholesterol levels. The blood that was taken was smeared on a strip, then inserted into a reader, and the results will be known in less than 3 minutes [9].

Sensitivity and specificity

With a specificity and sensitivity of more than 75% [10], it was possible to tell the difference between lipid abnormalities and hs-CRP levels of more than 1 mg/L. The digital tensimeter had a sensitivity level of up to 80% and a specificity level of 67.7% [8].

The determination of the cut-off point for cholesterol levels was divided into two categories, including normal (if TC < 200 mg/dL) and abnormal (if TC > 200 mg/dL) [11].

The American Heart Association also monitored blood pressure readings. If the systole number was more than equal to 130 and the diastole number was more than 80, it was categorized as Stage 1 hypertension [12].

Data analysis

The blood pressure variable was coded 1 if all information was available and 0 if no data was obtained. Each population cholesterol level variable was coded 1 if all information was available and 0 if information was unavailable. Determination of cholesterol level thresholds using the Finger Stick Cholesterol Test method. Testing the association between blood pressure and cholesterol examination was used the unadjusted and adjusted odds ratio (OR) with a 95% confidence interval. The level of statistical significance was determined by comparing the value of p <0.05 through calculations with the SPSS application [13].

RESULTS

A total of 58 (100%) respondents took blood pressure checks, while only 40 (69%) had cholesterol checks. Detailed descriptions of the characteristics of the respondents are presented in **Table 1**. Table 1 shows the prevalence of hypertension at 0.67, while of the 40 respondents, only 67.5% had cholesterol levels exceeding the normal level (<200 mg/dl). The proportion of female respondents (0.76) was higher than that of male respondents (0.23). Meanwhile, the highest proportion of respondents were aged equal to 60 (60.3%) years.

The univariate and multivariate analysis results of the association between blood pressure and cholesterol levels are presented in **Table 2**.

Table 1. Characteristic profile of respondents

Variable	Total (n= 58)		Blood pressure (yes, 58)		Cholesterol (yes, 40)	
	n	%	n	%	n	%
Sex	58	100	58	100	40	69
Male			14	24.1	9	22.5
Female			44	75.9	31	77.5
Age						
<60	23	39.7	23	39.7	10	25
>60	35	60.3	35	60.3	30	75
Hypertension						
Yes	39	67.2	39	67.2	29	72.5
No	19	32.8	19	32.8	11	27.5
Cholesterol level (normal =<200 mg/dl)						
Yes	40	68.9	40	68.9	27	67.5
No	18	31.1	18	31.1	13	32.5

Table 2. Association of blood pressure with cholesterol levels

Variable	Blood pressure measurement				Cholesterol levels measurement			
	Unadjusted Model		Adjusted Model		Unadjusted Model		Adjusted Model	
	OR	p-value	OR	p-value	OR	p-values	OR	p-values
Sex								
Female	1.00 (ref)		1.00 (ref)		1.00 (ref)		1.00 (ref)	
Male	0.82 (0.14-4.80)	0.83	1.43 (0.19-10.69)	0.72	6.85 (1.35-34.70)	0.02	8.69 (1.55-48.77)	0.01
Age								
<60	1.00 (ref)		1.00 (ref)		1.00 (ref)		1.00 (ref)	
>60	0.10 (0.02-0.53)	0.007	0.09 (0.01-0.52)	0.007	0.64 (0.14-2.84)	0.56	0.38 (0.07-2.05)	0.26

The probability of males getting cholesterol levels measured was higher than compared to females (OR= 8.69; p-value = 0.01). However, both (female and male) did not have a significant relationship or there was no difference in the blood pressure measurements (OR = 1.43; p = 0.72). Based on the test results, age > 60 had a significant association with blood pressure measurements compared to age < 60 (OR = 0.09;p == 0.007).

DISCUSSION

The main findings of our study showed that the prevalence of hypertension in the Sampangan Subdistrict was 0.67, and 60.3% of hypertension was found in an age range greater than 60 years. Respondents over 60 significantly correlated with blood pressure measurements compared to those under 60 (OR = 0.09; p = 0.007).

Increased blood pressure is associated with a person's increasing age [4]. This finding aligns with previous studies that revealed increasing age is more at risk of increasing blood pressure. At the moment, unnatural factors like lifestyle predominate, and patients do not regularly control it [14]. However, there are still often delays and low awareness among patients in diagnosing the risk of hypertension [15]. Our findings indicate a possible association between increasing age and blood pressure due to the patient's low awareness of regular control. Thus, it might increase worse outcomes, such as stroke [15].

An increased cholesterol level is related to sex. Sex differences in lipid control may be due to various factors. These differences may be sex-related factors, such as early menopause, pregnancy-related risk factors, hormonal contraceptive use, and a higher prevalence of thyroid dysfunction, or social and community factors, such as low compliance and high treatment dropout rates, and lower risk perception in women by patients. Controlling lipids, especially LDL-C levels, is a major risk factor that can be changed for the development and progression of CVD disease [16]. Because of this, it is important to know how men and women differ in this area to address differences in how CVD disease affects people. In our study, the probability of men experiencing changes in cholesterol was higher than that of women, which aligns with the previous study [1]. However, this finding contradicts other studies, which predominantly showed a greater risk in women [16, 17]. However, it might be followed by clinical and epidemiological analytical studies to describe the comprehensive causal-effect association.

This study has several limitations, such as involving a small sample size and only using secondary data from registers from January to April (4 months). The study has only applied lipid screening tools and blood pressure in clinical settings; there is still the possibility of variability in measurement results for respondents over 70 years of age [18]. However, the findings contribute to identifying and screening different groups of patients at risk for CVD, promoting self-care education for patients, and assisting in self-care management. This research also proposes an outreach strategy for health screening for patients with limited mobility, transportation access, and finances for routine checkups at public or government healthcare facilities.

CONCLUSION

The increase in cholesterol levels is closely related to gender. That is, males of a certain age experience higher changes in cholesterol levels compared to females. Blood pressure was also found to be related to a person's age, where those over 60 tended to have higher blood pressure compared to those under 60 years old. Future clinical and epidemiological studies are needed to determine the clinical and social determinants of factors associated with changes in cholesterol and blood pressure among the aging population.

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