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Research article

# Total Cholesterol Levels, Pulse Rate, and Body Mass Index with Blood Pressure in Patients with Hypertension

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**Abstract**

Introduction: Hypertension is a global health issue that significantly contributes to the increased risk of cardiovascular diseases. Objective: This study aims to analyze the correlation between total cholesterol levels, pulse rate, and body mass index (BMI) with blood pressure in hypertensive patients. Method: This research employed an analytical quantitative design with a cross-sectional approach. A total of 117 respondents were selected using a random sampling technique. Data collection involved the use of a sphygmomanometer for measuring blood pressure, a digital cholesterol meter for assessing total cholesterol levels, a stopwatch for pulse rate, and a digital scale and microtoise for BMI measurements. The data were analyzed using the Spearman Rank correlation test.. Results: The findings revealed a significant correlation between total cholesterol levels and BMI with blood pressure (p-value <0.05), while the correlation between pulse rate and blood pressure was not statistically significant (p-value > 0.05). The correlation coefficient indicated a strong and significant relationship for total cholesterol levels and BMI. Conclusion: This study is expected to serve as a reference for hypertension prevention and management efforts through the control of cholesterol levels and body weight.

## INTRODUCTION

Hypertension is a significant health issue and a priority in developing countries like Indonesia.[1] Hypertension is often referred to as a silent killer because it doesn't show obvious symptoms, so it's often overlooked or dismissed as a common health problem. However, if hypertension isn't properly managed, it can lead to serious complications.[2]

Globally, high blood pressure is the leading metabolic risk factor for deaths from non-communicable diseases, which causes 19% of global deaths, followed by overweight/obesity and high blood glucose levels (World Health Organization (WHO), 2021). Hypertension, or high blood pressure, is a condition that still affects many Indonesians. Data from the Indonesian Ministry of Health shows that the prevalence of hypertension in Indonesia increases with age, with a prevalence of

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45.9% among those aged 55 to 64, 57.6% among those aged 65 to 74, and 63.8% among those aged 75 and over.[3]

The prevalence of hypertension in Indonesia has increased significantly, reaching 25.8% in 2013 and 34.1% in 2023, according to the Basic Health Research.[4] Therefore, it is concluded that there has been an increase in the incidence of hypertension from 2018 to 2022. The results of the study showed that the prevalence of hypertension in Indonesia increased by 34.11%, or 658,201 people aged 65-74, 63.22%, or 38,335 people, and 69.53%, or 17,712 people aged 75 and over. Hypertension is a lifelong condition, and its prevalence in Indonesia increases annually: 121,153 people in West Java, 105,380 in East Java, and 89,648 in Central Java.[5] Semarang, the city with the highest number of non-communicable diseases (NCDs) in Central Java, recorded a total of 8,583 cases of hypertension. Of these, 2,359 patients, or 27.4% of the total, underwent regular hypertension treatment.[6]

Hypertension, or high blood pressure, is defined as a condition in which systolic blood pressure reaches or exceeds 140 mmHg on two separate measurements, five minutes apart, while the individual is at adequate rest (Yulanda & Lisiswati, 2017). Individuals with hypertension are at up to a 2.6-fold increased risk of coronary heart disease compared to those without hypertension.[7]

High levels of cholesterol in the blood can cause deposits on artery walls, resulting in narrowing of the blood vessels, a condition known as atherosclerosis. This process increases the workload of the heart and triggers cardiac hypertrophy, thereby increasing the oxygen demand of the blood pumped to the heart. This blockage results in narrowing of the blood vessel lumen and decreased elasticity of the artery walls, which in turn leads to increased blood pressure.[8]

One factor that triggers increased blood pressure is body mass index. BMI is the result of dividing body weight by the square of height (meters) to assess a person's nutritional status. Body mass index can reflect the level of apoptosis in the human body, and health risks can occur if there is excessive fat in the body.[9]

The majority of people aged 50 to 75, or older, can experience obesity due to a lack of vigorous activity. If energy consumption is excessive but not balanced with physical activity, the likelihood of fat accumulation in the body increases, thus increasing the risk of obesity (Sulistyoningsih, 2020).

## METHODS

This quantitative, correlational study using a cross-sectional approach aimed to analyze the relationship between total cholesterol levels, pulse rate, and body mass index (BMI) and blood pressure. The study was conducted in December 2025 at the Cito Indraprasta Laboratory in Semarang City. A sample of 117 respondents was selected using a random sampling technique. Data collection instruments included a digital sphygmomanometer for blood pressure and pulse, an Easy Touch GCU for total cholesterol levels, and a digital scale for measuring weight and height for BMI assessment. Data were analyzed univariately and bivariately using the Spearman Rank test.

## RESULTS

The results obtained through the data collection and analysis process are as follows:

## Respondent Characteristics

Table 1. Frequency Distribution of Respondents'Characteristics with Hypertension December 2025

| Kategori | Min | Max | Mean | Std. Dev | n |
|---|---|---|---|---|---|
| Age | 31 | 78 | 54.67 | 9.57 | 117 |
| Category | | Frequency | | Percentage | |
| Gender | | | | | |
| Man | | 59 | | 50,4 | |
| Woman | | 58 | | 49.6 | |
| Medical history (year) | | | | | |
| < 1 year | | 7 | | 6 | |
| 1-3 year | | 49 | | 41.9 | |
| 3-5 year | | 41 | | 35 | |
| > 5 year | | 20 | | 17.1 | |

Based on Table 1, the frequency distribution of respondent characteristics by age shows a minimum age of 31 years, a maximum age of 78 years, a mean of 54.67 years, and a standard deviation of 9.57. Respondent characteristics by gender show that 59 respondents were male (50.4%) and 58 respondents were female (49.6%). The highest prevalence of hypertension was 1-3 years medical record with a frequency of 49 respondents (41.9%).

## Total Cholesterol

Table 2. Frequency Distribution of Total Cholesterol Levels Respondents with Hypertension in December 2025

| Category | Min | Max | Mean | Std. Dev | n |
|---|---|---|---|---|---|
| Cholesterol Total | 152 | 276 | 218,63 | 27,65 | 117 |

Based on table 2, the distribution of total cholesterol results shows that the minimum cholesterol value is 152 mg/dl, the maximum is 276 mg/dl, the average is 218.63 mg/dl, and the standard deviation is 27.65.

## Blood Pressure, Body Mass Index and Pulse results

Table 3. Frequency Distribution of Hypertension, Body Mass Index and Pulse of Respondents with Hypertension at Cito Indraprasta Laboratory December 2025

| Variable | Category | Frequency (n) | Percentage (%) |
|---|---|---|---|
| Hypertension | Grade 1 | 80 | 68,4 |
| | Grade 2 | 18 | 15,4 |
| | Pre hipertensi | 19 | 16,2 |
| | Total | 117 | 100 |
| Body Mass Index | Under | 1 | 9 |
| | Normal | 22 | 18.8 |
| | Overweight | 21 | 17.9 |
| | Obesity 1 | 40 | 34.2 |
| | Obesity 2 | 33 | 28.2 |
| | Total | 117 | 100 |
| Pulse | Normal | 117 | 100 |

Based on table 3, the body mass index category obtained the highest category in the obesity level 1 category with a frequency of 40 respondents with a percentage of 34.2% and the lowest in the thin category with a frequency of only 1 respondent with a percentage of 9%. The highest prevalence of hypertension was found in the grade 1 hypertension category with a frequency of 80 respondents with a percentage of 68.4% and the lowest prevalence was in the grade 2 hypertension category with a frequency of 18 respondents with a percentage of 15.4%. The frequency distribution of pulse results shows that all 117 respondents were in the normal category, there were no respondents in the bradycardia or tachycardia categories.

### Cholesterol, Pulse, Body Mass Index and Blood Pressure

Table 4. Relationship between Pulse, body mass index and Blood Pressure

| Variable | P value | r |
|---|---|---|
| Cholesterol | 0.002 | 0.326 |
| Blood pressure | 0.002 | 0.326 |
| Pulse | 0.956 | 0.005 |
| Blood pressure | 0.956 | 0.005 |
| Body Mass Index | 0.006 | 0.255 |
| Blood pressure | 0.006 | 0.255 |

Based on Table 4, the relationship between total cholesterol and blood pressure in patients obtained a p-value of 0.002 and a correlation between variables of 0.326. From these results, it was found that there is a significant relationship between total cholesterol levels and blood pressure, as evidenced by a p-value of <0.05 and a strong relationship between variables with a value of 0.326. The relationship between pulse and blood pressure in patients obtained a p-value of 0.956 and a relationship between variables of 0.005. From these results, it was found that there was no significant relationship between pulse and blood pressure, as evidenced by a p-value <0.05 and a strong relationship between variables with a value of 0.005. The relationship between body mass index and blood pressure in patients was found to be p-value 0.006 and the correlation between variables was 0.255. These results indicate a significant relationship between body mass index (BMI) and blood pressure, as evidenced by a p-value of <0.05, and a strong correlation between variables at 0.255.

## DISCUSSION

### Respondents Characteristics

Respondent characteristics based on age were found to be a minimum of 31 years, a maximum of 78 years, with a mean of 54.67 years, and a standard deviation of 9.57. These results align with the theory that older adults experience the aging process and decline in physiological functions, which can lead to reduced activity of receptors that control cholesterol levels in the body.[10]

The standard prevalence of elevated total cholesterol in people aged 18+ to approximately 55 years (or until menopause) is high. Women tend to have lower low-density lipoprotein (LDL) levels than men. At any age, men tend to have lower high-density lipoprotein (HDL) levels than women (National Center for Chronic Disease Prevention and Health Promotion, 2023). With increasing age, in men aged 45 and over and women aged 55 years, the risk of high cholesterol and heart disease increases (WebMD Editorial Contributors, 2022).

**Gender**

Respondent characteristics based on gender showed that 59 respondents (50.4%) were male, and 58 respondents (49.6%). This is supported by several theories that suggest the risk factor for high cholesterol levels increases more sharply in women than in men, particularly for total cholesterol. After menopause, women's LDL cholesterol levels increase, as does the risk of heart disease; men are more likely to have high cholesterol (British Heart Foundation, 2025). High cholesterol levels are influenced by gender. Estrogen in premenopausal women can increase HDL cholesterol, thereby reducing the risk of cardiovascular disease. However, after menopause, LDL cholesterol levels increase, which can increase the risk in postmenopausal women. In general, women are more likely to have high cholesterol levels than men. However, these results may also be influenced by the higher proportion of female respondents in this study.[11]

**Duration of Hypertension**

The highest prevalence of hypertension was found in the categories ">3 years" and "<3 years," with a frequency of 41 respondents (35%). The lowest prevalence was ">5 years," with a frequency of 7 respondents (6%). This is supported by the theory that high total cholesterol levels are a risk factor for hypertension. Hypertension is associated with lipid abnormalities in total cholesterol, where dyslipidemia increases the risk of hypertension, thereby increasing the risk of cardiovascular morbidity and mortality. Increased coronary heart disease (CHD) and hypertension occur epidemiologically when serum total cholesterol exceeds 193.2 mg/dL.[12]

**Relationship between Total Cholesterol Levels and Blood Pressure**

The relationship between total cholesterol and blood pressure in patients was found to be p-value 0.002, with a correlation between variables of 0.326. These results indicate a relationship between total cholesterol and blood pressure, as evidenced by a p-value <0.05 and a strong correlation between the variables at 0.326.

This aligns with the results of research, which showed a significant relationship between cholesterol and hypertension.[13] Similarly, research conducted by Purnama et al. also showed a significant relationship between cholesterol levels and hypertension.[14]

**Relationship between Pulse Rate and Blood Pressure**

The relationship between blood pressure and pulse rate in patients showed a p-value of 0.956 and a correlation of 0.005, indicating no significant relationship between the two. This finding is supported by the theory that cholesterol, as a component of complex fats obtained from the consumption of animal products such as meat and eggs, plays a greater role in influencing blood pressure than pulse rate. Therefore, theoretically and empirically, pulse rate does not have a strong relationship with blood pressure.[15]

**Relationship between Body Mass Index and Blood Pressure**

The relationship between Body Mass Index and blood pressure in patients obtained a p-value of 0.006, and a correlation between variables of 0.255. These results indicate a relationship between BMI and blood pressure, as evidenced by a p-value <0.05, and a strong correlation between variables at 0.255.

These results align with a study in Gayaman Village, Mojoanyar District, Mojokerto Regency, which showed that respondents with a body mass index (BMI) categorized as obese mostly had blood pressure in the pre-hypertension category (34.8%). Meanwhile, respondents with an overweight BMI and normal weight.

## CONCLUSION

This study shows a significant relationship between total cholesterol levels and BMI with blood pressure, where an increase in both contributes to high blood pressure. Conversely, no significant relationship was found between pulse and blood pressure. These findings confirm that metabolic factors such as cholesterol and body weight have a greater influence on hypertension than physiological factors such as pulse rate. It is hoped that respondents will understand the importance of the relationship between total cholesterol levels and body mass index (BMI) with blood pressure, thereby increasing awareness of the risks of hypertension and encouraging healthy lifestyle changes, such as maintaining a healthy diet, regular exercise, and regular health check-ups. This study is expected to contribute to the development of nursing science, both as a scientific reference and to strengthen the practice of evidence-based nursing care.

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