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Biomedical Dietetic Study: The Relationship of Body Mass Index and Total Cholesterol Levels with Blood Pressure Among Workers in Indralaya, Indonesia

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ABSTRACT

Body Mass Index (BMI), total cholesterol levels, and blood pressure are important indicators in evaluating metabolic health status. These factors are interconnected and collectively influence the increased risk of cardiovascular diseases. This study analyzed the relationship between BMI, total cholesterol levels, and blood pressure among workers in Indralaya, Indonesia. Using a cross-sectional design, the study involved 30 purposively selected respondents. Data were collected through interviews, measurements of height and weight, total cholesterol examination, and blood pressure assessment. Data analysis was performed using Pearson correlation and linear regression. The results indicated a tendency for an association between BMI and blood pressure, although not statistically significant. Total cholesterol levels were not significantly associated with blood pressure. Regression analysis revealed that BMI contributed more strongly than blood pressure values. From a biomedical dietetic perspective, obesity has the potential to increase the risk of hypertension and dyslipidemia through mechanisms involving inflammation, insulin resistance, and atherosclerosis. Dietary interventions, such as balanced nutrition, limitation of saturated fats, and increased fiber intake, are recommended to reduce cardiometabolic risks.

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1. INTRODUCTION

Body Mass Index (BMI), total cholesterol levels, and blood pressure are key indicators in assessing an individual's metabolic health status. The combination of these three parameters is closely associated with an increased risk of cardiovascular disease, which remains the leading cause of morbidity and mortality worldwide [1][2]. Lifestyle changes driven by urbanization, high-fat and high-sugar diets, and low physical activity have further exacerbated this condition, including in Indonesia [3].

Recent studies have shown that increased BMI is strongly linked to hypertension and dyslipidemia. For instance, the study General and abdominal adiposity and hypertension in eight world regions found a strong association between adiposity (both general and abdominal) and the prevalence of hypertension across various regions worldwide [2]. In Indonesia, a report on the association between age, obesity indices, and cardiometabolic risk among women in South Sulawesi found that elevated BMI and the presence of central obesity significantly increase the likelihood of metabolic syndrome, including hypertension and lipid profile abnormalities [3]. Regarding cholesterol, the study Tribal differences in hypertension and cholesterol profiles in Aceh showed that total cholesterol levels (and lipid components such as LDL/HDL) are associated with hypertension in certain local populations [4]. Further research highlights the differences in non-HDL lipoprotein levels, blood pressure, and waist circumference among women with normal-weight obesity, lean, and obese conditions in Padang revealed that women with normal-weight obesity (NWO) had higher

Vol 4 Issue 4 2025, pp: 727-732
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non-HDL levels and larger waist circumference compared to lean or obese groups, although blood pressure differences were not always significant between groups [5].

At the national level, the prevalence of hypertension and its risk factors continues to rise. Data from RISKESDAS 2018 indicated that approximately 34.1% of adults in Indonesia suffer from hypertension, and risk factors such as BMI ≥25 (overweight/obesity) show a significant odds ratio for hypertension among young adults [6]. Another study found that BMI classification based on Asian criteria is more accurate in predicting hypertension in Indonesian adults compared to WHO or national criteria [7].

Based on this background, it is essential to conduct a study examining the simultaneous relationship between BMI, total cholesterol levels, and blood pressure in a local context. This research focuses on the workforce population in Indralaya, Indonesia, with the aim of generating relevant empirical evidence to support cardiovascular disease prevention through dietary interventions and more targeted health promotion strategies.

2. RESEARCH METHOD

This study employed a cross-sectional design [8] to analyze the relationship between BMI, blood pressure, and total cholesterol levels among workers in Indralaya, Indonesia. The sample consisted of 30 individuals selected using purposive sampling based on specific inclusion and exclusion criteria. Independent variables included BMI, calculated from weight and height, and total cholesterol, while dependent variables were systolic and diastolic blood pressure. Data were collected through anthropometric measurements, blood pressure assessment, and laboratory examination of cholesterol levels using standardized procedures.

Data analysis was conducted using SPSS version 30, including descriptive analysis, the Kolmogorov-Smirnov normality test, Pearson correlation, and multiple linear regression. The study protocol was approved by the Ethics Committee of the Faculty of Public Health, Universitas Sriwijaya. Participation was voluntary, with confidentiality guaranteed, and written informed consent was obtained from all respondents prior to data collection.

3. RESULTS AND ANALYSIS

3.1. Results

The following presents the research findings on BMI, total cholesterol, and blood pressure of the respondents, which were then analyzed to assess the relationships among these variables. The data are presented in tabular form with explanations provided below each table.

3.1.1. Descriptive Analysis of Numerical Variables

Table 1. Descriptive Analysis of Numerical Variables

Variable	Mean	SD	Min	Max
BMI (kg/m²)	25.4	3.7	18.8	33.2
Systolic (mmHg)	117.7	18.7	84	197
Diastolic (mmHg)	80.4	13.4	54	120
Cholesterol (mg/dL)	192.7	44.6	117	294

The descriptive analysis showed that the mean BMI of respondents was 25.4 ± 3.7 kg/m², with the majority classified as obese (63.4%). The mean systolic blood pressure was 117.7 ± 18.7 mmHg, while mean diastolic blood pressure was 80.4 ± 13.4 mmHg. Most respondents were in the prehypertension category (46.7%). The mean total cholesterol level was 192.7 ± 44.6 mg/dL, with more than half of respondents (53.3%) within the normal range.

3.1.2. Kolmogorov-Smirnov Normality Test

Table 2. Kolmogorov-Smirnov Normality Test Results

Variable	KS Statistic	p-value	Conclusion
Age	0.131	0.636	Normal
BMI	0.113	0.796	Normal
Systolic	0.167	0.338	Normal
Diastolic	0.197	0.171	Normal
Cholesterol	0.225	0.080	Normal

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All variables—age, BMI, systolic blood pressure, diastolic blood pressure, and cholesterol—had p-values > 0.05, indicating normally distributed data and fulfilling assumptions for parametric tests.

3.1.3. Bivariate Analysis: Relationship of BMI & Cholesterol with Blood Pressure

Table 3. Bivariate Analysis: Relationship Between BMI & Cholesterol with Blood Pressure

Relationship	r (Correlation)	p-value	Interpretation
BMI vs. Systolic Blood Pressure	0.347	0.060	Moderate positive correlation, not significant
BMI vs. Diastolic Blood Pressure	0.240	0.201	Weak positive correlation, not significant
Cholesterol vs. Systolic Blood Pressure	-0.145	0.443	Weak negative correlation, not significant
Cholesterol vs. Diastolic Blood Pressure	-0.022	0.910	No correlation, not significant

Pearson correlation analysis showed that BMI tended to have a positive correlation with systolic ($r = 0.347$; $p = 0.060$) and diastolic ($r = 0.240$; $p = 0.201$) blood pressure, though not statistically significant. In contrast, total cholesterol was not significantly correlated with either systolic ($r = -0.145$; $p = 0.443$) or diastolic blood pressure ($r = -0.022$; $p = 0.910$).

3.1.4. Multivariate Analysis (Multiple Linear Regression)

Table 4. Multivariate Analysis Results: Relationship Between BMI and Cholesterol with Systolic Blood *Pressure*

Variable	B (Coefficient)	Std. Error	Beta (β)	t	p-value
Constant	83.18	11.25	–	7.39	<0.001
BMI	1.78	0.54	0.52	3.28	0.003
Cholesterol	-0.05	0.06	-0.12	-0.83	0.410

$R^2 = 0.32$

Table 5. Multivariate Analysis Results: Relationship Between BMI and Cholesterol with Diastolic Blood Pressure

Variable	B (Coefficient)	Std. Error	Beta (β)	t	p-value
Constant	57.58	8.93	–	6.45	<0.001
BMI	0.89	0.42	0.40	2.12	0.040
Cholesterol	0.004	0.05	0.01	0.08	0.940

$R^2 = 0.18$

Multivariate analysis indicated that BMI significantly influenced both systolic ($\beta = 0.52$; $p = 0.003$) and diastolic blood pressure ($\beta = 0.40$; $p = 0.040$). However, total cholesterol did not significantly affect either systolic ($p = 0.410$) or diastolic blood pressure ($p = 0.940$). The R^2 values were 0.32 (systolic) and 0.18 (diastolic), suggesting that BMI and cholesterol explained only part of the variation in blood pressure.

3.2. Discussion

This discussion outlines the findings on respondents' general characteristics, the relationship between BMI, blood pressure, and cholesterol levels, and compares them with theories and previous research.

3.2.1. General Characteristics of Respondents

Descriptive analysis indicated that most respondents were of working age, with a mean BMI of 25.04 kg/m², classifying the majority as overweight or obese. Obesity is still regarded as one of the leading risk factors for cardiovascular diseases, including high blood pressure and diabetes [9]. Mean blood pressure was within the non-hypertensive range (117.7/80.4 mmHg), although pre-hypertensive and mild hypertensive cases were observed, consistent with reports that elevated BMI increases the risk of future blood pressure elevation [10].

Vol 4 Issue 4 2025, pp: 727-732
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The average total cholesterol level was 192.7 mg/dL, ranging from optimal to borderline-high. While most participants had normal cholesterol, a subset exhibited elevated levels, highlighting the combined risk of dyslipidemia and obesity for atherosclerosis and coronary heart disease. Abdominal fat accumulation was particularly associated with elevated blood pressure independent of cholesterol levels [11]).

These findings suggest that despite normal mean blood pressure and cholesterol, the high prevalence of overweight and obesity indicates hidden metabolic risks that may progress to metabolic syndrome or cardiovascular disease. Targeted preventive strategies, including weight control, dietary optimization, and physical activity, are warranted to mitigate these risks.

3.2.2. Relationship Between BMI and Blood Pressure

The analysis results showed that higher BMI tended to be associated with increased systolic *($r = 0.347; p = 0.060$)* and diastolic *($r = 0.240; p = 0.201$)* blood pressure, although the obtained relationship was not statistically significant due to limited sample size. After multiple linear regression, it provided a greater contribution to systolic *($\beta = 0.52; p = 0.003$)* and diastolic *($\beta = 0.40; p = 0.040$)* blood pressure. Thus, the direction of the relationship seen is in line with biomedical mechanisms that have been described in various recent studies. Physiologically, obesity affects blood pressure through multiple pathophysiological pathways. Increased body fat accumulation, particularly visceral fat, triggers the release of proinflammatory cytokines such as TNF-α and IL-6, which play a role in promoting oxidative stress and impairing endothelial function, thereby increasing peripheral vascular resistance. Additionally, obesity is linked to renal sodium retention and stimulation of the renin-angiotensin-aldosterone system (RAAS), leading to elevated blood volume in circulation and vascular constriction [12].

Furthermore, visceral fat accumulation is often associated with insulin resistance, which not only disrupts glucose metabolism but also exacerbates endothelial dysfunction, increasing the risk of hypertension. Niu, using data from the China Health and Retirement Longitudinal Study (CHARLS), reported that insulin resistance serves as a primary mediator in the relationship between obesity and the incidence of hypertension among middle-aged and older adults [13]. This is in line with Mao's findings, which indicate that visceral fat area (VFA) has a stronger association with arterial stiffness than abdominal subcutaneous fat in patients with type 2 diabetes [14], highlighting the role of central adiposity in vascular pressure elevation. Similarly, Zare reported that individuals with obesity are more likely to develop hypertension compared to those with normal weight [15].

Thus, although statistical significance was not achieved in this study, the observed patterns remain clinically relevant. These findings reinforce the view that elevated BMI is an important risk factor, and weight management through healthy diet, increased physical activity, and other lifestyle interventions is crucial to prevent progression from pre-hypertension to clinical hypertension.

3.2.3. Relationship Between Cholesterol and Blood Pressure

Although this study did not find a significant relationship between total cholesterol and blood pressure, either systolic *($r = -0.145; p = 0.443$)* or diastolic *($r = -0.022; p = 0.910$)*. Biomedically, cholesterol still has an important role in cardiovascular health. Elevated LDL promotes arterial stiffness, atherosclerotic plaque formation, oxidative stress, and endothelial dysfunction, all of which increase vascular resistance and contribute to hypertension [16], [17]. Evidence from hypertensive populations shows that higher LDL and total cholesterol levels are associated with poorer blood pressure control and higher hypertension severity [18], [19]. These findings underscore that cholesterol plays a clinically relevant role in blood pressure regulation, especially in high-risk or hypertensive individuals, even if the effect is less apparent in normotensive populations.

3.2.4. Biomedical Dietetic Implications

The dietetic implications of this study suggest that nutritional interventions are crucial strategies for preventing and managing obesity, dyslipidemia, and hypertension. Findings of elevated BMI, near-high cholesterol levels, and pre-hypertensive cases indicate hidden metabolic risks that may progress to cardiovascular disease if not addressed early[20]. Suggested dietary strategies encompass controlling energy consumption to prevent excess, maintaining a balanced macronutrient composition (50–60% complex carbohydrates, 20–25% healthy fats, and 15–20% protein), reducing saturated and trans fat intake, and enhancing the consumption of omega-3 fatty acids, phytosterols, and dietary fiber. This approach helps reduce LDL cholesterol, improve vascular health, and slow atherosclerosis progression. Combining a balanced diet with physical activity and nutrition education further strengthens the protective effects against cardiovascular risk.

Dietary patterns supported by evidence, including the Dietary Approaches to Stop Hypertension (DASH) and the Mediterranean diet, have demonstrated effectiveness in lowering metabolic risk factors [21]. Recent clinical trials report that an isocaloric Mediterranean diet combined with exercise over 12 weeks significantly decreased waist circumference, visceral fat, and triglyceride levels [22], [23]. Furthermore, systematic reviews and meta-analyses indicate that the Mediterranean diet offers protective benefits against major cardiovascular events—such as myocardial infarction and stroke—while also lowering cardiovascular mortality and enhancing blood pressure as well as lipid profiles in individuals who are overweight or obese [24].

These findings emphasize the importance of weight and blood pressure management supported by biomedical dietetic interventions, including improved dietary patterns, increased physical activity, and nutrition education to prevent cardiovascular disease risk. Both DASH and Mediterranean diets are scientifically supported for lowering blood pressure and enhancing cardiometabolic health, making them effective dietary strategies to reduce cardiovascular risk in the general population [15], [21], [25].

4. CONCLUSION

The findings of this study indicate that BMI has a clearer relationship with total cholesterol levels compared to blood pressure. Total cholesterol was not significantly associated with hypertension in this small sample; however, its biomedical contribution to atherosclerosis has been well established. Dietetic interventions such as weight management, healthy dietary patterns, and increased physical activity are strongly recommended to prevent cardiometabolic complications among workers.

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