ORIGINAL ARTICLE
Public Health and Preventive Medicine Archive (PHPMA) 2025, Volume 13, Number 1: 62 – 70
E-ISSN: 2503-2356

PHPMA
Published by
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Correlation between sociodemographic and anthropometric characteristics with blood pressure and cholesterol level among adult population in rural area of Sidomukti, South Lampung, Indonesia

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ABSTRACT

Background and purpose: Hypertension is one of the most frequent non-communicable diseases and a risk factor for cardiovascular disease, contributing to most deaths globally. The purpose of this study is to identify the correlation between gender, age, BMI, blood glucose, uric acid and cholesterol among adults in the community of rural area.

Methods: This study is utilizing the quantitative method with a cross-sectional design. The study involved 118 adult population of Sidomukti, South Lampung, Indonesia who were selected by purposive sampling. Data collected were age, gender, body weight, height, and blood pressure. Blood samples were also taken to measure uric acid, blood sugar and cholesterol levels. Descriptive and correlation analysis were carried out.

Results: There was a significant association between gender and BMI (r=0.273); and systolic blood pressure (r=0.153) and cholesterol (r=0.187). Age group is associated significantly with weak to moderate association with all other variables. BMI was weakly associated with systolic (r=0.302) and diastolic blood pressure (r=0.312). Systolic blood pressure showed strong association with diastolic blood pressure (r=0.768) and blood sugar (r=0.214). Uric acid only has association with age group (r=0.334), while cholesterol level also showed association with age group (r=0.227), and blood sugar (r=0.199).

Conclusion: There was correlation between variables that related to the risk of hypertension and cardiovascular disease among adults. Improvement of hypertension management, health education and promotion is essential to reduce the risk of cardiovascular disease among the population.

Keywords: blood pressure; blood glucose; cholesterol; health assessment; obesity

INTRODUCTION

Cardiovascular diseases (CVDs) are the leading cause of death worldwide. CVDs include acute coronary syndrome, stroke, and peripheral arterial disease. Cardiovascular risk factor are biological characteristic, life style habits, or condition that enfold the likelihood of morbimortality from CVDs in the long term (1). CVDs risk factors include high blood pressure, type 2 diabetes mellitus, obesity, smoking, and dyslipidemia (2). Reducing CVDs' morbidity and death is possible through public health initiatives that increase awareness and facilitate early detection of modifiable risk factors (3).

According to the World Health Organization (WHO) data, over one billion individuals worldwide, 25% of men and 20% of women, have hypertension. It accounts for about 7 million fatalities globally and over half of stroke and ischemic heart disorders (4). Based on the 2019 Lampung Province Health Profile, the prevalence of hypertension in the adult population aged ≥15 years in Lampung Province was 15.10% with the achievement of health services for hypertension patients coverage of 49.10%; while in Bandar Lampung City, the prevalence was 16.71% with the achievement of health services for hypertension patients coverage of 71.40% (5). Treatment guidelines advise individuals with cardiovascular disease and its counterparts to lower their blood pressure to less than 140/90 mmHg (6).

One of the main risk factors for hypertension is obesity. Obesity-related hypertension is linked to various disorders along the course of obesity, making the relationship between obesity and hypertension complicated (7). The prevalence of hypertension rises as BMI rises (8). Meanwhile, hyperuricemia is also a strong independent predictor of hypertension, with a roughly two-fold higher risk in the next five to ten years (7). Patients with more severe hypertension are more likely to have hyperuricemia (9).

The age-related pattern of absolute blood pressure indicates that blood pressure is significantly dependent on age, with a linear increase in systolic blood pressure with age after the ages of 30 to 40 and a plateau in late life (10). Physical, mental, and social declines are common among the elderlies. Elderly people who are physically deteriorated are more susceptible to illnesses, particularly degenerative diseases like hypertension. Therefore, this study explored the relationship between BMI, uric acid, cholesterol, blood glucose, and age with blood pressure.

METHOD

This study was utilizing the descriptive quantitative method with cross-sectional design. The population were all the adult people who live in Sidomukti Village, South Lampung, Indonesia. Sidomukti is a village in Tanjung Sari sub-district in South Lampung District with number of populations approximately 2,374 as per July 2024. The samples of 118 adults that met the inclusion and exclusion criteria was selected by purposive sampling.

Data were collected through a survey using questionnaire and measurement that include age, gender, body weight, height, and blood pressure. Blood samples were also obtained to measure uric acid, blood sugar and cholesterol levels. Data collection was conducted between June to July 2024. The researchers performed data

management and categorized the variables accordingly, and then descriptive analysis followed by bivariable correlational analysis across the variables were performed.

The study has obtained an ethical approval from The Ethic Commission of Health Research, Faculty of Nursing, Adventist University of Indonesia with number: 405 / KEPK-FIK. UNAI / EC / IX / 24.

RESULT

Of the 118 adults involved in the study, most of the respondents were female (65.3%), and were at middle age (36.4%). For nutritional status based on BMI, overweight category was accounted for 28%, while obesity was 10.6%. Systolic blood pressure that fell in the elevated category was 16.9% and 67.8% was in hypertension stages. Meanwhile, the diastole hypertension Stage I category was 43.2%, followed by Stage II at 33.9%. Those that have increased blood glucose with Prediabetes category and Diabetes were 9.3%, respectively. The majority of the respondents have high uric acid level (60.2%) and high cholesterol level (63.6%).

Table 1. Distribution of demographic and clinical characteristics

Variable (n=118)	Category	Frequency (f)	Percent (%)
Gender	Male	41	34.7
	Female	77	65.3
Age	Young Adult	1	0.8
	Adult	20	16.9
	Middle Age	43	36.4
	Elderly	39	33.1
	Old	15	12.7
Body Mass Index	Under Weight	20	16.9
	Normal	52	44.1
	Overweight	33	28.0
	Obesity Type 1	11	9.3
	Obesity Type 2	1	0.8
	Extreme Obesity	1	0.8
Systole	Normal	18	15.3
	Elevated	20	16.9
	Hypertension Stage 1	13	11.0
	Hypertension Stage 2	6.3	53.4
	Hypertension Crisis	4	3.4
Diastole	Normal	26	22.0
	Elevated	1	0.8
	Hypertension Stage 1	51	43.2
	Hypertension Stage 2	40	33.9
Blood Sugar	Normal	96	81.4
	Prediabetes	11	9.3
	Diabetes	11	9.3
Uric Acid	Low	2	1.7
	Normal	45	38.1
	High	71	60.2
Cholesterol	Normal	43	36.4
	High	75	63.6

Table 2 shows a significant weak negative relationship (r=-0.183) between gender and age with p-value of 0.047, a positive weak association (r=0.273) between gender and BMI with p-value of 0.003; and similarly for gender and systole (r=0.153with p-value of 0.033, also for gender and cholesterol (r=0.187) with p-value of 0.042. Age group is associated significantly with weak to moderate association other variables; it was negatively associated with BMI with p-value of 0.003 whilst other variables are positively associated. As for BMI, it was weakly associated with systolic (r=0.302) and diastolic blood pressure (r=0.312).

Meanwhile, systolic blood pressure showed strong positive association with diastolic blood pressure (r=0.768) and weakly associated with blood sugar (r=0.214). Uric acid only has association with age group (r=0.334), while cholesterol level also showed weak positive association with age group (r=0.227), and blood sugar (r=0.199)

Table 2. Correlation between variables

		Gender	Age Group	BMI	Systole	Diastole	BS	Uric Acid	Cholesterol
Gender	r		-.183*	.273**	.196*	.153	.099	-.035	.187*
	p value		.047	.003	.033	.098	.286	.709	.042
Age Group	r			-.272**	.347**	.255**	.215*	.334**	.227*
	p value			.003	.000	.005	.019	.000	.013
BMI	r				.302**	.312**	.104	.041	-.142
	p value				.001	.001	.264	.657	.124
Systole	r					.768**	.214*	.111	.125
	p value					.000	.020	.233	.179
Diastole	r						.057	.126	.148
	p value						.539	.175	.110
BS	r				.			.070	.199*
	p value							.452	.031
Uric Acid	r								.038
	p value								.681

r=pearson correlation coefficient, p value - 2 tailed, BS=blood sugar, BMI=body mass index

DISCUSSION

The implementation of PHC integration in the study area has been operating well which a good achievement of the in-building services but a lower achievement of the out-building activities. Out-of-building health services showed limited number of home visits, that showed improvements for more comprehensive integration was needed.

CONCLUSION

From the study, we found significant association between gender and the following variables: age group, BMI systolic blood pressure and cholesterol level. Gender is associated with the level of fat in the blood which is also influenced by other factors such as age, smoking, food, activity factors, and BMI. Women's high HDL levels can be explained by the hormone estrogen. It is well known that estrogen inhibits women's tendency to accumulate body fat (11). The risk of cardiovascular disease increases after woman experience menopause,

because it is related to decrease estrogen levels (12).

There are biological and psychological differences between men and women when they are exposed to obesogenic situations. One gender is more likely to become obese due to biological variables such sex hormones (13). Several studies suggest that prevention with lifestyle and behavioral modifications, such as dietary changes or smoking cessation, may reduce the risk of cardiovascular diseases (14).

We also found a significant relationship between age group with several variables, namely: BMI, age group, systolic blood pressure and diastolic blood pressure. According to the Johns Hopkins Precursors study, men who became overweight or obese in midlife (age 45) had a twofold increased risk of hypertension compared to those of normal weight (HR=1.91, 95%CI: 1.46-2.49), while obesity in young adulthood (age 25) conferred a threefold risk (HR=2.79, 95%CI: 1.30-6.00) (8). Weight gain from young adulthood (ages 18 and 21 for women) to middle life (age 55) was linked to an increased risk of hypertension in both women (incidence rate ratio (IRR)=1.24, 95%CI: 1.20-1.28), and men (IRR=1.21, 95%CI: 1.12 to 1.31), according to the Nurses' Health Study and Health Professionals follow-up study (15). Longer exposure to excess adiposity may be the reason for the high correlation between hypertension and overweight in earlier adulthood compared to later adulthood (16).

There was also a significant relationship between BMI and systolic and diastolic blood pressure. Unhealthy lifestyles such as frequent consumption of fast food and less exercise cause the risk of obesity to increase body mass index (BMI) is positively associated with both systolic blood pressure and diastolic blood pressure (17–19). Similar finding from a study in China that showed blood pressure and BMI, which has significant ramifications for cardiovascular risk in the future (20).

It has been demonstrated that age significantly affects blood pressure, blood cholesterol, and blood glucose levels. As people age, their blood glucose levels tend to rise as well (21,22). Women are more likely than males to experience elevated blood pressure as they approach menopause. Reduced estrogen levels, oxidative stress, endothelial dysfunction, the renin-angiotensin system, and sympathetic activation are some of the variables that contribute to the rise in blood pressure (23). Blood pressure is impacted by a high body mass index. Maintaining a healthy lifestyle and managing body weight are important ways to keep blood pressure from rising (24,25).

Blood glucose was associated with age group, systole blood pressure and cholesterol level. There is a log-linear relationship between systolic blood pressure and the risk of cardiovascular disease in DM patients, regardless of gender or age. This association is strongly influenced by age, with younger patients (less than 50 years old) at higher risk of CVD for a comparable increase in systolic blood pressure than older patients (26). Based on the result, a low systolic blood pressure and high blood glucose lead to ACS patient mortality (27). Age and blood glucose levels are significantly correlated (28). A prior study that shown a significant correlation between blood glucose levels and TG and LDL-C, which are associated with an increased risk of obesity and cardiovascular disease, corroborated the findings of this investigation (29).

We found a significant relationship between uric acid and age group. According to a survey of those over 65, the prevalence of hyperuricemia doubled in women (from 15.3% in those over 65 to 34.4% in the 90s) but only increased by 6% in men from 65 to over 90 (30). Female respondents showed the same prevalence of hyperuricemia as male subjects in the population over 70, but male subjects had a higher incidence in individuals under 70. Among older men, uric acid levels did not differ substantially by age subgroup. Among

the potential causes are alcohol use, which is more common in men; and the impact of estrogen (31).

There was a significant relationship between cholesterol and these variables: age group, gender and blood glucose. Studies showed substantial correlation between TC, LDL, and TGL in those 65 and older. Hypercholesterolemia was 1.2 times more common in women than in men. Furthermore, compared to non-diabetics, diabetic patients had 2.55 times the risk of hypertriglyceridemia and 1.98 times lower HDL (32). According to other research, dyslipidemia rises in both sexes as people age (33).

This study suggests that behaviors modification to maintain normal BMI that include exercise, healthy diets are important since it is associated with several important indicators of cardiovascular risk such as systolic and diastolic blood pressure, blood sugar and cholesterol level. This research has its own limitation since it was only limited to one village, hence generalization is limited.

CONCLUSION

From this study, we found association of several indicators of cardiovascular disease including association of gender, age group and BMI with systolic and diastolic blood pressure and uric acid. One of the most important aspects of managing hypertension is taking the proper precautions against these risk factors. Long-term health education, promotions initiatives and community engagement should be used to raise population health literacy. Programs to improve behaviors modification to maintain normal BMI that include exercise and healthy diets should be intensified.

ACKNOWLEDGEMENT

The authors are grateful to all the people of Sidomukti Village, District Tanjung Sari, South Lampung, and all the medical staff of the Bandar Lampung Adventist Hospital.

AUTHORS' CONTRIBUTION

The authors made significant contributions to the research and manuscript preparation. ES was responsible for conducting the research, developing the methodology, and drafting the manuscript, ensuring that the findings were clearly presented. Meanwhile, IS played a crucial role in analyzing data, interpreting the results, and ultimately submitting the manuscript for publication, thereby facilitating the dissemination of the findings to the academic community.

CONFLICT OF INTEREST

There is no conflict of interest in this study.

FUNDING

All research activities received funding from Loma Linda Indonesia Adventist Ministry.

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