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The Difference of Triglyceride and total Cholesterol Values between the Normotension and Hypertension groups Among the Population in Surakarta

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Abstract

Hypertension is associated with a factor of ischemic heart disease and other chronic medical conditions. The association between hyperglycaemia and elevated abnormal blood lipid concentration has already been proposed. However, information about the roles of total cholesterol (TC) and triglycerides (TG) is currently limited. This study intends to explore the difference in triglycerides and total cholesterol between the normotension and hypertension groups in the Surakarta community. An observational study applying a cross-sectional design has been accomplished, and the study population resided in Surakarta, Central Java, Indonesia. This study was conducted in August-November 2022. Each participant should complete the provided questionnaire to survey the general characteristics such as age and sex. Patients were also measured in terms of their body weight and height, abdomen circumference, body mass index, total cholesterol, and triglyceride. Univariate and bivariate analyses were used in this study. The univariate analysis aims to describe each characteristic of the research variable. After univariate analysis, bivariate analysis was performed on two related variables. This study used Mann-Whitney analysis to identify the differences between predictor variables. Individuals with hypertension demonstrated substantially higher amounts of SBP and DBP than the normotension group (p=0.002 and 0.000 respectively). Total cholesterol between normotension and hypertension groups showed a significant difference (p=0.004). Other variables such as body weight, body height, abdomen circumference, body mass index, and triglyceride didn't significantly differ between normotension and hypertension groups. It can be concluded that total cholesterol can be used as a predictor for hypertension risk.

Keywords: *Cholesterol, Hypertension, Triglyceride.*

Introduction

Hypertension, also called high blood pressure, significantly increases the risk of developing heart, brain, kidney, and other problems [1]. Increased blood pressure is one of the risk factors for ischemic heart disease and related persistent medical conditions. Worldwide data shows that 1.28 billion people aged 30 to 79 are expected to have hypertension, with over half (two-thirds) occurring in countries with middle or low incomes. According to reports, people with hypertension are 46% not inclined to be aware of their condition. Twenty-one per cent of those with hypertension have it under control. Hypertension is one of the leading causes of premature death worldwide. One of the worldwide non-communicable illness targets is reducing hypertension prevalence by 33% between 2010 and 2030. There is 42% of adults

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diagnosed with hypertension have been detected and treated.

Triglycerides have been proven to be connected to both systolic and diastolic blood pressure [2]. The increased endothelial repair activity may help prevent hypertension because hypertension and endothelial impairment form a vicious loop /bidirectional relationship.4 Study conducted in the Japanese population, serum triglycerides have been linked to the onset of CKD/Chronic Kidney Disease on their own [3]. Another study in the Jatinangor population (Indonesia) also showed a correlation between total cholesterol and systolic level [4]. A study conducted in NTB General Hospital about systolic, triglycerides, and diastolic blood pressure are significantly related to total cholesterol. LDL and total cholesterol account for 11.9% of the value of systolic blood pressure.

Numerous variables contribute to the risk of high blood pressure. Certain risk factors, like unwholesome lifestyle choices, are modifiable [5]. Age, family history, genetics, race, ethnicity, and sex are risk variables that cannot be altered. Maintaining a healthy lifestyle can help lower blood pressure. In urban slums, at least one-third of those aged 35 to 64 suffer from hypertension. Age, marital status, wealth index, physical inactivity, and BMI are all significant risk factors for hypertension [6]. To avoid hypertension and its deteriorating effects, preventive efforts should focus on modifiable risk factors [7]. To prevent hypertension and its deteriorating effects, preventive measures should focus on modifiable risk factors [8].

Surakarta is one of regency in Central Java, Indonesia. As one of the provinces in Indonesia, Central Java also facing some non-communicable diseases including hypertension. According to the results of the national health research in 2018, the prevalence of hypertension in Central Java was 37.57%. Hypertension is found more frequently in women (40.17%) than in men (34.83%). The incidence in urban regions is slightly greater (38.11%) than in rural areas (37.01%). The prevalence is growing with maturation [9]. This study aims to investigate the difference in triglyceride and total cholesterol between normotension and hypertension groups in the Surakarta population.

Materials and Methods

Data Collection and Sample

A cross-sectional observational analytical study was obtained, and the study population resided in Surakarta, Central Java. This study was conducted in August- November 2022. Individuals who took lipid-lowering drugs, hypoglycaemic drugs, and information incomplete were excluded. Finally, 418 participants were eligible and met the inclusion criteria. These were classified into two groups, the normotension and hypertension groups.

Ethical Clearance

The research design has already been evaluated. By the Health Research Committee of Poltekkes Kemenkes Surakarta with the registered number LB.02.02/1.1/ 2677.1 /2021. All of the participants signed an informed consent as a prove of their willingness to be a participant.

Clinical Measurements

Each participant should fill out the provided questionnaire to survey the general characteristics such as age and sex. Patients have also measured their body measurements, abdomen circumference, body mass index, total cholesterol, and triglyceride. Their blood pressure in systolic and diastolic (SBP and SDP) were measured twice using an electronic sphygmomanometer at five-minute intervals. The blood samples from each participant were obtained after at least 8 hours of overnight fasting. Serum levels of triglyceride and total cholesterol level were measured by biochemical auto analyser.

Variable Definition

Normotension groups were used to define if participants have SBP <120 mm Hg and DBP <80 mmHg. Hypertension was used to define if participants have SBP >120 mmHg and DBP <80 mmHg. Triglyceride was calculated as TG (mg/dl). The BMI has been calculated as weight (kg)/height2.

Statistical Analysis

Univariate and bivariate analyses were used in this study. The univariate analysis aims to describe each characteristic of the research variable. This analysis produces minimum, maximum, mean, and deviation standards for the ratio variable, while the categoric variable produces frequency distribution and percentage. After univariate analysis was conducted, bivariate analysis was performed on two related variables. In this study, Mann-Whitney analysis was used to identify the differences between predictor variables in ratio (age, body measurements, BMI, abdominal circumference, total cholesterol) in hypertension disease. Meanwhile, for the categoric variable of the predictor variable (gender), the chi-square test was used.

Results

Table 1 presents the distribution of respondents. Regarding the gender out of 418 samples, 144 (73.10%) were male and 128 (63.68%) were female. Moreover, sample 78 (18.66%) belongs to the age group of 20-30 years, sample 134 (32.06%) belongs to the age group of 31-40 years, sample 117 (27.99%) belongs to the age group of 41-50 years, and sample 89 (21.29%) belongs to the age group of over 50 years. Regarding education, 20 (4.78%) were in primary education, 120 (28.71%) were in secondary education, 130 (31.10%) Of those with upper secondary education, 148 (35.41%) were graduates or higher. Out of 418 samples, 140 (33.49%) earned less than the regional minimum wage monthly, while 278 (66.51%) earned more. According to marital status, 59 (14.11%) were single, 340 (81.34%) were married, and 19 (4.55%) were divorced.

Regarding smoking behaviour, out of 418 samples, 356 (85.17%) were smokers, and 62 (14.83%) were non-smokers. Regarding alcohol consumption, 3 (0.72%) were drinking alcohol, and 415 (99.28%) were never consuming alcohol.

Table 1. Frequency Distribution of Respondents (N=418)

Characteristics	Number	Percentage (%)
Gender		
Male	213	50.96
Female	205	49.04
Age		
20-30	78	18.66
31-40	134	32.06
41-50	117	27.99
Above 50 years	89	21.29
Education		
Primary	20	4.78
Secondary	120	28.71
Higher Secondary	130	31.10
Graduate or above	148	35.41
Monthly Income		
< regional minimum wage	140	33.49

≥ Regional minimum wage	278	66.51
Marital Status		
Single	59	14.11
Married	340	81.34
Divorce	19	4.55
Currently Smoking		
Yes	62	14.83
No	356	85.17
Alcohol Consumed		
Yes	3	0.72
No	415	99.28

Data on the health status of respondents are presented in Table 2. The categorization of health status namely diabetes melitus, hypertension, cardiovascular, stroke, cancer, thalassemia, asthma, and chronic bronchitis or emphysema.

Table 2. Health Status of Respondents

Characteristics	Number	Percentage (%)
Diabetes Mellitus		
Yes	16	3.83
No	389	93.06
Unknown	13	3.11
Hypertension		
Yes	146	11.96
No	272	84.93
Unknown	13	3.11
Cardiovascular		
Yes	9	2.15
No	391	93.54
Unknown	18	4.31
Stroke		
Yes	2	0.48
No	410	98.09
Unknown	6	1.44
Cancer		
Yes	1	0.24
No	409	97.85
Unknown	8	1.91
Thalassemia		
Yes	0	0.00
No	407	97.37
Unknown	11	2.63
Asthma		
Yes	27	6.46

No	379	90.67
Unknown	12	2.87
Chronic Bronchitis or Emphysema		
Yes	2	0.48
No	391	93.54
Unknown	25	5.98

Descriptive Statistics

The baseline characteristics of the two groups with their blood pressure are shown in Table 3. Based on the level of their blood pressure, eligible study participants (n=418) were classified into two groups, participants with hypertension (n=146) and patients with normal tension/normotension (n=272).

Table 3. Participants were Distributed Depending on Gender in the Normotension and Hypertension Group

Gender	**Blood Pressure**				***p*-value**
	Normotension (n=272)		**Hypertension (n=146)**		
	n	**%**	**n**	**%**	
Male	144	67.61	69	32.39	0.043*
Female	128	62.44	77	37.56	

Based on the graph in Figure 1, it can be seen that in the normotension group, there are more males than females, namely 144 people (67.61%), while in the hypertension group, the female sex is dominated by 77 people (37.56%).

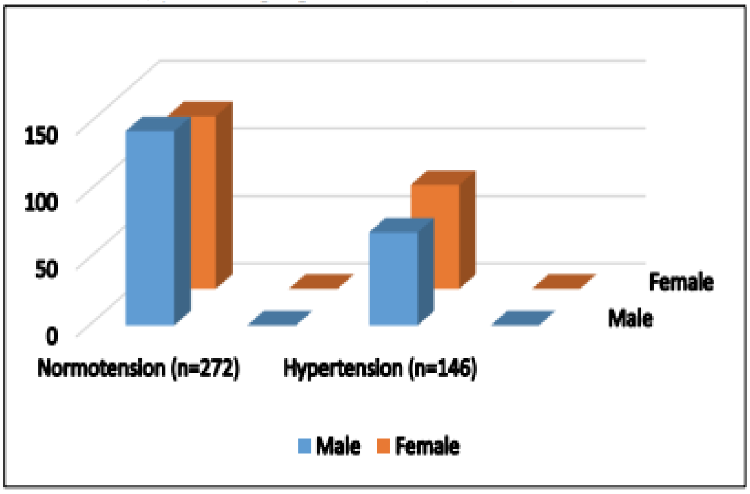

Figure 1. Percentage of Participants Depending on Gender

Univariate Analysis

The age of the hypertension group (42.33) was higher than the normotension group. Body weight in the hypertension group (68.03) was higher than in the normotension group (n=272). Body height in the normotension group (161.59) was higher than in the hypertension group. The mean of abdomen circumference in the hypertension group (88.5) was also higher than in the normotension group (87.99). The Hypertension group also had a higher body mass index (26.44) than the normotension group (25.96). Total cholesterol was also analyzed and showed higher in the hypertension group (205.968) than in the normotension group (194.434) (Table 4). Significant variations between the groups regarding age, body measurement (height and weight), abdominal circumference, BMI, total cholesterol, and triglyceride levels existed.

Mann-Whitney Analysis

Individuals with hypertension had significantly higher values of SBP and DBP than those with normal blood pressure (p=0.002 and 0.000, respectively). Total cholesterol between the normotension and hypertension groups showed a significant difference (p=0.004). Body measurement (weight and height), abdomen circumference, body mass index, and triglyceride didn't show significant differences between normotension and hypertension group (Table 4).

Table 4. The Clinical Characteristics of Normotension and Hypertension Group

Variables	**Blood pressure**				**p-value**
	Normotension (n=272)		**Hypertension(n=146)**		
	Mean	**Std.Deviation**	**Mean**	**Std. Deviation**	
Age	40.63	10.338	42.33	11.018	0.168
Body Weight	67.88	13.954	68.03	12.974	0.685
Body Height	161.59	8.077	160.16	7.677	0.116
Abdomen Circumference	87.99	11.769	88.5	10.404	0.5
BMI	25.96	4.913	26.44	4.33	0.169
Sistole	120.2	13.573	125.8	16.21	0.002**
Diastole	82.37	7.909	85.29	8.246	0.000***
Total Cholestrole	194.434	34.69	205.968	40.474	0.004**
Trigliceryde	141.14	79.79	143.991	78.59	0.531

Discussion

This cross-sectional study in Surakarta investigated the comparison of triglyceride and total cholesterol between normotension and hypertension groups without diabetes mellitus. The current results show that the age group didn't show significant differences between normotension and hypertension groups (*p*-value: 0.168). A total of 146 participants were grouped into the hypertension group with a mean age was 42.33. Age is one of the significant factors, non-modifiable risk factors for hypertension. Age-related increases in the prevalence of hypertension were seen, and they were more pronounced in females than in males. In each 10-year age range, the prevalence of hypertension rose by over 20%, from 17.7% in the 34-44 years group to 34.6% in the 45-55 years group to 51.5% in the 55-64 years group. If the proper steps aren't taken, many pre-hypertensive adults (48.3%) may develop full hypertension as the population matures [8, 10, 11].

The second variable which also identified is body weight, which was higher in the hypertension group than in normotension, but didn't significantly differ (p=0.685). Further investigation has found a correlation between the risk of developing arterial hypertension and an increase in body weight (BW) or obesity [12–15]. The connection between obesity and hypertension has been discussed for a long time

[16]. However, conclusive proof didn't come to light until much later in the Framingham Heart Study, where it was found that obese people had a roughly two-times increased chance of developing arterial hypertension. Furthermore, it was established that BW and BP have a linear connection. Every 4.5 kg increase in body weight induces a rise in systolic blood pressure (SBP) of 4 mmHg [12]. Weight loss causes both diastolic and systolic blood pressure (DBP) to decrease [12, 13].

The mean body height of the participant in the normotension group was 161.59, while in the hypertension group was 160.16, but the significant difference wasn't shown. Previous studies extended the association between adult height and blood pressure. Epidemiological statistics and physiological research suggest an inverse connection between adult height and blood pressure [17]. Furthermore, in a cross-sectional study of 3,374 adults, Ferrie and colleagues [18] revealed an inverse relationship between height and all BP indications for women but not males. A subsequent study conducted by Bourgeois et al, who evaluated the 12,988 men and women from the USA who were included in the NHANES database, found that while DBP was positively associated with height in older men and women, it was not significantly different, and SBP was negatively associated with height in older men and women [19]. More research is needed to identify the specific relationship between adult height and blood pressure, and whether patient heights should be considered when developing antihypertensive therapy strategies and goals.

This study shows that the hypertension group has a higher abdomen circumference than the normotension group. A large US study involving more than 12,000 adults shows that waist circumference could be used as an important biomarker for assessing the likelihood of (pre) hypertension. The following results suggested that waist circumference measurement should be used to assess the cardiometabolic risk associated with fat distribution regardless of BMI [20]. In Indonesian circumstances, previous investigations in Jatinangor populations demonstrated a favourable association between waist circumference and the prevalence of hypertension [4]. A comprehensive study in China, which included 7217 normal-weight and overweight persons with standard cardiometabolic profiles, found that greater waist circumference was significantly related to the increased prevalence of hypertension, even in individuals with normal metabolic profiles. Also, those with excessive waist circumference demonstrated higher all-cause mortality if hypertension was confirmed [21]. Thus, this measurement should be frequently assessed and managed regardless of metabolic profiles.

Higher BMI in the hypertension group was shown in this study, compared with the normotension group [22]. Body mass index is one of the risk factors for hypertension. A normal BMI was linked to a lower prevalence and incidence of cardiovascular and non-cardiovascular diseases [23]. The fact that obesity-related hypertension is inextricably linked to other illnesses as obesity advances, the association between obesity and hypertension is complex. Obesity, commonly measured by BMI, is one of the key risk factors for hypertension [24, 25]. And hypertension prevalence rises with increasing BMI [26, 27]. Unfortunately, the most important anthropometric measure, BMI, does not account for the distribution of body fat [28], and its utility as a predictor of excessive weight and obesity has recently been called into question. Concerns have also been raised regarding its capability to predict the risk of blood pressure and CVD [29, 30].

Total cholesterol shows a significant difference between the normotension and hypertension groups. This aligns with the International Study of Macro/Micro-nutrients and Blood Pressure (INTERMAP), which discovered a low-order, favourable link for several relevant factors, the relationship between dietary cholesterol intake and SBP [31].

Conclusion

It can be concluded that total cholesterol can be used as a predictor for hypertension risk. The higher the total cholesterol level, the higher the likelihood of hypertension. Fat accumulation on the endothelial walls of blood vessels can form plaque due to fat accumulation so that the arteries narrow and decrease in arterial elasticity (atherosclerosis), resulting in arterial stiffness and slow blood flow, which causes an increase in heavy heart load hypertension.

Recommendations

Reduced dietary cholesterol consumption may help prevent and manage high blood pressure in general populations. The study results suggest that health workers may improve health services, especially when delivering health education to the community, by describing the causes of hypertension in greater depth and providing adequate prevention. Respondents can consume foods that are high in fibre and low in carbohydrates, reduce the consumption of foods that contain high cholesterol, exercise regularly, control stress, check cholesterol and blood pressure regularly for a certain period, and regulate their lifestyle. Further studies could elaborate on how total cholesterol could affect blood pressure.

Conflict of Interest

Nil.

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