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Physical activity and the incidence of hypertensive heart disease in patients at Indonesia Hospital in 2022

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Abstract

Background: Hypertensive Heart Disease (HHD) contributes to the increasing burden of cardiovascular disease worldwide and is associated with an increased risk of death. Globally, the prevalence of HHD increased by 137.91% from 7.82 million in 1990 to 19.60 million in 2019. At the national level, China carries the highest prevalence of HHD, followed by the United States and India. Indonesia is ranked 3rd with the highest number of HHD sufferers in the world after China and India based on the DALY (Disability-Adjusted Life Year) level. Lack of physical activity has long been associated with the incidence of HHD. In Indonesia, 33.5% of the population is included in the low physical activity group. The province with the largest percentage of the population who does not do physical activity is DKI Jakarta, where 47.8% of the population does not do physical activity. **Methods:** This study used an analytical method with a retrospective cross sectional approach. The populations in this study were all HHD patients at the Cardiology Polyclinic of Pasar Rebo Hospital Jakarta with a total sample of 124 respondents. **Results:** The results of the univariate analysis in this study showed that as many as 69 respondents (55.6%) had low levels of physical activity, 46 respondents (37.1%) had moderate levels of activity, and 9 respondents (7.3%) had high levels of physical activity. The results of the bivariate analysis in this study using the chi square test showed that there was a relationship between physical activity and the incidence of HHD with p value = 0.000 dengan odd Ratio.

Keywords: Hypertensive, Hypertensive Heart Disease, Physical Activity

INTRODUCTION

Hypertensive Heart Disease (HHD) is a complication caused by high blood pressure which starts from preclinical, mechanical, cellular, and extracellular myocardial changes to become clinical signs of heart failure. In this model, an increase in blood pressure causes an increase in left ventricular wall pressure, which results in compensatory wall thickening and an increase in left ventricular mass. Gender, race, cytokines, neurohormones, and growth factors all play a role in the development of fibrosis, myocardial rigidity, and mechanical dysfunction, leading to VKi hypertrophy and remodeling, and ultimately heart failure[1].

A total of 17.1 million people worldwide in 2017 had HHD with a mortality rate of 925,675 people. The highest prevalence rate of HHD based on age standards in Kuwait was 637.5 per 100 thousand people and Jordan 632.5 per 100 thousand people. While the lowest prevalence rate of HHD is in the Netherlands at 46.8 per 100 thousand people and Ukraine at 26.9 per 100 thousand people[2]. The number of people with HHD in Indonesia is not known for certain, but it has been shown in various studies that people with hypertension can develop heart disease. About 50-60% of people with hypertension will have a risk of heart failure[3].

The results of the study (Waty & Hasan, 2013) stated that the prevalence of the incidence of HHD in adults (over 20 years of age) with congestive heart failure who were treated in the cardiovascular ward at H. Adam Malik Hospital Medan in 2011 belonged to the very high category, namely equal to 44.5%[4]. Another study by (Raka et al., 2015) in hospitalized patients showed that HHD was the most common cause of congestive heart failure in Irina F Heart RSUP Prof. Dr. R. D. Kandou Manado by 45.5%[5]. The results of these studies are supported by research results (Yanti, 2019) which show that the incidence of re-hospitalization in heart failure patients with HHD at RSUD Dr. Soedarso Pontianak by 60.1%[6]. This indicates that there is a relationship between the severity of hypertension and the incidence of re-hospitalization in heart failure patients with HHD. The data also show that about 40% of heart failure is not due to HHD. Based on the results of research (Karmilla Kaban, Pani Firman Saputra, 2017) conducted at the Cardiology Polyclinic of RSUD Raden Mattaher Jambi, it was found that there were 87 patients with hypertension without HHD[7].

Many factors can cause HHD. The factors are classified as non-modifiable and modifiable. Age, gender, and family history of hypertension are non-modifiable risk factors[3]. The results of the study (Hadiwiardjo et al., 2020) stated that patients with HHD at the Cardiology Polyclinic of Drajat Prawiranegara Hospital Serang Regency in 2018 were found at most >65 years of age as many as 12 people (34.3%) while at the age of <46 years as many as 2 people (5.7%)[8]. Another study by (Prakoso, 2019) showed that patients with HHD in RSUD Dr. Moewardi in 2017 as many as 45 people (56.25%) were found in patients with male gender, while as many as 35 people

(47.75%) were found in patients with female gender[9]. In addition, research results were also obtained (Zubir, 2020) which showed that patients with HHD in RSUD dr. Zainoel Abidin Banda Aceh City in 2014 the majority had a family history index of 34 people (57.6%)[10].

The risk factors that can be modified in patients with HHD include obesity, high-fat and high-salt diet, physical activity, and the degree of hypertension[3]. The results of the study (Lasianjayani, 2014) stated that hypertensive patients with obesity at the Cardiology Polyclinic of RSU Haji Surabaya in 2014 were found to be 23 people (79.3%)[11]. Another study by (Zubir, 2020) showed that if patients with HHD in RSUD dr. Zainoel Abidin Banda Aceh City in 2014 the majority had a poor diet as many as 32 people (54.2%), poor physical activity as many as 31 people (52.5%), and experiencing stage II hypertension as many as 31 people (52.5%)[10].

Physical activity is very important to prevent the occurrence of HHD. Regular exercise can help lower blood pressure by dilating or vasodilating blood vessels and burning fat in the arteries of the heart, making blood flow smoother. Physical activity reduces sympathetic nerve activity and increases arterial diameter by decreasing norepinephrine, renin, and systemic vascular resistance[12]. Globally, 81% of adolescents aged 11-17 years and adults over 18 years of age 28% do not do enough physical activity. In high-income countries, 35% of women and 26% of men are not physically active enough, compared to 24% of women and 12% of men in low-income countries[13]. In Indonesia, 33.5% of the population is included in the low physical activity group. The province with the largest percentage of the population who does not do physical activity is DKI Jakarta, where 47.8% of the population does not do physical activity[14].

The results of the study (Abadini & Wuryaningsih, 2018) stated that the level of physical activity of the people in Jakarta in 2018 of 59% had less physical activity[15]. Another study by (Lontoh et al., 2020) stated that 59.7% of the people in the Tomang sub-district, West Jakarta, had light physical activity[16]. Research by (Asrifuddin, 2017) stated that patients with hypertension at Level III Hospital R. W. Mongisidi Manado in 2017 had less active physical activity as many as 28 people (90.3%)[17]. However, the results of the study (Sitorus, 2018) stated that hypertensive patients in the Outpatient HKBP Balige Hospital had strenuous activities as many as 20 people (52.6%)[18]. Different research results were also found by (Situmorang, 2015) which showed that 41 people (57.7%) of hypertensive patients in the Inpatient ward of the Sari Mutiara Medan Hospital did good physical activity[19].

Based on the results of the description, it is known that there are differences between theory and research results, so the question arises how is the relationship between physical activity and the incidence of HHD in patients at Pasar Rebo Hospital in 2022.

METHODS

This study uses an analytical method with a retrospective cross sectional approach conducted from March to April 2022. The population in this study were all HHD patients at the Cardiology Polyclinic of Pasar Rebo Hospital Jakarta with a total sample of 124 respondents with inclusion criteria, including patients suspected of or diagnosed with HHD in middle age (45 – 54 years) to elderly (55 – 65 years), patients from the Pasar Rebo Hospital Polyclinic, had performed ECG and Echocardiography examinations, had heart abnormalities in the form of left ventricular hypertrophy in ECG and Echocardiography recording results, can speak Indonesian, and are willing to fill out a questionnaire.

Purposive sampling is the type of sampling used. The sampling procedure using purposive sampling is based on certain considerations such as inclusion and exclusion criteria that have been determined by the researcher and are considered to have a relationship with previously known population characteristics. The data collected in this study is by using primary data and secondary data. Primary data was obtained through interviews using the GPAQ (Global Physical Activity Questionnaire) questionnaire, while secondary data was obtained through medical record status to identify patients diagnosed with HHD.

In this study, data analysis was conducted through the use of SPSS software-version 24. First, to describe the frequency distribution of all analyzed variables. And then, to analyze the relationship between two variables using the chi square test. The significance level for all tests was set at 0.05.

RESULTS

Most (55.6%) of the respondents were in the age category 55 – 65 years (N=69), (61.3%) were female (N=76), (62.1%) had a family history of HHD (N=77), (57.3%) had a history of hypertension (N=71), (17.7%) had a history of DM (N=22), (55.6%) were included in the category of low physical activity (N=69), and (73.4%) were diagnosed with HHD (N=91). Statistical analysis the relationship between age, gender, family history, history of hypertension, history of DM, and physical activity with the incidence of HHD found a significant relationship. The results of the study can be seen in tables 1, tables 2, and tables 3.

Table 1: Respondent characteristics.

Variable	N	%
Age		
45 – 54 years	55	44.4
55 – 65 years	69	55.6
Gender		
Women	76	61.3
Men	48	38.7
Family history		
Yes	77	62.1
No	47	37.9
History of hypertension		
Yes	71	57.3
No	53	42.7
History of DM		
Yes	22	17.7
No	102	82.3
Physical activity		
Low	69	55.6
Moderate	46	37.1
High	9	7.3
HHD incident		
HHD	91	73.4
Not HHD	33	26.6

Table 2: Type of physical activity.

Activity type	N	%
Activities at work		
Yes	7	5,6
No	117	94,4
Activities of traveling from one place to another		
Yes	99	79,8
No	25	20,2
Recreational activities		
Yes	89	71,8
No	35	28,2
Daily activities		
Yes	124	100

Table 3: Factor associated with the incidence of HHD.

Variable	P value	OR	95% CI	
			Lower	Upper
Age	0.005	0.284	0.123	0.659
Gender	0.005	3.462	1.512	7.923
Family history	0.012	3.054	1.343	6.943
History of hypertension	0.000	14.784	5.137	42.546
History of DM	0.004	1.478	1.293	1.691
Physical activity	0.000	-	-	-
Activities at work	0.149	0.247	0.052	1.170
Activities of traveling from one place to another	0.051	2.750	1.095	6.907
Recreational activities	0.150	2.039	0.874	4.757

DISCUSSION

1. Age with incidence of HHD

Blood vessels become stiffer and their elasticity decreases with age. Stiff blood vessels and decreased elasticity in blood vessels causes blood to flow through a narrower lumen than usual with each heartbeat. This causes the risk for hypertension to increase in middle age (> 40 years)[20].

The results in this study indicate that there is a relationship between age and the incidence of HHD, where the majority of respondents are aged 55 – 65 years. This is in line with (Tackling G, 2021) which states that based on a meta-analysis, there is a log-linear relationship between an increase in blood pressure and an increased risk of cardiovascular disease, which increases with age[21]. Another study by (Liu et al., 2012) showed that left ventricular hypertrophy may be more common in adults <65 years[22].

However, the results of a different study by (Cuspidi et al., 2012) divided hypertensive patients into 3 groups of categories (Category I: 18 – 40 years, Category II: 41 – 64 years, Category III: >65 years), stating that the prevalence of hypertensive patients with left ventricular hypertrophy was mostly found in patients in category III (>65 years) as much as 63.6%, while in categories I and II it was around 29.4% and 48.2%, respectively. Overall, more than a quarter of patients with left ventricular hypertrophy have an increased left ventricular mass index. Elderly (>65 years) with hypertension have a risk of severe left ventricular hypertrophy 2 – 4 times higher than young and middle-aged people with hypertension[23].

2. Gender with incidence of HHD

The occurrence of hypertension is strongly related to gender, where the incidence in women is higher than men, especially when a woman experiences menopause[24]. The hormone estrogen is able to protect women who have not experienced menopause, which has a role to increase levels of HDL (High-Density Lipoprotein). High HDL cholesterol levels are one of the protective factors in the prevention of atherosclerosis. The existence of immunity in premenopausal women is thought to be due to the protective action of the hormone estrogen. Women lose the hormone estrogen, which has protected blood vessels from harm as they approach menopause. This process continues with the hormone estrogen which naturally changes in amount with the age of a woman, which usually begins around the age of 55 years[25].

The results in this study indicate that there is a relationship between gender and the incidence of HHD, where the majority of respondents are female. This is also in line with (Benjamin et al., 2017) which states that women tend to have uncontrolled blood pressure and new studies reveal that certain classes of antihypertensive drugs may be less effective in women[26].

However, the results of the study differed by (Sabour et al., 2012) from a total sample of 566 respondents, only 2.7% (15 samples) of postmenopausal women had an ECG picture with left ventricular hypertrophy. If concluded, there is no relationship between postmenopausal women and the occurrence of left ventricular hypertrophy. However, this does not rule out the lack of sensitivity to ECG criteria based on T-axis and QRS-T anomalies for diagnosing left ventricular hypertrophy[27].

3. Family history with incidence of HHD

The majority of hypertensive patients (90 – 95%) will be classified as essential or primary hypertension. Essential

hypertension has an unknown etiology. However, complicated interactions between genetic and environmental factors are a possibility[28]. Clients who have parents with hypertension are at higher risk for developing hypertension at a young age. This is due to the fact that many genes are involved in the Renin Angiotensin-Aldosterone (RAA) system, ion channels, α-Adducin, signal transduction pathway system/G protein, the noandrogenic system, as well as the immune and inflammatory systems, all of which play a role in the mechanism of hypertension involved can lead to HHD[29].

The results in this study indicate that there is a relationship between family history and the incidence of HHD, where the majority of respondents have a family history of HHD. The results of this study are supported (Atkilt et al., 2019) which divides patients into 2 groups, namely the case group and the control group. It shows that the case group with a family history has a higher proportion of cases by 28.3% compared to patients in the control group as much as 12.3%[30]. However, the results of a different study by (Aryantiningsih & Silaen, 2018) which also divided patients into 2 groups (cases and controls) showed that there was no significant relationship between family history and hypertension in HHD patients[31].

4. History of hypertension with incidence of HHD

High blood pressure has long been associated with the development of left ventricular hypertrophy. Based on the results of the analysis of the First National Health and Nutrition Examination survey, it shows that someone with high blood pressure has a 1.4 times higher risk of suffering from left ventricular hypertrophy compared to normotensive people[32]. Hypertension is a multifactorial disease characterized by an increase in blood pressure that causes a hemodynamic imbalance in the heart. Prolonged and prolonged increase in blood pressure causes changes in the structure of the heart muscle, coronary arteries, and heart conduction which is known as hypertensive heart disease with its manifestations in the form of left ventricular hypertrophy in systemic arterial systolic and diastolic hypertension[33].

The results in this study indicate that there is a relationship between a history of hypertension and the incidence of HHD. The results of this study are in line with (BP Damayanti & Limantoro, 2014) which states that patients with hypertension can experience left ventricular hypertrophy as a result of compensatory efforts in response to an increase in heart muscle wall pressure caused by pressure overload or volume load. volume overload)[34]. However, the results of a different study by (Prakoso, 2019) showed that HHD patients with a history of DM were 11 respondents (13.75%) higher than HHD patients with a history of hypertension as many as 4 respondents (5%)[9].

5. History of DM with incidence of HHD

Diabetes is one of the many risk factors for hypertension. Insulin resistance and hyperinsulinemia are thought to increase peripheral vascular resistance and vascular smooth muscle contractility in diabetic individuals by causing an overreaction to norepinephrine and angiotensin II. The Renin Angiotensin-Aldosterone (RAA) system and physiological feedback mechanisms result in an increase in blood pressure in this state, causing changes in heart function and structure, leading to HHD[35].

The results in this study indicate that there is a relationship between a history of DM and the incidence of HHD. This is in line with (Khansa & Partiningrum, 2018) which states that 71.4% of patients with left ventricular hypertrophy have a history of DM. Diabetes mellitus can cause left ventricular hypertrophy through the mechanism of p300 upregulation and abnormal insulin regulation that activates the RAA system[36]. Another study by (Mayasari & Salsabilah, 2019) also stated that patients identified with type 2 diabetes were one of the risk factors for the occurrence of ECG abnormalities. In individuals with diabetes, blood flow to the heart muscle is decreased, resulting in decreased energy and subsequently impaired ion exchange for depolarization and repolarization, leading to left ventricular hypertrophy and abnormalities in the ECG[37]. However, the results of a different study by (Prayoga, 2020) showed that there was no significant relationship between diabetes mellitus and left ventricular hypertrophy[38].

6. Physical activity with incidence of HHD

Physical activity is one of the factors that can help prevent left ventricular hypertrophy. Inactive adults have a faster heart rate, which makes each contraction of the heart muscle harder. The bigger and more often the heart muscle pumps, it makes circulation and elasticity decrease, causes damage to the structure and function of blood vessels, and increases pressure in peripheral blood vessels, resulting in an increase in blood pressure[39].

The results in this study indicate that there is a relationship between physical activity and the incidence of HHD, where the majority of respondents have low physical activity. This is in line with (Hajar, 2016) which states that one of the biggest risk factors for cardiovascular disease is lack of physical activity[40]. Individuals with low physical activity intensity (<600 MET-minutes/week) are twice as likely to develop cardiovascular disease as those with high physical activity intensity (>3000 MET minutes per week)[41].

Another study by (F. Fatimah et al., 2019) showed that as many as 27 respondents (71.1%) had a low level of physical activity with an OR value of 2.727 (OR > 1), where it can be concluded that someone who lacks physical activity has a higher risk of being physically active 2.727 times more likely to experience HHD than someone with a high level of physical activity[42]. However, the results of the study (Maulidina, 2019) showed different results, in which low physical activity did not have a significant relationship with the incidence of HHD[43].

7. Type of physical activity with incidence of HHD

a. Activities at work

Activities at work are divided into 2 types as stated in the GPAQ questionnaire, namely heavy work activities and moderate work activities. Strenuous work activity causes a large increase in breathing rate or heart rate for at least 10 minutes on a regular basis. Examples of heavy work activities in question include carpenter work such as sawing wood, masons, porters, or other construction work. Moderate work activities cause a slight increase in breathing rate or heart rate for at least 10 minutes on a regular basis. Examples of moderate work activities in question include work as an employee who is dominated by working indoors, work with light lifting, or work done at home such as feeding livestock, cleaning the yard such as pulling weeds or grass, etc.

The results of the analysis of the relationship between the type of physical activity and the incidence of HHD showed that there was no relationship between the type of activity at work and the incidence of HHD, where the majority of respondents were aged 55 – 65 years and did not work. This is in line with (Budiman et al., 2016) which states that age is related to a person's performance where there is a degeneration process, so in this case the ability of the organ will decrease. With increasing age, the condition, ability, and capacity of the human body will decrease and become more prone to fatigue. This is due to a decrease and muscle endurance, so fatigue will increase[44].

b. Activities of traveling from one place to another

The activity of traveling from one place to another is defined as an activity carried out by walking for at least 10 minutes on a regular basis to travel to a place. The results of the analysis of the relationship between the type of physical activity and the incidence of HHD showed that there was a relationship between the type of activity traveling from one place to another and the incidence of HHD, where the majority of respondents carried out these activities.

The results of the study are in line with the recommendation (Kemenkes, 2018) to carry out physical activity by walking from one place to another at least 30 minutes per day[45]. Individuals who do physical activity by walking regularly, there will be a decrease in vasopressin, an increase in the efficiency of the heart's work, and a decrease in sympathetic activity. As a result of a decrease in vasopressin and an increase in the efficiency of the heart's work, it causes a decrease in cardiac output followed by a decrease in systolic blood pressure. Decreased sympathetic activity causes vasodilation of blood vessels and total peripheral resistance followed by a decrease in diastolic blood pressure[46]. In addition, physical activity by walking regularly can also solve cholesterol in the form of fat in the blood which narrows blood flow, so that blood flow becomes smooth and there is a decrease in blood pressure[47].

c. Recreational activities

Recreational activity is a physical activity carried out by individuals in their spare time based on a desire because it provides satisfaction or pleasure. Recreational activities in question are recreational sports. Recreational sports are divided into two types according to what is listed in the GPAQ questionnaire, namely strenuous recreational sports and moderate recreational sports that are carried out for at least 10 minutes regularly. Examples of strenuous sports recreational activities include fitness, football, boxing, basketball, and running. While examples of moderate sports recreational activities include brisk walking, swimming, cycling, horse riding, swimming, playing golf, and volleyball.

The results of the analysis of the relationship between the type of physical activity and the incidence of HHD showed that there was no relationship between the type of recreational activity and the incidence of HHD, where the majority of respondents carried out recreational activities. This is in accordance with (Kemenkes, 2018) which states that the type of physical activity that is effective in reducing blood pressure is activity by walking from one place to another with a minimum of 30 minutes per day[45].

However, another opinion by (Kardi et al., 2020) states that recreational functional activities can maintain health, especially when entering old age. The elderly need physical exercise that not only impacts their physical abilities, but also psychology that allows them to achieve physical, psychological, and social health through the use of recreational functional activities[48]. Recreational functional activities have been shown to increase endorphins and the transmission of neurotransmitters (noradrenaline, dopamine, and serotonin) in the brain. These components help in lowering stress levels, while endorphins help in increasing happiness[49].

CONCLUSIONS

This study reveals that the incidence of HHD in the Cardiology Polyclinic of Pasar Rebo Hospital is 73.4%. There is a relationship between individual characteristics, physical activity, and types of physical activity traveling from one place to another with the incidence of HHD in Pasar Rebo Hospital.

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ETHICAL CLEARANCE

This research has received ethical approval from the Research Ethics Committee, Health Polytechnic of Jakarta I No.011/KEPK/II/2022.

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