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Association between Physical Activity Frequency and Hypertension Incidence among Indonesian Adults based on Indonesian Family Life Survey Wave 4 and 5

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Abstract

Introduction: Hypertension incidence among adults in Indonesia increase every year. Many factors affect blood pressure, such as lifestyle which include diet and physical activity. This research aimed to analyse the association between physical activity frequency and hypertension incidence in Indonesia.

Methods : This study used secondary data from Indonesian Family Life Survey Wave 4 and 5 held in 2007 and 2014, respectively from 257 adults. The subjects in this study had completed data on blood pressure, socioeconomic, and physical activity in both waves. The hypertension incidence was assessed using health practitioners' diagnosis. Data analysis was conducted in logistic regressions.

Results: There were differences in age, education level, systolic blood pressure (SBP), diastolic blood pressure (DBP), hypertension stage, and physical activities frequencies between IFLS4 data (2007) and IFLS5 data (2014) of the same subjects, with the p-values of <0.001. All of the physical activity frequencies (walk, moderate and vigorous) has no correlation with systolic blood pressure. The vigorous physical activity was positively correlated with diastolic blood pressure in both unadjusted (p=0.029) and adjusted analysis (p=0.017).

Conclusion: The frequency of physical activity (walk, moderate, and vigorous) was not correlated to systolic blood pressures, but vigorous physical activity was positively correlated to diastolic blood pressure. For hypertension prevention, vigorous physical activity need to be reduced into moderate activities.

Keywords: Diastolic blood pressure, Hypertension, Indonesia, Physical activity

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Introduction

Non-communicable diseases (NCD) was the foremost global cause of death all around the world, including Indonesia.[1,2] Hypertension is a worldwide health problem that lead to cardiovascular disease risk and stroke.[3,4] Large number of deaths are caused by severe and chronic hypertension and its complications.[5] It was estimated that hypertension contributed to 57 million Disability Adjusted Life Years (DALY) and approximately 7.5 million

deaths, or roughly 12.8% of the overall death all around the world.[6]

Hypertension is a non-communicable disease commonly known as the silent killer because it often occurs without symptoms or asymptomatic. Hypertension plays a significant role in the initiation of cardiovascular disease and becoming more linked to various factors leading to deaths.[7] Based on National Basic Health Research (RISKESDAS) data, there was an increase in the occurrence of hypertension in Indonesia, from 25.8% in 2013 to 34.1% in 2018. [8] The risk factors for hypertension were age, sex, nutritional status, and physical activity.[9]

Engaging in physical activity offers advantages in warding off the onset of cardiovascular disease and mortality risk.[10] Regular physical activity can decrease adiposity and increase body mass are also prevent several diseases that accompany obesity including disease of cardiovascular.[11] Obesity or overweight combined with an insufficient physical activity can elevate the probability of developing hypertension.[12] Physical inactivity can stimulate vasoconstriction in the blood vessels, resulting in changes to the cardiovascular system.[13] Additionally lack of physical activity in a person also results in a heart rate that tends to be higher so that the heart works harder when contracting and causes more significant pressure on the arteries.[14]

Given the preceding background, the objective of this research was to explore the connection between the frequency of physical exercise and hypertension in Indonesian adults aged 18 to 64 years using data obtained by Indonesian Family Life Survey (IFLS) from the fourth and fifth waves in 2007 and 2014. The respondent of 2007 and 2014 namely same people that aged 18-57 years in 2007 and 25-64 years in 2014. The use of two waves of IFLS aimed to compare the variables between 2007 and 2014.

Methods

Study Populations

The secondary data obtained from the fourth wave of the 2007 Indonesian Family Life Survey (IFLS), as well as the fifth wave in 2014 used in this study was initiated by RAND Corporation in 1993 with the aim of research and development selection that becoming an independent and non-profit organization. More than 30,000 adults living in 13 of 27 provinces in Indonesia's (DKI Jakarta, DI Yogyakarta, East Java, Central Java, West Java, North Sumatera, West Sumatera, South Sumatera, South Sulawesi, South Kalimantan, West Nusa Tenggara, Lampung, Bali) made up the IFLS subjects, which represents roughly 83% of the country's population. IFLS data contain information collected at the individual and household levels that were designed to provide data such as several economic and non-economic welfare indicators for studying behavior and outcomes.[15]

Data were analyzed from subjects that participated in the 4th and 5th IFLS, for a total of seven years. Adults aged 18 to 64 years who completed physical activity, anthropometric measurements, blood pressure readings, and sociodemographic information were included in this study. Pregnant and breastfeeding women, people with disabilities, having another chronic diseases, using anti-hypertension medication, has been diagnosed hypertension in 2007, and having diastolic blood pressure (DBP) >120 mmHg in 2007 or systolic blood pressure (SBP) >80 mmHg in 2007 were excluded from this study.

Figure 1 shows that IFLS4 respondents were 44.103 and total respondents aged 18-57 were 24.413 and IFLS5 respondents were 50.148 and total respondents aged 26-64 were 24.329. Total respondent with similar data in 2007 and 2014 were 6.311. Our study excluded 6.054 respondent and used a total of 257 respondents aged18-64 years that completed all information on physical activity related to hypertension.

Sociodemographic Characteristic

In this study, sociodemographic data were collected using a questionnaire. Geographical residence (rural or urban), marital status (married/ever married or not married), and education level (low if less than 12 years of school attainment or high if more than 12 years of school attainment) were the sociodemographic variables used in this study.

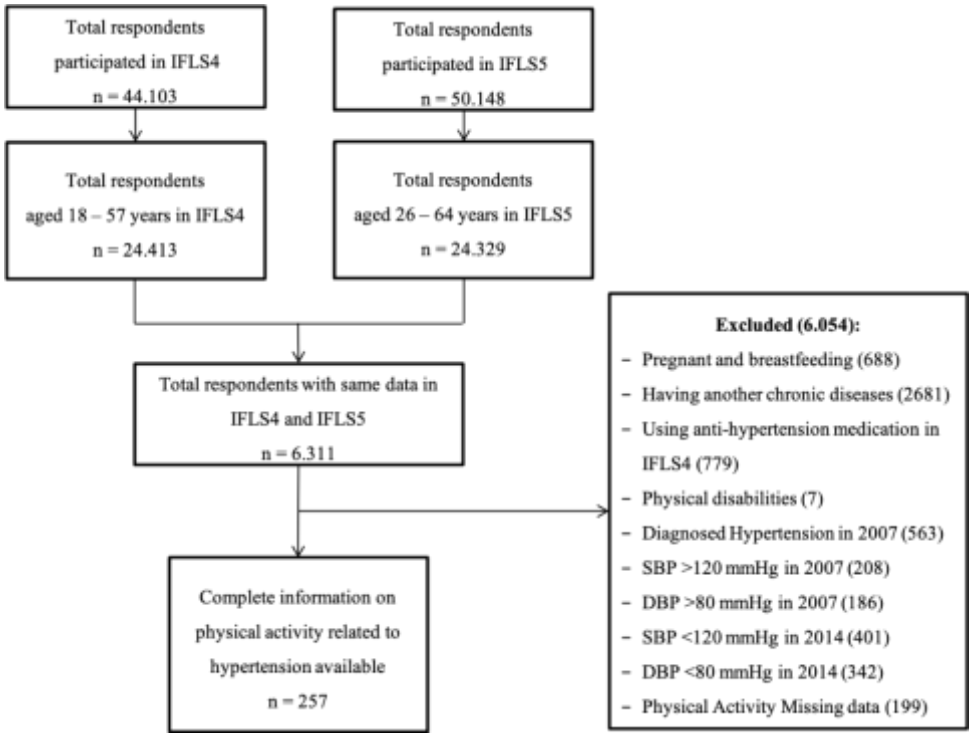

Figure 1. Flowchart of Study Participants

Hypertension Measurement

Diastolic and systolic blood pressure were used for the measure of hypertension that taken three times on alternate arms (left, right and left if possible) and measured by nurses. The tool that used to taking blood pressure was an Omron^{R} meter HEM-7203.[15] Cut offs for the criteria of hypertension: normal (SBP <120 mmHg and DBP <80 mmHg), pre-hypertension (SBP 120-139 mmHg) and DBP 80-89 mmHg), Stage I Hypertension (SBP 140-159 mmHg and DBP 90-99 mmHg) and Stage II Hypertension (SBP ≥160 mmHg and DBP ≥100 mmHg).[16]

Physical Activity Measurement

Physical activities frequency was categorized as vigorous, moderate and walk. Vigorous activities defined as activities that make the subjects had much harder breathing compared to usual. Moderate physical exertion was defined as activities that need somewhat harder breathing than usual, such as light lifting, cycling at a steady speed, and mopping the floor for at least ten minutes at a time in the last seven days. For walking, activities that included working at home, walking to move from place to place, or any other walking-related activities that respondents may participate in purely for enjoyment, sports, health, or leisure.[15] The measurement of physical activities was used by how many days the respondents did in the last week.

Statistical Analysis

This study used STATA 17 for processing and analyzing the data. While categorical data were presented as percentages and compared using chi-square, continuous data were displayed as mean ± SD and subjected to t-test analysis. The correlation between physical activity and blood pressure was examined through logistic regression. Sex and age were used in adjusted model. A statistically significant value was defined as a probability value of $p<0.05$.

Results

Table 1 shows that the mean age (standard deviation) of the participants in 2007 was 51(3) and 58(3) for 2014. There were a significant difference in marital status, geographical residence, educational level, smoking habits, waist circumferences, and hip between 2007 and

2014. Most of the participants had limited educational attainment. There was no significant difference between weight and height from 2007 to 2014. Between 2007 and 2014, the mean of systolic blood pressure rose from 127(9) to 152(18), and diastolic blood pressure increased too from 79(7) in 2007 to 89(11) in 2014.

Participants who had hypertension was increased from 257(100%) normal in 2007 to pre-hypertension 57(22.1%), then hypertension stage I 122(47.7%) and for hypertension stage II 38(30.3%) in 2014. The mean of physical activity was the same between walk and moderate 2007 and 2014. For walk, from 5(3) in 2007 to 4(3) in 2014 and moderate 5(3) in 2007 and 2(3) in 2014. Whereas, the mean of vigorous physical activity was reduced from 2(3) in 2007 to 1(2) in 2014.

Table 1. Subjects' Characteristics

Variable	Total (n=257)		p value [a]
	2007	2014	
Age(years), mean (SD)	51(3)	58(3)	<0,001
Marital Status, %			<0,001
Not Married	254 (98.8)	254 (98.8)	
Married/Ever Married	3 (1.1)	3 (1.1)	
Geographical Residence, %			<0.001
Urban	135 (52.5)	116 (45.1)	
Rural	122 (47.4)	141 (54.8)	
Education Level, %			0.001
Low (<12 years)	225 (87.5)	225 (87.5)	
High (>12 years)	32 (12.4)	32 (12.4)	
Smoking Habit, %			<0.001
No Smoking	149 (57.9)	142 (55.2)	
Smoking	83 (3.3)	85 (33.0)	
Former Smoking	25 (9.7)	30 (11.6)	
Waist Circumference (cm), mean (SD)	82 (10)	87 (10)	<0.001
Hip Circumference (cm), mean (SD)	100 (9)	94 (8)	<0.001
Weight (kg), mean (SD)	56 (10)	58 (10)	0.085
Height (cm), mean (SD)	155 (9)	155 (8)	0.704
SBP (mmHg), mean (SD)	127 (9)	152 (18)	<0.001
DBP (mmHg), mean (SD)	79 (7)	89 (11)	<0.001
Hypertension [b], %			<0.001
Normal	257 (100.0)	0 (0.0)	
Pre-Hypertension	0 (0.0)	57 (22.1)	
Hypertension Stage I	0 (0.0)	122 (47.4)	
Hypertension Stage II	0 (0.0)	78 (30.3)	
Physical Activity (days), mean (SD)			
Walk	5 (3)	4 (3)	<0.001
Moderate	5 (3)	2 (3)	<0.001
Vigorous	2 (3)	1 (2)	<0.001

Note: Categorical data are presented as n (%) and continuous data are presented as mean (SD).
[a] T test was used to compare between year 2007 and 2014 with significance p-value <0,05.
[b] Hypertensive defined as systolic blood pressure ≥ 140 mmHg or diastolic blood pressure ≥90 mmHg.

Table 2 displays the correlation between blood pressure and physical activity between 2007 and 2014. The dependent variables (systolic blood pressure 2007 and 2014) showed the negative correlations between independent variables (physical activity walk, moderate and vigorous 2007 and 2014). Based on the result of statistical test, systolic blood pressure in 2007 has no significant correlation with walking (p=0.188), moderate (p=0.321), and vigorous (p=0.740) physical activity. The 2014 results also demonstrated no correlation between systolic blood pressure and walking (p=0.283), moderate activity (p=0.452), and vigorous activity (p=0.979), even after adjusted with sex and age, there was no significant correlation found.

Table 2 The correlations between blood pressure and physical activity between

Dependent	Independent	Total (n=257)			
		Unadjusted		Adjusted	
		β Coefficient	p-value	β Coefficient	p-value
		2007			
BP-S	PA-Walk	0.268	0.188	0.360	0.401
	PA-Moderate	0.197	0.321	0.577	0.165
	PA-Vigorous	0.064	0.740	0.193	0.647
		2007			
BP-D	PA-Walk	0.239	0.133	0.212	0.183
	PA-Moderate	0.108	0.483	0.100	0.516
	PA-Vigorous	0.328	0.029 *	0.374	0.017
		2014			
BP-S	PA-Walk	0.399	0.283	0463	0.218
	PA-Moderate	0.300	0.452	0.285	0.480
	PA-Vigorous	0.016	0.979	0.078	0.901
		2014			
BP-D	PA-Walk	0.128	0.561	0.128	0.561
	PA-Moderate	0.308	0.192	0.308	0.192
	PA-Vigorous	0.285	0.437	0.285	0.437

Note: BP-S: Blood Pressure Systolic ; BP-D: Blood Pressure Diastolic ; PA: Physical Activity
Age and Sex was added as a variable for adjusted.
Hypertensive defined as systolic blood pressure ≥ 140 mmHg or diastolic blood pressure ≥90 mmHg.
*Significance p-value <0,05

Discussion

The results in this study was in line with previous research by Sihotang and Elon (2020) which showed that the systolic blood pressure was not significantly associated with physical activity (p=0,521).[17] This results also in accordance with Syahitdah & Rama (2018) study that systolic blood pressure showed negative association with physical activity (p=0,564).[18] However, the result of this study did not align with the research carried out by Teh et al. (2015) which emphasized that physical activity level (p=0.02) was correlated with the systolic blood pressure (SBP), but not correlated to the level of physical activity and diastolic blood (p=0.31).[19] Diastolic blood pressure in 2014 was also found not correlate with walking (p=0.561), moderate activity (p=0.192), and vigorous activity (p=0.437). There was a positive correlation between diastolic blood pressure and vigorous physical activity in 2007 (p=0.029). even after adjusted with sex and age, the p value was decreased to p=0.017. Blood pressure, heart rate, and pulmonary function will increase at vigorous physical activity.[20] increasing heart rate may result in an increase diastolic pressure with unchanged arteriole resistance. A higher diastolic blood pressure was the beginning point results from increasing heart rate.[21]

This results may be influenced by low education and living in urban. Table 1 shown that most of the respondents were in low education level and living at urban areas. Physical activity level was higher in the higher educational attainment related with working capacity and productivity at work. Rather than leisure time physical activity, occupational physical activity was used to define physical activity level.[22] The educational background was correlated to job performance. [23] Working in urban settings (white collar) or prestigious positions typically call for qualified or higher educational levels.[24] About 50% of office and administration support (OAS) job ads contain educational requirements.[25]

The combination of substantial workloads and limited job decision-making contributing to occupational stress has an association with hypertension.[26] Based on the previous research, higher diastolic blood pressure was significantly associated with low job control, but not for high job. Even after accounting for age, body mass index, heart rate, and smoking, it was still associated.[27] The correlation between job stress and cardiovascular diseases has been explained by Jayarajah and

Seneviratne (2019) using both direct and indirect mechanism. The direct mechanism worked through increased blood pressure and raised serum cholesterol and the indirect mechanisms were through smoking and alcohol intake.[26]

Theoretically, for the prevention of hypertension, physical activity was commonly recommended for a lifestyle modification.[28] Exercise also improves cardiovascular function by strengthening the vascular system and heart.[29] Regular physical activity help to reduce blood pressure, cardiovascular risk.[30] and markers associated with atherosclerosis.[31,32] The right duration of regular physical activity may decrease the blood pressure.[18] The analysis of 27 randomised controlled studies by Börjesson et al. (2016) showed that a regular aerobic exercise of medium to high intensity lowers blood pressure by 11.5 mmHg.[33] The other study by Sardana et al. (2021) showed that each 1000 steps resulted in a drop of 0.49 mmHg systolic and 0.36 mmHg diastolic.[34]

This study showed that there was no link between systolic blood pressure and any frequency of physical activity, whilst vigorous physical activity connected to diastolic blood pressure. The results of this study may be influenced by the choice of physical activity that was employed, which could be occupational rather than recreational.

Conclusion

Based on the study, it can be inferred that all frequencies of physical activity not associated with systolic blood pressure while vigorous physical activity associated with higher diastolic blood pressure, even after adjustment for sex and age. A further study which considering many other factors is needed, since hypertension has a multifactorial problem.

Ethics approval

The human Subjects Protection review process for the IFLS5 and all previous IFLS waves was conducted by IRB (Institutional Review Board) at RAND (United States) and Universitas Gadjah Mada (Indonesia).The protocol approval number (ethical clearance number) has been successfully reviewed and approved with the number S0064-06-01-CR01.[15]

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