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Risk factors of hypertension in rural Indonesia: a cross-sectional study from a rural village in Indonesia

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Abstract

Aim – To determine the risk factors of hypertension in rural Indonesia.

Methods – A cross-sectional study was conducted in a rural district in East Java, Indonesia. Using the modified WHO STEPwise approach to chronic disease risk factor surveillance (STEPS) questionnaire, variables related to the risk factors of hypertension were collected. Acquired data was analysed for significance using SPSS ver. 23.0 (IBM Corp, Armonk, USA).

Results – A total of 103 respondents participated in this study. The prevalence of hypertension in this study was 35.92%. Old age (OR = 8.25, CI 95% 1.69 – 40.31) and obesity (OR = 6.18, CI 95% 2.09 – 18.32) was found to be a significant risk factor of hypertension. While gender, education level, occupation, physical activity, and smoking habits were considered not significant.

Conclusion – Prevalence of hypertension in rural Indonesia is still high. This study highlighted age and body mass index as the significant risk factors of hypertension.

Keywords: Hypertension, Indonesia, Risk factor, Rural health

Background

Hypertension is a serious medical condition and have become a global health problem. Worldwide, an estimated of 1.13 billion people have hypertension, where majority of them live in low-and middle-income countries (WHO, 2019). In Indonesia, hypertension was estimated to affect 63.3 million people (34.1%), with higher prevalence in women (36.9%) (Ministry of Health, 2018). A recent study highlighted that prevalence of hypertension in rural area is higher compared to urban area (28.4% vs 23.9%) (Dastan et al, 2017).

Hypertension can increase the risk of developing diseases in major organs such as the heart, brain, eye, and kidney. An elevated blood pressure may damage the blood vessels in those organs and interfere with their ability to maintain the blood flow effectively. As a result, high blood pressure elevates greater risk for developing potentially life-threatening conditions (American Heart Association, 2016; WHO, 2019). Recent evidence showed that 23.7% of disease-related mortality in Indonesia were related to hypertension (Ministry of Health, 2018).

Several studies have outlined various risk factors of hypertension (Ibekwe, 2015; Kim and Lee, 2015; Babu et al, 2018; Edward and Periasamy, 2019). However, majority of those studies were conducted in urban area. Risk factors of hypertension in rural area might differ from urban area as there were different geographical condition, socioeconomic status, and lifestyle pattern between them (Dastan et al, 2017). Therefore, this study aims to analyse the risk factors of hypertension among adults in rural Indonesia.

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Methods

Study Design

An observational cross-sectional study was conducted in February 2020 at Songgon district in Banyuwangi Residence, East Java, Indonesia. Consecutive sampling was conducted on local villagers aged 18 years and above in a one-week period. The sample size was calculated using the formula for descriptive cross-sectional studies from Sample Size Determination in Health Studies (Hulley et al, 2013). Upon substitution of the variables and adding 20% of the calculated sample size for non-sample, we obtained 103 as the minimum sample for this study.

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Data Collection

Data was collected using a pre-validated interviewer administered questionnaire which was modified from the WHO STEPwise approach to chronic disease risk factor surveillance (STEPS). The questionnaire consisted of two parts. In the first part, we collected sociodemographic data, medical history, as well as behavior and lifestyle data which included physical activity and smoking habits. Physical activity was assessed by asking the average amount of time the respondent use to exercise which excludes work-related activity. Physical activity was further classified into low physical activity and high physical activity. Low physical activity was defined as exercising less than 30 minutes a day and less than 3 hours a week, while high physical activity was defined as exercising for more than 30 minutes a day or more than 3 hours a week. Smoking habits was classified into smoker and non-smoker. Smoker was defined as a person who smoke at least 1 cigarette a day in the last 30 days, while non-smoker was defined as a person who never smoked or smoked less than 1 cigarette a day in the last 3 months. In the second part of the questionnaire, we measured the respondent anthropometric index and blood pressure. All interviewers had undergone a standardized

training program for questionnaire administration, anthropometric index measurement, and blood pressure measurement. Height measurement was conducted using a stadiometer with a capacity of 200 cm and an accuracy of 0.1 cm. Respondent was asked to remove their shoes and head coverings, stand erect to the wall, and an interviewer will take record of the respondent height. Body weight measurement was conducted using a bathroom scale with a capacity of 120 kg and an accuracy of 0.1 kg. Respondent was asked to remove footwears, heavy clothing, and pocket belonging before being measured for body weight. Body mass index (BMI) measurement was conducted using standard formula, and the result was classified into underweight (BMI <18.5), normal (BMI 18.5 – 25.0), and obese (BMI >25.0). Blood pressure measurement was conducted using a sphygmomanometer and stethoscope.

Data Analysis

Acquired data was sorted out, coded, and analysed using IBM SPSS Statistics for Windows ver. 23.0 (IBM Corp, Armonk, USA). Descriptive data were presented in frequency tables whereas risk factors analysis was calculated using bivariate logistic regression to determine the risk. P-value of <0.05 was considered statistically significant.

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Ethical Clearance

This study follows the principles of the Declaration of Helsinki and had received ethical clearance from the Faculty of Medicine Universitas Airlangga before it began. Permission to conduct the study was also obtained from the community leaders and individual consent was obtained from the respondent prior to their inclusion in the study. Details that might disclose the identity of the respondents under study were omitted.

Results

Demographic Data

A total of 103 responses were collected for the survey. Mean age of the respondents was 43.70 ± 13.11. Most of the respondents were male, and the education level were mostly senior high school or higher. Regarding of the occupation, most of them were self employed or subsistence. Majority of the respondents had low physical activity and most of them were non-smoker. Based on the BMI, most of them were normal.

Blood Pressure

In this study, hypertension was diagnosed by blood pressure measurement when the respondents were resting for at least 10 minutes. The result was taken just once. Respondents with systolic blood pressure higher than 140 mmHg or diastolic blood pressure higher than 90 mmHg was diagnosed as hypertension. This study found 37 respondents (35.92%) have hypertension, while 66 respondents (64.08%) have no hypertension.

Risk Factor Analysis of Hypertension

Table 2 analyse the correlation between the demographic and anthropometric data of respondents and the respondents hypertension status. It was found that age and BMI were a significant risk factor of hypertension. However, we observed that gender, education level, occupation, physical activity, and smoking habits were not significantly related with increased risk of hypertension.

Discussion

We found that the prevalence of hypertension in our study was 35.92%, which consisted 40.00% of males and 25.00% of females. This figure was similar to previous studies (Dastan et al, 2017; Peltzer and Pengpid, 2018; Rahman et al, 2018) and the national prevalence of hypertension (Ministry of Health, 2018). One study found that prevalence of hypertension in urban area was significantly higher compared to the rural areas (Peltzer and Pengpid, 2018). It was argued that residence's awareness of their health and healthcare accessibility in urban areas were the cause of increased health-seeking behavior, which leads to the increased prevalence of hypertension in urban areas.

Similar to previous studies (Booth III et al, 2017; Dastan et al, 2017; Rahman et al, 2018) we found that older age correlates significantly with increased risk of hypertension. This study also observed that elderly (age group 61-70) had the highest risk of developing hypertension, which was in agreement with a previous study (Zdrojewski et al, 2016). It was argued that structural changes of blood vessels, reduced baroreceptor sensitivity, and decline in major organs function due to aging process may contribute to the increased prevalence of hypertension among elderly (Pinto, 2007).

In this study, we found that hypertension risk was not significantly correlated with gender. This finding was similar to some studies where gender was not a risk factor of hypertension in rural area (Dastan et al, 2017; Rahman et al, 2018). However, this result was different from previous studies (Reckelhoff, 2018; Song et al, 2020) where male tends to have higher blood pressure than female in the same age group. A study suggested that female have a greater anti-inflammatory immune profile than male to limit the increase of blood pressure, however the underlying mechanism is still unclear (Gillis and Sullivan, 2016). Therefore, we suggested that further studies were required to analyse the correlation between gender and hypertension.

Similar to previous studies (Adhitomo, 2014; Rahman et al, 2018) we found that education level was not significantly correlated with hypertension risk. However, this finding was different from several studies (Dastan et al, 2017; Peltzer and Pengpid, 2018) which states that low educational level increased the risk of developing hypertension due to unhealthy nutritional habits, poor stress management, and inadequate access to medical services. The authors argued that this difference might be caused by lower stress level observed in the rural areas (Swatan et al, 2020).

Our study found no significant correlation between employment status and increased hypertension risk. This finding was similar to several studies (Dastan et al, 2017; Satoh et al, 2017), but contradicts some (Steptoe et al, 2016; Rahman et al, 2018). It was argued that work might be stressful and may correlate with the increased risk of developing hypertension (Steptoe et al, 2016). However, we argued that work related stress might not be a significant predictor due to the lower stress level observed in rural areas (Dastan et al, 2017; Swatan et al, 2020).

Physical inactivity was known to be a predictor of increased risk for hypertension (Gambardella et al, 2020). In this study, we found no significant relationship between physical inactivity and hypertension. This result was different from several studies (Dastan et al, 2017; Diana et al, 2018; Peltzer and Pengpid, 2018). We argued that although residence in rural areas does not exercise routinely, their daily activities often involve ample amount of physical activity, which leads to a reduced risk of developing hypertension.

Different from the previous studies (Dhungana et al, 2016; Singh et al, 2017), this study found that smoking was not significantly correlated with the prevalence of hypertension. We argued that differences of the results might be due to variations in frequency and duration of smoking. It was known that smoking could stimulate sympathetic nerve which increases

cathecholamine production, systolic blood pressure, heart rate and endothelial dysfunction, which will eventually lead to hypertension (Singh et al, 2017).

In line with the previous studies (Singh et al, 2017; Babu et al, 2018), we found that BMI was significantly in correlation with the prevalence of hypertension. Obese respondents had sixfold risk of being hypertensive in comparison to underweight or normal BMI respondents. It was argued that increased body fat may cause an increase in peripheral resistance of arterioles. Other than that, urbanization could also change lifestyle and dietary habit which resulted in obesity and increased prevalence of hypertension (Abebe et al, 2015).

This study has several limitations. Firstly, this study was only conducted in one rural area which may not represent other rural areas in Indonesia. Secondly, limited amount time which restrict the sample size and method. However, we managed to reach the minimum sample required. Third, several data was collected based on respondent's memory which may potentially cause a recall bias. Therefore, further study with more sample size in several other rural areas is recommended.

Conclusion

Hypertension remains as a nation-wide problem in developing countries where Indonesia is no exception. Epidemiological studies of risk factors remain as an important focus in health promotion and prevention of hypertension. This study highlighted age and body mass index as the significant risk factors for hypertension while gender, education level, occupation, physical activity, and smoking habits was not significantly correlated with increased risk of hypertension. As there were still conflicting evidence regarding the predictors of hypertension risk factors, we suggest further studies with more sample sizes in several rural areas in Indonesia to further represent the whole population.

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Competing Interest:

The authors have declared that no competing interests exist.

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Data Availability Statement

Data used in this study is available at https://doi.org/10.6084/m9.figshare.12957992.v1

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Tables

Table 1. Demographical Characteristic of the Respondents

Demographic data (n=103)	**N(%)**
Age	
Range	18 – 70
Mean ± SD	43.70 ± 13.11
Gender	
Male	75 (72.82)
Female	28 (27.18)
Education Level	
Completed Elementary School	33 (32.04)
Completed Junior High School	18 (17.48)
Completed Senior High School or Higher	52 (50.48)
Occupation	
Self-employee/subsistence	32 (31.07)
Civil servant/non-government employee	28 (27.18)
Farming	21 (20.39)
Unemployed/retired	22 (21.36)
Physical Activity	
Low Physical Activity	67 (63.04)
High Physical Activity	36 (34.96)
Smoking Habits	
Smoker	43 (40.78)
Non-smoker	60 (59.22)
Body Mass Index	
<18.5	10 (9.71)
18.5 – 25.0	73 (70.87)
> 25.0	20 (19.42)

Table 2. Correlation analysis between risk factors and hypertension

Parameter	No Hypertension (n=66)	Hypertension (n=37)	OR (CI 95%)
Age			
≤ 40	33 (50.00)	8 (21.62)	1.00 (Ref)
41 – 50	18 (27.27)	13 (35.14)	2.98 (1.04 – 8.53)*
51 – 60	12 (18.18)	10 (27.03)	3.44 (1.10 – 10.75)*
61 – 70	3 (4.55)	6 (16.21)	8.25 (1.69 – 40.31)*
Gender			
Male	45 (68.18)	30 (81.08)	2.00 (0.76 – 5.29)
Female	21 (31.82)	7 (18.92)	1.00 (Ref)
Education Level			
Completed Elementary School	20 (30.30)	13 (35.14)	1.22 (0.50 – 3.03)
Completed Junior High School	12 (18.18)	6 (16.21)	0.94 (0.30 – 2.94)
Completed Senior High School or Higher	34 (51.52)	18 (48.65)	1.00 (Ref)
Occupation			
Self-employee/subsistence	22 (33.33)	10 (27.03)	1.21 (0.37 – 4.02)
Civil servant/non-government employee	14 (21.21)	14 (37.84)	2.67 (0.81 – 8.81)
Farming	14 (21.21)	7 (18.92)	1.33 (0.36 – 4.92)
Unemployed/retired	16 (24.25)	6 (16.21)	1.00 (Ref)
Physical Activity			
Low Physical Activity	44 (66.67)	23 (62.16)	0.82 (0.36 – 1.90)
High Physical Activity	22 (33.33)	14 (37.84)	1.00 (Ref)
Smoking Habits			
Smoker	23 (34.85)	20 (54.05)	2.20 (0.97 – 5.00)
Non-smoker	43 (65.15)	17 (45.95)	1.00 (Ref)
Body Mass Index			
<18.5	7 (10.61)	3 (8.11)	1.14 (0.27 – 4.83)
18.5 – 25.0	53 (80.30)	20 (54.05)	1.00 (Ref)
> 25.0	6 (9.09)	14 (37.84)	6.18 (2.09 – 18.32)*

Bivariate Logistic Regression was used

*significant for $p<0.05$