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The association between body mass index, hypertension, and lifestyle on cardiovascular disease in Indonesian elderly

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Background: Cardiovascular disease is one of the non-communicable diseases that causes most deaths in Indonesia. According to data from the Ministry of Health, coronary heart disease is the leading cause of all deaths at 26.4%. The rate of heart disease increases at a concerning pace every year, affecting at least 15 in 1000 Indonesians.
Objective: This study aimed to determine the relationship between BMI, hypertension, and lifestyle to heart disease in the elderly communities in Indonesia.
Methods: This study is a cross-sectional descriptive-analytic study that uses secondary data from a questionnaire in the Indonesian Family Life Survey (IFLS) 5 IIIB book. The sample includes elderly people in Indonesia who met both the inclusion and exclusion criteria and are registered as respondents in IFLS-5. The bivariate analysis used the Chi-Square test and the multivariate analysis used the multivariate logistic regression test.
Result: The result shows that there is a significant relationship between gender (p= 0.000; OR = 0.492; 95% CI= 0.351-0.691), education (p= 0.003; OR= 0.584; 95% CI= 0.409-0.833), BMI (p= 0.041; OR=1.748; 95% CI= 1.023-2.987), and smoking habits (p= 0.000; OR= 0.202; 95% CI= 0.125-0.327) with cardiovascular disease. The most significant factor is BMI (p= 0.041; OR=1.748; 95% CI= 1.023-2.987).
Conclusion: Gender, education, BMI, and smoking habits have a significant relationship with heart disease. BMI is the most significant factor and act as a risk factor of cardiovascular disease.

Keywords: *Elderly, BMI, hypertension, lifestyle, heart disease.*

INTRODUCTION

Heart disease is the leading cause of death worldwide; around 17.9 million people worldwide suffer from heart disease each year.[1] The highest prevalence of morbidity and risk factors for heart disease is in Southeast Asian countries, Indonesia.[2] According to data from the Ministry of Health, coronary heart disease is the main cause of all deaths, which is 26.4%.[3] The rate of heart disease increases every year; at least 15 out of 1000 people in Indonesia are affected by heart disease.[4] Based on data from the Ministry of Health in 2016 regarding non-communicable diseases, the age group of more than 60 years was ranked first as the age with the most coronary heart disease.[5]

Many studies on heart disease have been carried out, especially research on the relationship between Body Mass Index (BMI) and lifestyle to the incidence of hypertension. Still, studies that combine the three variables, namely BMI, hypertension, and lifestyle on heart disease, as far as researchers are looking, have never been done. In addition, respondents from existing studies are mostly adults; therefore, researchers are interested in researching elderly respondents to adjust data from the Ministry of Health, which states that Indonesia has entered the aging population structure. It is expected that the findings of this study will be more relevant to Indonesia's condition in the coming years. This study aimed to determine the relationship between BMI, hypertension, and lifestyle to heart disease in the Indonesian elderly.

MATERIAL AND METHODS

This was a descriptive-analytic study with a cross-sectional method using secondary data that has been taken using a questionnaire in the Indonesian Family Life Survey (IFLS) 5 IIIB. Respondents aged 60 and above in Indonesia who completed the IFLS 5 III-B questionnaire were included in this study, while respondents with missing data were excluded. The independent variables in this study were sociodemographic factors, BMI, hypertension, and lifestyle in the elderly. The sociodemographic factors measured using a sociodemographic questionnaire. BMI measurement is done by measuring the respondent's height (Seca plastic height board scale model) and weight (digital weight scale model Camry EB1003).[6] BMI classification was divided into obese (≥30.0) and non-obese (<30.0).[7] The hypertension factor was measured three times on the respondent's arm using Omron digital blood pressure meter, HEM-7203, averaged, then classified into hypertension (systolic ≥140 mmHg and/

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or diastolic ≥90 mmHg) and no hypertension.[6,8] The smoking habits were defined as the respondent's current smoking habit or burning cigarettes assessed in Smoking Habits section (KM).[6] The International Survey on Physical Activities Questionnaire (IPAQ), which has been translated into Indonesian was used to assess respondents' physical activity, which was then divided into two categories: moderate to heavy and light physical activity or walking.[9]

The dependent variable in this study is heart disease in the form of a heart attack, coronary heart disease, angina, or other heart problems that are currently or have been experienced by the respondent. The measuring instrument used is a questionnaire in CD (Chronic Conditions) section F.[10] To reduce bias, every measuring instrument used during data collection is calibrated.[10]

Data analysis was using the SPSS analysis program. The minimum samples required are calculated using the categorical descriptive formula and being weighted; the total sample was 4291. Univariate analysis is explained using a frequency distribution table—bivariate analysis using the Chi-square test. Multivariate analysis used a multivariate logistic regression test with a confidence interval of 95% and a degree of deviation of 0.05.

RESULTS

From 4291 respondents, the majority of the respondent were aged 60-79 years old (95.3%). Men (49.6%) and women (50.4%) have nearly same gender proportions. Most of the respondents' education level was less than nine years (84.7%). Table 1 shows information on the characteristics of research participants.

Age (p=0.017; OR=0.220; 95% CI=0.054-0.893), education (p=0.000; OR=0.418; 95%CI= 0.299-0.584), BMI (p=0.004; OR=2.099; 95% CI=1.248-3.530), and smoking habits (p=0.000; OR=0.280; 95% CI=0.180-0.437) were all found to have a significant relationship with heart disease. Table 2 displays the results of bivariate test.

The results of multivariate analysis using binary logistic test showed that the significant variables were gender (p=0.000; OR=0.492; 95% CI=0.351-0.691), education (p=0.003; OR=0.584; 95% CI=0.409-0.833), BMI (p=0.041; OR=1.748; 95% CI=1.023-2.987), and smoking habits (p=0.000; OR=0.202; 95% CI=0.125-0.327). The results of multivariate test can be seen in Table 3.

DISCUSSION

Age is known to play a role as one of the main risk factors for heart disease. A study conducted by Maharani, *et al.* stated that at the age of 60-64 years, the prevalence of a person's high risk of developing cardiovascular disease over the next ten years was 38.2%, at the age of 65-69 years, the prevalence increased to 39.5%, and it continues to increase with age.[11]

The study results are in accordance with the results of this study, where there is a significant relationship between age and heart disease (p=0.017). Still, the multivariate

Table 1. Respondent characteristics distribution frequency.

Variable		n	%
Sosiodemographic			
Age	60-79 years	4088	95.3
	≥80 years	202	4.7
Gender	Male	2126	49.6
	Female	2165	50.4
Education	≥9 years	657	15.3
	<9 years	3633	84.7
BMI	Not obese	4077	95.0
	Obese	214	5.0
Hypertension	No	1715	40.0
	Yes	2575	60.0
Lifestyle			
Smoking Habits	No	2845	66.3
	Yes	1446	33.7
Physical Activity	Moderate-High	2758	64.3
	Light/walking	1532	35.7
Cardiovascular Disease	No	4112	95.8
	Yes	178	4.2

BMI, body mass index

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Table 2. Bivariate analysis result.

Variable	p	OR	95% CI	
			Lower	Upper
Sociodemographic				
Age	0.017	0.220	0.054	0.893
Gender	0.335		0.639	1.165
Education	0.000	0.418	0.299	0.584
BMI	0.004	2.099	1.248	3.530
Hypertension	0.449		0.657	1.205
Lifestyle				
Smoking habits	0.000	0.280	0.180	0.437
Physical Activity	0.199		0.900	1.658

BMI, body mass index; OR, odds ratio

Table 3. Multivariate analysis result.

Variable	*p*	OR	95% CI	
			Lower	*Upper*
Age	0.060	0.235	0.052	1.061
Gender	0.000	0.492	0.351	0.691
Education	0.003	0.584	0.409	0.833
Body Mass Index	0.041	1.748	1.023	2.987
Hypertension	0.198	0.816	0.599	1.112
Smoking Habits	0.000	0.202	0.125	0.327
Physical Activity	0.164	1.248	0.914	1.705

OR, odds ratio

results showed a non-significant result (p=0.060). This meaninglessness may be caused by the determination to diagnose heart disease based on questionnaires rather than medical records, resulting in less accurate data; additionally, the researchers did not consider whether each respondent has the same access to health facilities and undergoes routine health checks, because the respondent may have heart disease but be asymptomatic.

Increasing age is associated with increased production of reactive oxygen species (ROS); increased ROS can cause functional and electrical heart disorders, usually related to persistent inflammation and chronic diseases such as heart disease.[12]

Based on the 2019 AHA update regarding heart disease and stroke, the incidence of heart disease was reported to be 77.2% in men and 78.2% in women from 60-79 years of age.[13] The higher prevalence in women is due to estrogen's cardioprotective role, which has been linked to a lower overall incidence of heart disease in premenopausal women than males of a similar age. That theory is not in accordance with the results of this study, where there was no significant relationship between gender and heart disease (p=0.335), but the multivariate test showed significant results (p= 0.000; OR= 0.492; 95% CI = 0.351-0.691), females are 0.492 times less likely to be at risk of heart disease. Although gender contributes to an individual's risk of heart disease, other factors such as smoking habits, high stress levels, poor eating habits, physical inactivity, and others all play a role. According to some theories, men are more likely than women to have high cholesterol levels and smoke more.[14]

The results of this study are inversely proportional to the research conducted by Suherwin at the Emergency Installation of Tk. II dr.AK.Gani Hospital Palembang in 2016 showed that there was a significant relationship between gender and the incidence of heart disease (p=0.002). However, in that study, the gender group that had a higher risk was male; there were 42 respondents aged <40 years. In theory, for respondents aged <40 years, the gender that has a greater risk is male.[15]

The World Health Organization (WHO) mentions that one of the specific health determinants is education.[16] In heart disease, education level affects the mortality rate, prevention behavior, and treatment.[17] In a study conducted by Dégano, *et al.* showed that respondents who had an undergraduate education level had a 49% reduced risk of developing heart disease compared to respondents with a low level of education.[18] This is in line with the results of this study, where there is a significant relationship between education

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level and heart disease (p=0.000), as well as the multivariate test (p=0.003; OR=0.584; 95% CI=0.409-0.833). People with education levels < 9 years have 0.584 times less risk for heart disease. This could be due to the less specific classification of education in this study; for example, if a person has an education level of < 9 years, the respondent may never have attended school, had his last education at elementary school or junior high school but did not finish, as well as an education level above 9 years. In addition, high education is usually associated with a high socioeconomic level that can lead to obesity, high alcohol consumption, and so on.

Individuals ≥ 75 years had a lower prevalence of obesity (27.8%) than those aged 65-74 years (40.8%). Research conducted by Anggraini, *et al.* showed that the average BMI of the elderly was 25±5,14.[19,20]

In this study, the results of the bivariate test showed a significant relationship between BMI and heart disease both bivariate (p=0.004) and multivariate (p=0.041; OR=1.748; 95% CI=1.023-2.987). People who are obese have a 1.748 times higher risk of developing heart disease.

The results of this study are in line with research conducted by Maharani, *et al.* which showed that obese individuals had a greater prevalence of heart disease risk over the next ten years (p<0,001;OR=1.66).[11] Aging accompanied with changes in body composition being the main factor causing this. The balance between energy intake and expenditure determines body fat mass. In the elderly, energy intake may decrease over time. Therefore, reduced energy expenditure plays an important role in increasing fat mass with age; it can increase a person's risk of obesity which can cause hemodynamic changes and changes in heart structure.[21]

According to the National Health and Nutrition Examination Survey (NHANES), 70% of adults aged 65 years have hypertension. A study conducted by Anggraini, *et al.* in 2020 showed that the elderly who had hypertension was 34%.[20,22] Another study conducted by Rulandani, *et al.* in 2015 also showed a significant relationship between blood pressure and heart disease (p=0.026).[23]

This is not in accordance with the results of this study, which showed that there was no significant relationship between hypertension and heart disease (p=0.449). This finding could be attributed to the fact that the researcher in this study did not use the respondent's hypertension medical record data to assess a person with hypertension, instead relying on the average respondent's blood pressure measurement.

High blood pressure causes the heart to work hard against this pressure. If this continues, the heart muscle and blood vessels will thicken and can cause heart failure. If there are cholesterol deposits in the blood vessels, it can increase a person's risk of having a stroke or heart attack.[24]

A study conducted by Hussain, *et al.* stated that smoking is one of the most common risk factors for vascular disease in men (64.9%). Smoking habits accounted for 25% as a risk factor for coronary heart disease.[14] This is in line with this study, which stated a significant relationship between smoking and heart disease (p=0.000; OR=0.202; 95% CI=0.125-0.327). These results indicate that respondents with a smoking habit of 0.202 times have a lower risk of heart disease. The researchers did not evaluate additional smoking parameters, such as respondent's past smoking habits, the duration of smoking, the number of cigarettes smoked per day and others factors which could have influenced the outcomes of this study. Smoking can cause atherogenesis, which can lead to atherosclerosis and atherothrombosis, both of which can impair heart function.[25]

A study conducted by Setyaji, *et al.* stated that those who did not do strenuous activities or only did activities < 80 minutes/week had a higher prevalence of coronary heart disease than those who were active (p=0.00).[26]

In contrast to the results of this study, which stated that there was no significant relationship between physical activity and heart disease (p=0.164). This could be due to the elderly's limited capacity to engage in moderate to vigorous physical activity. Furthermore, despite the fact that physical activity must be done on a regular basis to reduce a person's risk of heart disease, the amount of physical activity required was only seven days.

Physical activity or endurance training can increase HDL levels, reduce triglycerides, LDL, VLDL levels which can reduce the risk of coronary artery disease.[27]

This study has various limitations, including the fact that the data was gathered indirectly through secondary data available in IFLS-5, limiting both the topic and the variables chosen, the researcher also can not anticipated the errors that may occur during data collection. Furthermore, the data was not collected using medical records so the results could not be properly evaluated.

CONCLUSION

Gender, education, BMI, and smoking habits have a significant relationship with heart disease. The most significant factor is BMI as a risk factor for heart disease.

CONFLICT OF INTEREST

The author declares that there are no competing interests in this study.

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ETHICS CONSIDERATION

This research has been approved by the Ethics Commission of the Faculty of Medicine, Atma Jaya Catholic University of Indonesia.

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AUTHOR CONTRIBUTIONS

All authors equally contribute to the study from the conceptual framework, data acquisition, data analysis, and reporting the study results through publication.

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