

# The Relationship of Physical Activity and Body Mass Index with Blood Pressure in the Elderly at Social Foundation of Salib Putih Salatiga Nursing Home

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**Abstract**—Physical activity (PA) is an important factor to do, PA that has a relationship with body mass index (BMI) where BMI is also one of the factors that influence blood pressure (BP). The purpose of this study was to study the relationship between PA and the future with BP in the elderly. This research was an correlational analytics study using a cross sectional approach. The subjects of this study are the elderly who are at social foundation of salib putih salatiga nursing home. The sampling technique uses saturated samples where the sample is the entire population of 19 elderly. PA scores, body weight, height, and blood pressure values are obtained from direct measurements. Data analysis techniques in this study used the pearson correlation followed by linear regression analysis. The results found no relationship between PA with systolic blood pressure (SBP) ( $r = 0.173$ ) ( $p = 0.479$ ) and diastolic blood pressure (DBP) ( $r = 0.018$ ) ( $p = 0.943$ ) while for BMI associated with SBP ( $r = 0.820$ ) ( $p = 0.820$ ) = 0,000) DBP ( $r = 0.508$ ) ( $p = 0.027$ ) any increase in BMI of 1 kg / m<sup>2</sup> will be followed by an increase of 1.772 mmHg and 0.779 mmHg. It can be concluded that there is a relationship between BMI and BP but there is no relationship between PA and BP.

**Keywords:** *physical activity, bmi, blood pressure, elderly*

## I. INTRODUCTION

Metabolic diseases increase due to changes in unhealthy lifestyles in society. Changes in lifestyle are triggered by modernization and technological development in accordance with the flow of globalization which is increasingly advancing. One of the metabolic diseases caused by the lifestyle changes is hypertension. Based on blood pressure (BP) measurement data on the incidence of hypertension, Indonesian population aged  $\geq 18$  years in 2013 reached 25.8% and in 2018 it increased to 34.1% while in Central Java it reached 26.4%[1]. The condition of hypertension in adolescents / adults is lower when compared to the condition of hypertension in the elderly. The condition of hypertension in the elderly is influenced by increased BP in adolescence to adulthood and also hypertension is a major risk factor that significantly and independently increases the risk of cardiovascular disease[2].

WHO 2017 explains around 972 million people (26.4%) of the world's population suffer from hypertension and this percentage is likely to continue to increase to 29.2% in 2025, from 972 million people with hypertension, 333 million are in developed countries and 639 million are in a developing country<sup>3</sup>. The data explains the prevalence of elderly hypertension in Indonesia for 55-64 years old (45.9%), 65-74 years old (57.6%) and age  $> 75$  by (63.8%)[3]. There are several factors that influence the incidence of hypertension, including body mass index (BMI), lifestyle and unhealthy eating patterns. Physical activities such as yoga and brisk walking are effective for decrease blood sugar in people with hypertension[4], but in other studies explain there is no significant relationship between physical activity (PA) with BP[5], whereas in several other studies which mention that PA has a correlation with BMI where BMI is also one of the factors that influence BP[6][7]. An increase in BMI of 1 kg / m<sup>2</sup> is associated with an increase in SBP and DBP of 2.0 / 1.5 mmHg respectively[8]. BMI is positively related to systolic blood pressure and diastolic blood pressure [9].

Studies show that the average SBP and DBP is found increasing in men compared to women, which means that increasing in BMI is accompanied by increasing in SBP and DBP, and in men it is found statistically higher than women[10][11].

Increased SBP and DBP in the elderly is still common condition, and this needs attention. Based on data from 19 elderly in the Yayasan Sosial Panti Wredha Salib Putih Salatiga found a total of 8 elderly (42.1%) included in the category of hypertension, 6 elderly (31.6%) in the category of prehypertension and 5 elderly (26.3%) in the normal/ normotensive category. Based on the background of the problems that have been described above, it is necessary to conduct research that aims to determine the relationship of physical activity (PA) and body mass index (BMI) with blood pressure (BP) in the elderly. The existence of this research is expected to make efforts to prevent hypertension in a promotive and preventive manner.

**II. METHOD**

This research was an correlational analytic study using a cross sectional approach. This research was held in June 2018 at Yayasan Sosial Pantu Wredha Salib Putih Salatiga. The population in this study is elderly in Yayasan Sosial Pantu Wredha Salib Putih Salatiga that meet the inclusion and exclusion criteria. The inclusion criteria in this study were the elderly who lived at the Pantu Wredha with age > 50 years, male and female, no communication disorders, while the exclusion criteria in this study are the elderly who can move normally and are not having bed rest.

The sampling technique used in this study is saturated sampling, due to the relatively small population. The sample in this study was the entire population that met the research criteria of 19 respondents. In this study there are two variables, the independent variable and the dependent variable. The independent variables in this study are physical activity and body mass index while the dependent variable in this study is blood pressure.

Obtaining physical activity scores is done by filling out the Global Physical Activity Questionnaire (GPAQ) v2.0 with 3 outcome criteria, low, moderate, and high. Whereas BMI is obtained through measurements of height and weight that refer to WHO anthropometric standards 2007. Measurement of blood pressure is done by tensimeter which is categorized into normal blood pressure, prehypertension and hypertension according to the classification of JNC VII, 2003. Analysis of the data in this study used the pearson trial to prove the relationship between variables or more that would be solved by linear regression analysis processed with SPSS 21, but previously the normality of the data would be tested using the Komolgorov smirnov to access normally distributed data or not with a standard level significance > 0.05.

**III. RESULT**

In this study, 19 respondents of elderly people, the number of elderly men is less, that is 5 elderly (26%), compared to the women 14 elderly (74%). Blood pressure is categorized into three namely normal, prehypertension, and hypertension. Elderly included in the normal category there are 5 elderly (26.3%), prehypertension category 6 elderly with percentage (31.6%), and hypertension category totaling 8 elderly (42.1%).

Physical activity is categorized into three levels, low, moderate and high. Elderly who have a low level of physical activity amounted to 6 people (31.6%), while those included in the category of moderate physical activity level amounted to 8 people (42.1%) and elderly who reached a level of high physical activity amounted to 5 elderly people (26, 3%). Data can be seen in table 1.

**TABLE I. DISTRIBUTION OF RESPONDENTS**

Variable	n	%
<b>Gender</b>		
Men	5	26%
Woman	14	74%
<b>Blood Pressure</b>		
Normal	5	26,3%
Prehipertensi	6	31,6%
Prehypertension	8	42,1%
<b>Physical Activity</b>		
Low	6	31,6%
Moderate	8	42,1%
High	5	26,3%

**TABLE II. DATA NORMALITY TEST**

Data	p	Explanation
PA-SBP	0.661	Normal
PA-DBP	0.692	Normal
BMI-SBP	0.991	Normal
BMI-DBP	0.478	Normal

Normality test data is performed to determine whether the data is normally distributed or not. Based on table 2, it explains that the data of each variable is normally distributed with a significance level of > 0.05

**TABLE III. RELATIONSHIP BETWEEN PA AND BMI WITH BP**

Variable	Systolic	Dyastolic
Physical Activity	r= 0.173	r= 0.018
	p= 0.479	p= 0.943
Body Mass Index	r= 0.820	r = 0.508
	p= 0.000	p = 0.027

Based on table 3, it explains that there is no relationship between physical activity and blood pressure variables (systolic and diastolic) and there is a relationship between the Body Mass Index (BMI) variable and blood pressure (systolic and diastolic)

**TABLE IV. LINEAR REGRESSION ANALYSIS OF BMI WITH BP**

Variable	R <sup>2</sup>	Linear Equation	p
BMI	0.672	Systolic = 94.615 + 1.772 X	0,000
	0.258	Dyastolic = 67.018 + 0.779 X	0,027

Based on the explanation in Table 4, the R<sup>2</sup> value = 0.672 shows that the predicted value of the effect of BMI on SBP is 67.2%. Significant value was obtained at 0,000 (p <0.05) which means that there was a significant effect between BMI

and SBP. And the line equation is obtained  $Y = 94.615 + 1.772X$

Furthermore, the DBP obtained  $R^2 = 0.258$  which means that the predicted value of the influence of BMI on DBP is 25.8%. Obtained a significance value of 0.027 ( $p < 0.05$ ) which means that there is a significant influence between BMI and DBP, and the obtained line equation  $Y = 67.018 + 0.779 X$ .

#### IV. DISCUSSION

The results of this study indicate there is no significant relationship between physical activity and blood pressure while the body mass index has a significant relationship with blood pressure, this is in line with some previous studies that discuss the relationship between the BMI with the SBP and DBP[12] [7], and the relationship between BMI has been recognized as significant[13]. In studies looking for multiple linear (multivariate) correlation tests, it showed that overweight subjects had systolic and diastolic blood pressures which were respectively 5.1 mmHg and 2.5 mmHg, compared with individuals who had a normal body mass index. , whereas individuals in the obesity category each had higher levels of 11.3 and 6.2 mmHg[14]. Increased body mass index followed by an increase in average blood pressure which will trigger a higher risk of hypertension among overweight and obese population groups [15]. The effects of increasing BMI in women and men, they are at an increased risk of hypertension[9].

In addition to body mass index, blood pressure is also influenced by age. At the age of children, they have lower blood pressure than adults, but this will continue to increase with age and BMI[16]. Continuing from other studies mentioning the independent relationship between body mass index and age, although the magnitude of the correlation is different, but there is a significant correlation between body mass index with age compared to systolic and diastolic blood pressure. Data shows that individuals who are overweight and obese are more likely to have hypertension than those who have a normal BMI[17].

#### V. CONCLUSION

There is no correlation between physical activity and blood pressure, but there is a correlation between body mass index and blood pressure. Each increase in body mass index (BMI) per 1 kg / m<sup>2</sup> is predicted to increase systolic blood pressure by 1.772 mmHg and diastolic blood pressure by 0.779 mmHg. While the predicted effect of BMI on blood pressure was 67.2% and 25.8%, respectively.

#### ACKNOWLEDGMENT

The researcher thanks to the head of Social Foundation of Salib Putih Salatiga Nursing Home for letting the researcher to take the research. Thanks also to all elderly and to all participant who as well as support.

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