

## Research Article

# Correlation Between Age and Degenerative Diseases in Kendalkerep Primary Health Care (PHC) Malang

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**Abstract.**


Increasing life expectancy will increase the risk of degenerative diseases such as hypertension, hyperlipidemia, hyperglycemia and mental-emotional disorders in the elderly. This quantitative study aimed to determine the correlation between age and degenerative diseases. The independent variable was age and Body Mass Index (BMI) and the dependent variables were blood pressure, blood sugar and cholesterol. The population were pre-elderly and elderly in Kendalkerep PHC (8,629 elders). Researchers used 20% of the population as a sample (1,769 elders). The data collected was the elderly health screening data. Data collection was done through Google Forms. Data were analyzed univariate and bivariate to determine the correlation between age and BMI to the incidence of hypertension, hyperglycemia, and hypercholesterolemia. The univariate test showed that the majority of respondents were elderly (75.7%). 66% were female, 65.9% were classified as obese, 15.1% had moderate hypertension and 4.3% had severe hypertension, 13% suffered from hyperglycemia, 12.8% suffered from hypercholesterolemia and about 61.2% of elders had visual impairments. The Spearman test showed that there was a significant relationship ( $\alpha < 0.05$ ) between age and blood pressure, between BMI and blood pressure, between BMI and blood sugar, and between BMI and cholesterol. However, there was no relationship ( $\alpha > 0.05$ ), between age and blood sugar and between age and cholesterol. This study suggested that elders in Kendalkerep PHC should have further medical examinations to prevent further impacts such as degenerative diseases. However, improvement in ways of living is also suggested.

**Keywords:** Age, BMI, Blood Pressure, Blood Sugar, Cholesterol

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## 1. INTRODUCTION

The senior population is growing everywhere. However, Indonesia's elderly population is expected to grow faster than that of Asia and the entire world after 2050. According to the findings of the 2010 census of the population, Indonesia is currently one of the five nations with the highest concentration of old people world. Over the past 30 years, there

has been a huge rise in Indonesia's elderly population. According to current estimates, it will consist of 27.08 million people, or 9.99% of Indonesia's entire population (1).

The process of degeneration and aging is closely related to non-communicable diseases (NCDs). NCDs prevalence led to lower production, increased morbidity, and increased medical costs. (2). There is 63.5% of the old population suffers from hypertension, 5.7% of the elderly have diabetes mellitus, 4.5% have heart disease, 4.4% have strokes, 0.8% have kidney difficulties, and 0.4% have cancer (Risksedas 2018).

According to the research, hypertension is the most common issue affecting the elderly. A condition known as hypertension causes blood pressure to rise over normal ranges. According to the American Society of Hypertension (ASH), hypertension is a syndrome or group of escalating cardiovascular symptoms brought on by other complicated and connected illnesses. Although the exact etiology of hypertension is unknown, its effects result in morbidity that necessitates severe medical attention and a high fatality rate, earning it the nickname "the silent killer." Numerous known causes of hypertension include modifiable causal variables (diet, obesity, smoking, diabetes mellitus, exercise habits, stress and personality type) (3) and unchangeable causal factors (age, race, gender and genetics) Coronary heart disease, heart failure, stroke, chronic renal failure, and retinopathy are complications that can arise from hypertension.(4). The elderly must apply self-management as one of the illness management strategies in daily life and maintain a healthy lifestyle in order to prevent the complications of hypertension.

According to research, age has an impact on the prevalence of obesity, hence the chance of becoming obese increases with age. Obesity is a result of an imbalance between the body's energy expenditure and food consumption. Lifestyle, diet, and physical activity are a few of the causes of obesity. Adult obesity affects one's health since it increases risk factors for non-communicable diseases like weight gain and becoming obese. (5). According to the study, pre-elderly people who are fat are 2.53 times more likely to develop hypertension than those who are not obese. (6).

All bodily systems, including the endocrine system, suffer declines due to aging. Diabetes Mellitus is a common disorder that is brought on by situations of insulin resistance as people age, which leads to unstable blood sugar levels (7). DM is a condition defined by metabolic problems in the pancreas organ that result in hyperglycemia, a condition brought on by a reduction in the quantity of insulin produced by the pancreas (8). Age, physical activity, exposure to tobacco, blood pressure, stress, lifestyle, family history, HDL cholesterol, triglycerides, gestational diabetes, history of glucose abnormalities, and abnormalities are risk factors for the development of type 2 Diabetes Mellitus (9).

According to another study, the prevalence of diabetes is rising more quickly in low- and middle-income nations than in high-income nations. (10).

As people age, physiological capabilities deteriorate as a result of degenerative processes including elevated cholesterol levels (hypercholesterolemia), which can result in blood vessel blockage (atherosclerosis) (11). Two categories of factors—those that cannot be modified and those that can—are used to categorize the various elements that contribute to the rise in cholesterol levels. Genetics, age and gender, and education are among the unchangeable elements; on the other hand, lifestyle choices like smoking, drinking, lack of exercise, and obesity are largely influenced by diet and other behavioral factors like smoking and drinking (12). The most popular and useful metric for determining the prevalence of overweight and obesity in people is body mass index (BMI). A high BMI can suggest an increase in blood cholesterol as well as an increase in free body fat levels, which will result in an increase in the release of free fatty acids into the blood. Coronary heart disease will result from high cholesterol.

Health screening activities are one of the ways NCDs is prevented. Every Indonesian person over the age of 60 must undergo a standard health check, according to the Minister of Health Regulation. Measurements of blood pressure, blood sugar, cholesterol, and mental, emotional, and behavioural abnormalities, including senility, are among the benchmarks for screening elderly patients for health issues (13). According to Permenkes Number 75 of 2014, which deals with Community Health Centers, Puskesmas will take the main role in attempts to meet Minimal Standard targets, including providing screening services for the elderly (14). Elderly health screenings are organized by a number of health facilities, including Kendalkerep PHC. In the working region of Kendalkerep PHC, the goal of this study is to describe the health of the old and their relationship to the prevalence of NCDs in the elderly.

## 2. MATERIALS AND METHODS

The study design used in this research is quantitative analytic with a cross sectional approach. This study was conducted in collaboration with Health District Office Malang. The independent variable were age and BMI. Meanwhile, the dependent variable is blood pressure, blood sugar, and cholesterol. The population in this study were pre-elderly and elderly in the working area of the Kendalkerep PHC which amounted to 8,629. Researchers used 20% of the population as a sample, namely a total of 1,769 taken by quota sampling technique. The data collected is elderly health screening data based on instrument of Ministry of Health (MoH). Data was collected by using an online

survey method using google form. The data were analyzed univariately to determine the frequency distribution of each variable and bivariately using the Spearman correlation test to determine the correlation between age factor and blood pressure, the correlation between age factor and blood sugar, the correlation between age factor and cholesterol, the correlation between BMI and blood pressure, the correlation between BMI and blood sugar, and the correlation between BMI and cholesterol.

### 3. RESULTS

#### 3.1. Characteristic of Respondents

TABLE 1: Demographic Characteristic of Respondents.

No	Characteristic	Category	Frequency	Presentage
1.	Age	Pre Elderly ( $\leq 60$ Tahun)	429	24,3
		Elderly ( $> 60$ Tahun)	1.340	75,7
		Total	1.769	100
2.	Gender	Male Female	590 1.179	33,4 66,6
		Total	1.769	100

Table 1 shows a description of the characteristics of the elderly respondents who are included in the working area of the Kendalkerep PHC. Based on the percentage, it can be seen that the number of elderly people (75.7%) is more than the number of pre-elderly (24.3%). The data shows that based on the percentage of gender, more elderly is female (66.6%) than male (33.4%).

#### 3.2. Univariate Data

In table 2, the clinical condition of the respondents shows that in the elderly at Kendalkerep PHC, more elderly people have a Body Mass Index in the Obesity category (65.9%) and only 6% are included in the normal category (6%). Related to blood pressure, there are more elderly who have the Normal category (48.7%), however there are elderly who are included in the category of Mild Hypertension (31.8%). On blood sugar levels, more elderly has normal blood sugar levels (87%) compared to hyperglycemia (13%). Regarding cholesterol levels, more elderly has normal cholesterol levels (87.2%) than those with hypercholesterolemia (12.8%). Researchers also asked about the disorders experienced by the elderly related to kidney, vision and hearing. As many as 0.3% of

TABLE 2: Clinical Condition of Respondents.

No	Characteristic	Category	Frequency	Percentage
1.	Body Mass Index (IMT)	Underweight Normal	106 498	6 28,2
		Obesity	1.165	65,9
		Total	1.769	100
2.	Hypertension	Normal Low	862 563	48,7 31,8
		Middle Hypertension	268	15,1
		Severe Hypertension	76	4,3
		Total	1.769	100
3.	Blood Sugar	Normal	1.539	87
		Hyperglykemi	230	13
		Total	1.769	100
4.	Cholesterol	Normal	1.543	87,2
		Hypercholesterolemia	226	12,8
		Total	1.769	100
5.	Kidney Dissfunction	Yes	6	0,3
		No	1.763	99,7
		Total	1.769	100
6.	Visual Impairment	Yes	1.082	61,2
		No	687	38,8
		Total	1.769	100
7.	Hearing Impairment	Yes	145	8,2
		No	1.624	91,8
		Total	1.769	100

the elderly have kidney problems, 61.2% of the elderly have visual impairments and 8.2% of the elderly have hearing problems.

### 3.3. Bivariate Data

#### 3.3.1. Correlation of Age Factor and Blood Pressure

TABLE 3: Correlation Test Between Age and Blood Pressure.

Variable	Blood Pressure		Result
	P value	R Correlation	
Age	0,000	0,094	There is a significant relationship.

Based on Table 3, the analysis of the correlation between age and blood pressure produced a p-value of 0.000. This demonstrates a significant positive association between age and blood pressure. This implies that blood pressure rises with aging.

### 3.3.2. Correlation of Age Factor and Blood Sugar

TABLE 4: Correlation Test Between Age and Blood Sugar.

Variable	Blood Sugar		Result
	P value	R Correlation	
<b>Age</b>	0,737	0,008	There is no correlation.

Table 4 shows the analysis’s findings about the correlation between age and blood sugar when a p-value of 0.737 was found. This demonstrates that there is no significant correlation between age and blood sugar.

### 3.3.3. Correlation of Age Factor and Cholesterol

TABLE 5: Correlation Test Between Age Factor and Cholesterol.

Variable	Cholesterol		Result
	P value	R Correlation	
<b>Age</b>	0,591	0,013	There is no correlation

Based on table 5, the results of the analysis of the correlation between age and cholesterol obtained p-value = 0.591. This shows that there is no significant correlation between age and cholesterol.

### 3.3.4. Correlation of BMI and Blood Pressure

TABLE 6: Correlation Test Between BMI and Blood Pressure.

Variable	Blood Pressure		Result
	P value	R Correlation	
<b>BMI</b>	0,000	0,130	There is significant correlation.

Based on table 6, the results of the analysis of the relationship between BMI and blood pressure obtained a p-value = 0.000. This shows that there is a significant correlation between BMI and blood pressure with a positive correlation direction. This means that the higher the BMI, the higher the blood pressure.

### 3.3.5. Correlation of BMI and Blood Sugar

Based on table 7, the results of the analysis of the correlation between BMI and blood sugar when obtained p-value = 0.001. This shows that there is a significant correlation

TABLE 7: Correlation Test Between BMI and Blood Sugar.

Variable	Blood Sugar		Result
	P value	R Correlation	
<b>BMI</b>	0,001	0,079	There is significant correlation

between BMI and blood sugar while in a positive direction. This means that the higher the BMI, the possibility of an increase in blood sugar at any time.

### 3.3.6. Correlation of BMI and Cholesterol

TABLE 8: Correlation Test Between BMI and Cholesterol.

Variable	Cholesterol		Result
	P value	R Correlation	
<b>BMI</b>	0,001	0,081	There is significant correlation.

Based on table 8, the results of the analysis of the relationship between BMI and cholesterol obtained p-value = 0.001. This shows that there is a significant correlation between BMI with a correlation with a positive correlation direction. This means that the higher the BMI, the possibility of an increase in cholesterol.

## 4. DISCUSSION

### 4.1. Bivariate Data

#### 4.1.1. Correlation of Age Factor and Blood Pressure

According to the study’s findings, there is a direct association between age and blood pressure. This indicates that blood pressure rises as age increases. The elderly will experience changes, particularly physiological changes, as the function of body organs declines with age, either due to natural factors or disease. The cardiovascular system, which includes a decrease in the elasticity of the aortic wall, thickening and stiffening of the heart valves, and a decrease in the ability of the heart to pump blood, is one of the most common health problems experienced by the elderly. This results in a decrease in blood volume and contraction, a loss of blood vessel elasticity, a lack of effectiveness of peripheral blood vessels for oxygenation, and an increase in peripheral vascular resistance. This will raise blood pressure in the elderly.

According to other research, age affect hypertension in the elderly (3). The findings of this study are consistent with other studies that have shown that elderly people are

most likely to have high blood pressure. This is due to a decline in the body's capabilities as a person ages, especially the cardiovascular system, in this instance the heart and blood arteries. Blood pressure rises as blood vessels tighten and their walls stiffen (15).

Similar findings came from study that indicated people over 55 years of age were at higher risk for developing hypertension. Because of the aging process, which causes blood vessels to thicken and stiffen, blood pressure tends to be high (16). A person's body's ability to resist sickness and physiological function decline as they get older, making them more prone to illness. When blood arteries lose their flexibility, blood continues to flow through them without any dilatation, which raises blood pressure. This is one cause of hypertension in the elderly (17).

#### 4.1.2. Correlation of Age Factor and Blood Sugar

There is no correlation between age and blood sugar at any moment, according to table 4. The result might be happened because the different method of blood sugar test between one integrated health center for elders and another center. This condition lead to decrease the validity of blood sugar test.

The findings of this study unsupported by previous research that showed a correlation between age and fasting blood sugar levels in people with type 2 diabetes mellitus at KPRJ Proklamasi, Depok, West Java (P-value = 0.004). The aging process, which lessens the pancreas cells' capacity to make insulin, is what causes the risk of diabetes to rise with age, especially in people over the age of 40. Additionally, the mitochondrial activity in muscle cells decreased by 35% in elderly people. This causes insulin resistance and is linked to a 30% increase in muscle fat levels. (18).

According to the findings of a different study, genetic variables with a DM family (OR = 10,938), poor eating patterns, age 45, obese BMI, and low education level were risk factors that were shown to have an impact on DM, specifically type two at the Puskesmas I Wangon (7). A family history of diabetes increases a person's chance of having the disease by 6.48 times compared to a person without a family history (OR: 6.48; 95% CI: 2.08 - 20.21). The population, especially those with a family history of DM, needs to eliminate bad eating habits and boost physical exercise to avoid the development of DM (19). There is a correlation between type 2 diabetes mellitus and quality of life in the elderly, as indicated by the p value of 0.000 for this association (20).



### 4.1.3. Correlation of Age Factor and Cholesterol

Physical activity tends to decline with age, and there is a lack of sports activity, so it is possible that existing cholesterol cannot undergo a complete metabolic and combustion process in old age; in this case, the existing cholesterol will accumulate in the blood vessels and raise its levels in the blood. However, according to our findings there is no correlation between age and cholesterol as shown in table 5. One of the reason might be due to elders who is not consumes an excessive amount of cholesterol. Unfortunately, this study did not cover the data related to food recall of elders.

The findings of this study unsupported by previous research that showed that hypercholesterolemia develops when a person consumes an excessive amount of cholesterol, which raises blood cholesterol levels for an extended length of time. It can result in death in severe cases. Blood cholesterol levels are more likely to rise in overweight, physically inactive, smoker, and older people as well as in those who smoke (6).

Other study also showed that many elderly suffer from high cholesterol because as people age, their bodies become less active, causing the buildup of cholesterol in the liver. As a result, a healthy balance between nutrition and activity is necessary to prevent high cholesterol in the elderly (21). Additionally, the aging process causes changes in body composition that raise the risk of hypercholesterolemia in the elderly. As a result, body fat mass increases while lean mass and bone mass decline (22)

According to a different study, the prevalence of hypercholesterolemia was higher in the age group of 75 to 90 years, in women, pensioners, and people with higher levels of education, with average values of 229 mg/dl, 235 mg/dl, and 236 mg/dl, respectively. The study found that, on average, 228.56 mg/dl of blood cholesterol was present in more over half of the senior residents of PHC (23).

### 4.1.4. Correlation of BMI and Blood Pressure

Table 6 of the study's findings demonstrates that there is a correlation between BMI and blood pressure with a positive correlation direction. This implies that the prevalence of BMI is inversely correlated with blood pressure levels.

Body fat and the distribution of fat throughout the body are highly correlated with body mass index. Obese people automatically undergo a rise in fat tissue, which translates to larger body mass. More blood is required to provide oxygen and nutrition to the body's tissues the more mass there is in the body. This implies that the amount of blood circulating through the blood vessels rises, increasing the pressure on the artery walls.

As a result, blood pressure rises, increasing the blood vessels' resistance. To circulate blood throughout the body, the heart must exert more effort.

Our findings supported by other study which stated that there is significant correlation between BMI ( $p < 0,05$ ) and blood pressure having a correlation value of 0.316 for diastolic blood pressure and 0.330 for systolic blood pressure. This study demonstrates that BMI is one of the factors that must be taken into account and affects blood pressure (24).

Another study showed that, after adjusting for age and a family history of hypertension, elders who are fat have a 6.0-fold higher chance of having hypertension than elderly people who are not obese (25). Moreover, study in the work area of the Kuin Raya Health Center in 2022 also found that there is a relationship between obesity (P-value = 0.040) and the incidence of hypertension in the pre-elderly (26).

#### 4.1.5. Correlation of BMI and Blood Sugar

According to the findings, there is correlation between blood sugar and BMI. Accordingly, the likelihood of a rise in blood sugar at any time is higher the higher the BMI. As people get older, their metabolisms slow down, and most start storing extra weight as body fat. This happens as a result of an imbalance between energy intake and expenditure that causes an excessive buildup of body fat. Insulin participates in the metabolism of glucose, turning blood sugar into glycogen that is then stored in the body to help blood sugar levels return to normal. People who are obese have excess body fat, which can interfere with insulin's ability to do its job. Even when you are not eating, your blood sugar levels stay high because insulin cannot turn glucose into glycogen.

This is in line with study from the Sabar Narimo Posyandu, Semarang Regency, which found a connection between blood sugar and BMI in older patients. Furthermore, The study also recommends an activity, such as elderly exercise at least three times per week, that can lower the BMI index of the elderly without compromising their health. The elderly, especially those with a BMI above 27, are also advised to limit the volume of food and increase bodily movement as much as possible without exerting themselves so that their blood sugar levels stay conditional and not excessive (27).

According to the other findings of statistical analyses, factors such as respondents' obesity (OR=1,896 and  $p\text{-value}=0,000$ ) are associated to the prevalence of type 2 diabetes in older Indonesians. (28).

#### 4.1.6. Correlation of BMI and Cholesterol

The association between Body Mass Index and cholesterol has a positive correlation direction, according to table 8. This implies that there is a probability of a rise in cholesterol the higher the BMI. If the blood's level of cholesterol is adequate and stays within the range that is typically needed, the regulation of cholesterol metabolism will function normally. However, it is said that there may be abnormalities in the regulation of fatty acids in obese people, which will raise levels of triglycerides and cholesterol esters. High amounts of free fatty acids (FFA) are present in thicker adipose tissue in obese people, which causes an increase in FFA flow in the liver, which in turn increases triglyceride formation. These triglycerides will cause an excessive amount of VLDL to develop, which can then result in an abundance of LDL in the blood, raising total cholesterol levels.

The proportion of body fat mass has increased, which is reflected in the rising BMI. However, despite the fact that overweight and older people tend to have hypercholesterolemia, it is still possible for people to develop this metabolic illness at a young age as a result of lifestyle changes. A rise in excess BMI shows the quantity of body fat accumulated, and fat will undoubtedly also be seen in the blood (29).

The findings of this study are consistent with earlier research on pre-elderly people in Patihan Village, which found a substantial correlation between total cholesterol levels and both belly circumference and body mass index (BMI). The study recommends using healthy lifestyle practices to lower high cholesterol levels, including regular health maintenance, exercise, limiting fast food intake, and quitting smoking (11). Other study also showed that there is a relationship between weight with total blood cholesterol levels in the elderly  $p$  value 0.002 (where  $\alpha < 200\text{mg/dl}$ ) (30).

## 5. CONCLUSION

The results showed that the majority of respondents were elderly (75.7%). As many as 66% of female respondents, 65.9% classified as obese, 15.1% classified as moderate hypertension and 4.3% classified as severe hypertension, 13% suffering from hyperglycemia, 12.8% suffering from hypercholesterolemia and about 61,2% of elders have visual impairment. The Spearman test showed that there were a significant relationship ( $\alpha < 0.05$ ) between age and blood pressure, between BMI and blood pressure, between BMI and blood sugar, between BMI and cholesterol. However, there were no relationship ( $\alpha > 0.05$ ), between age and blood sugar and between age and cholesterol. This study

implies that elders in Kendalkerep PHC should have further medical examination to prevent further impact such as degenerative diseases. However, the improvement of ways of living is also suggested.

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