

The Relationship between Body Mass Index (BMI) and Total Cholesterol Levels in the Elderly in Warisa Village, Kampung Baru, Talawaan District, North Minahasa Regency

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ABSTRACT

Cholesterol is a fatty compound produced by various cells in the body. Increased levels of total cholesterol in the blood are the main cause of the burden of disease in developed and developing countries, namely as a risk factor for heart disease and stroke. Cholesterol levels are influenced by many factors, one of which is the body mass index (BMI). A person with a large BMI, will experience an increase in fat levels which can cause an imbalance in fat metabolism so that it can ultimately affect a person's body cholesterol levels. Therefore, this study aims to determine the relationship between BMI and total cholesterol levels in the elderly in Warisa Kamung Baru Village, Talawaan District, North Minahasa Regency. This type of research is descriptive analytical using a correlation research design with a cross sectional approach. The sampling technique is total sampling. The sample in this study is 50 elderly people in Warisa Kampung Baru Village. The instruments used are scales, microtoise, autocheck GCU meters, pen lancet, cholesterol strips, cotton alcohol and sterile gloves. The data was analyzed using the Spearman correlation test with a significance value of $p > 0.05$, then H_0 was accepted and H_1 was rejected. A total of 50 elderly people participated in this study with most having a normal BMI (44.0%), underweight (2.0%), overweight (18.0%), obese 1 (24.0%), obese 2 (12.0%). Most of the elderly who were respondents had good cholesterol (52%), high threshold cholesterol (30.0%) and high cholesterol (18.0%). This study concluded that there was no relationship between body mass index (BMI) and total cholesterol levels in the elderly in Warisa Kampung Baru Village, Talawaan District, North Minahasa Regency.

Keywords: BMI; cholesterol levels; elderly

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INTRODUCTION

Cholesterol is a fatty compound produced by various cells in the body, where about a quarter of the cholesterol produced, is produced by liver cells (Susanti et al., 2024). A condition in which the total cholesterol level in the blood exceeds >240 mg/dL is known as hypercholesterolemia (Budi & Sijabat, 2023). Increased levels of total cholesterol in the blood are the main cause of the burden of disease in developed and developing countries, namely as a risk factor for heart disease and stroke. About one-third of global ischemic heart disease cases are caused by high cholesterol levels (hypercholesterolemia).

This condition contributes greatly to the increasing prevalence of cardiovascular disease worldwide (Krispila et al., 2022).

The prevalence of elevated cholesterol levels in adults in the United States increased by > 12% in 2016, then increased to 40% in 2017 and continued to increase to 48.6% in 2018 (Krispila et al., 2022). It is estimated that elevated cholesterol levels contributed to 2.6 million deaths, or 4.5% of total deaths, and accounted for 29.7 million disability-adjusted life years (DALYs), which is equivalent to 2% of the total DALY (Iskandar et al., 2018). According to Basic Health Research 2018, the proportion of total cholesterol levels based on gender, is highest in women at 24.0% and men at 18.3% (Rahayu et al., 2023). Based on provincial data issued by the Ministry of Health in 2016 regarding the number of visitors with high cholesterol at posbindu and FKTP in North Sulawesi, the percentage of high cholesterol is 35.7% (Ministry of Health, 2017).

Increased cholesterol levels are influenced by several factors, namely irreversible factors and modifiable factors. Age, gender and genetics are factors that increase cholesterol levels irreversibly. Meanwhile, factors that can increase cholesterol levels that can be changed consist of physical activity, nutrient intake, smoking habits, alcohol, stress and body mass index (BMI) (Archilona et al., 2014).

Body Mass Index (BMI) is a simple index of weight to height used to classify overweight and obesity in adults. BMI is defined as a person's weight in kilograms divided by the square of height in meters (kg/m^2) (Budiman et al., 2022). Classification of Body Mass Index (BMI) based on the World Health Organization (WHO) Asia-Pacific, a person is said to be overweight if the BMI value is more than equal to 23 and is said to be obese if the BMI value is more than equal to 25 (Lim et al., 2017).

The greater the BMI value of a person, the higher the fat content in his body. Excessive fat accumulation will lead to increased lipogenesis activity and the amount of free fatty acids (*Free Fatty Acid*/FFA) until the cholesterol levels formed in the blood increase (Clarasinta, 2018). This is in line with a study conducted by Musdalifa et al in 2017, which showed that there was a meaningful relationship between BMI and total cholesterol levels (Musdalifa et al., 2017).

In Indonesia, the results of research on the relationship between body mass index (BMI) and cholesterol levels still vary. Research by Nugraha et al. on 96 respondents in Surakarta concluded that there is a relationship between BMI and total cholesterol levels (Nugraha et al., 2014). Similarly, a study by Sitepu of 93 respondents in hospitals also showed insignificant results (Nugraha et al., 2014). However, research by Koampa et al., (2016) found a significant relationship between obesity and *High Density Lipoprotein* (HDL) and *Low Density Lipoprotein* (LDL). Although research on the relationship between cholesterol and BMI has been widely published, studies comparing cholesterol levels between obese and non-obese individuals are still limited.

An elderly person is someone who has reached the age of 60 years (sixty) years and above (Hermawati & Sos, 2015). This group is interesting to study because the elderly tend to experience physiological changes that affect lipid metabolism, including

cholesterol levels. As we age, the body's ability to clear cholesterol in the blood decreases, so the risk of cardiovascular disease also increases. Older people often have different diets, physical activity, and health conditions than younger populations, so it's important to understand the relationship between body mass index (BMI) and total cholesterol levels in this age group (Widodo, 2020).

Initial research conducted on the elderly in Warisa Kampung Baru Village, Talawaan District, North Minahasa Regency, 2 out of 10 elderly people admitted to suffering from high cholesterol. Based on data from the Village Health Center, the number of elderly people who routinely participate in Posyandu Elderly activities is only half of the total elderly population in Warisa Kampung Baru Village, Talawaan District, North Minahasa Regency.

This study aims to determine in general the relationship between body mass index (BMI) and total cholesterol levels in the elderly in Warisa Kampung Baru Village, Talawaan District, North Minahasa Regency. Specifically, this study aims to determine body mass index (BMI) and total cholesterol levels in the elderly in the region, as well as analyze the relationship between the two variables.

The benefits of this research include both theoretical and practical benefits. Theoretically, this study is expected to be a source of literature and contribute to the development of medical science, especially in the study of body mass index (BMI) and its relationship with total cholesterol levels. Practically, this research provides benefits for various parties. For researchers, this research can add insight, knowledge, and understanding of the relationship between BMI and total cholesterol levels, as well as a means to hone skills in compiling scientific papers and meet one of the requirements to obtain a Bachelor of Medicine degree at the Faculty of Medicine, Sam Ratulangi University. For institutions, the results of this research are expected to be a useful reference for future research related to this topic. For the public, this study aims to increase their knowledge about the relationship between BMI and total cholesterol levels, as well as to encourage awareness about the importance of maintaining a healthy diet and lifestyle to improve the quality of health, especially among the elderly.

RESEARCH METHODS

Research Design

This study is an observational analytical research using a *cross-sectional cross-sectional* study research design which aims to examine the relationship between body mass index (BMI) and total cholesterol levels in the elderly in Warisa Kampung Baru Village, Talawaan District, North Minahasa Regency.

Location and Time of Research

This research was carried out in Warisa Kampung Baru Village, Talawaan District, North Minahasa Regency. The time of the research will take place from October to November 2024.

Research Population and Sample

The population in this study is the elderly living in Warisa Kampung Baru Village, Talawaan District, North Minahasa Regency. The sampling technique uses the Total Sampling method, by selecting all subjects that meet the inclusion and exclusion criteria. The inclusion criteria include the elderly who live in Warisa Kampung Baru Village, are willing to be research subjects by signing informed consent, and have stable health conditions and are able to follow research procedures. Meanwhile, the exclusion criteria included the elderly who were not present during data collection, did not fast before data collection, or had severe mental or cognitive impairments that hindered the ability to follow the research procedures optimally.

Data Collection Procedure

1. Survey of the elderly population in Warisa Kampung Baru Village, Talawaan District, North Minahasa Regency.
2. Collecting data for the elderly who meet the inclusion and exclusion criteria.
3. Measuring weight, height, and total cholesterol levels in the elderly in Warisa Kampung Baru Village, Talawaan District, North Minahasa Regency.
4. Processing data

Data Processing and Analysis

The results of the data that have been entered are re-checked (*editing*), then the answer coding stage (*coding*), then a table is made based on variables (*tabulating*) and finally entered into a computer program (*entry*) for statistical analysis with the SPSS (*Statistical Product and Service Solution*) program. Univariate analysis was carried out to determine the characteristics of the research subjects and distribute each variable studied. Univariate analysis was performed by entering the data separately in the frequency distribution table. Bivariate analysis is an analysis carried out to assess the relationship between two variables, namely between Body Mass Index (BMI) and total cholesterol levels. The test used is the *Spearman test*.

RESULTS AND DISCUSSION

Univariate Frequency Distribution

Table 1. Sample Distribution by Gender and Age

Gender and Age	Frequency (n)	Percent (%)
Woman	31	62,0
Man	19	38,0
61-70 years old	33	66,0
71-80 years old	17	34,0
Total	50	100,0

Based on the sample distribution (Table 1), it can be seen that the elderly who are the research sample amounted to 50 respondents consisting of 31 female samples (62.0%)

and 19 male samples (38.0%). The age of the elderly who were the most studied samples was 61-70 years old (66.0%), while the elderly were 71-80 years old (34.0%).

Table 2.Sample Distribution based on Body Mass Index

IMT	Frequency (n)	Percent (%)
<i>Underweight</i>	1	2,0
Usual	22	44,0
<i>Overweight</i>	9	18,0
Obesity 1	12	24,0
Obesity 2	6	12,0
Total	50	100,0

The distribution of samples based on BMI calculations (Table 2), data were obtained on the elderly who were underweight as many as 1 person (2.0%), normal as many as 22 people (44.0%), *overweight* as many as 9 people (18.0%), obesity I as many as 12 people (24.0%), and obesity 2 as many as 6 people (12.0%).

Table 3.Sample Distribution by Cholesterol

Cholesterol Levels	Frequency (n)	Percent (%)
Usual	26	52,0
High threshold	15	30,0
Tall	9	18,0
Total	50	100,0

The distribution of samples based on cholesterol (Table 3), data was obtained on the elderly who had normal cholesterol values as many as 26 people (52%), high threshold cholesterol as many as 15 people (30.0%), and high cholesterol as many as 9 people (18.0%).

Bivariate Frequency Distribution

Table 4. Spearman Correlation Test Body Mass Index and Cholesterol Levels

		IMT	Cholesterol
Body Mass Index	Correlation Coefficient	1,00	0,100
	Sig. 2-tailed	.	0,491
	N	50	50
Cholesterol	Correlation Coefficient	0,100	1,00
	Sig. 2-tailed	0,491	.
	N	50	50

Based on (Table 4), the significance value between the BMI and Cholesterol variables is 0.491 which means $p > 0.05$ so it can be concluded that there is no correlation

between these two variables, and the correlation coefficient obtained is 0.100 indicating a very weak correlation strength level relationship.

Discussion

Based on the results of research conducted in Warisa Village, Kampung Baru, data was obtained that of the 50 elderly, most of them had a normal body mass index, namely 22 elderly people (44.0%). While the rest have a body mass index *Underweight* (2.0%), *overweight* (18.0%), obesity 1 (24.0%), obesity 2 (12.0%). The results of this study are in line with the research conducted by Swastini, (2021) where the majority of the research respondents had a normal body mass index (22.6%). This is due to factors that can affect body mass index such as age, genetics, diet and physical activity (Jauza et al., 2023). The results of the study conducted on the elderly in Warisa Kampung Baru Village also showed that of the 50 elderly most of them had normal cholesterol values, namely 26 people (52%). While the rest have high threshold cholesterol values (30.0%) and high cholesterol (18.0%). The results of this study are in line with the research conducted by Aruan et al., (2022) where the majority of respondents in the study had normal cholesterol values (52%).

The results of Spearman's statistical test obtained a value of *p value* 0.491 (*p value* > 0.05) which means that H1 is rejected and H0 is accepted, there is no relationship between body mass index (BMI) and total cholesterol levels in the elderly in Warisa Kampung Baru Village, Talawaan District, North Minahasa Regency. The results of this study are in line with the research conducted by Wahyuni & Diansabila, (2021) where there was no relationship between the body mass index and the respondents' cholesterol levels with *p value* 0.576 and a correlation value of -0.127 which indicates a very weak correlation or negative correlation. Similar results were also obtained in a study at the Bhayangkara Polyclinic by Putri & Ciptono, (2022) Where in this study, no significant correlation was found between body mass index and total cholesterol *P value* 0.633. These findings are contrary to research conducted by Erda et al., (2023) where there is a significant relationship between the relationship between body mass index and cholesterol levels with the results of statistical tests obtained a *p value value* by 0.000 (*p value* < 0.05).

Cholesterol levels are not only influenced by body mass index (BMI) but also influenced by other factors that can be research biased. Diet is one of the main factors that affect cholesterol levels. Consumption of foods high in saturated and trans fats, such as fatty meats, full-fat dairy products, and processed foods, can increase LDL cholesterol (bad cholesterol) levels. On the other hand, a diet rich in fiber, fruits, vegetables, and unsaturated fats can help lower cholesterol levels. Physical activity can also lead to an increase in cholesterol levels. Regular physical activity helps increase HDL cholesterol levels (good cholesterol) and lower LDL levels (Setiani, 2022). Cholesterol levels tend to increase with age. In addition, hormonal differences between men and women also affect cholesterol levels. Women tend to have lower cholesterol levels before menopause, but after menopause, their cholesterol levels often increase. Genetic factors are also one of

the factors that also affect cholesterol levels. Some individuals may have a genetic predisposition to have high cholesterol levels regardless of their diet or lifestyle. Overall lifestyle, including smoking habits and alcohol consumption, can also affect cholesterol levels. Smoking can lower HDL levels, while excessive alcohol consumption can increase triglycerides (Mulyani et al., 2018).

Based on the results of the study where a *p value* of 0.491 (*p value* > 0.05) was obtained, which means that H1 was rejected and H0 was accepted, the researcher concluded that there was no significant relationship or correlation between body mass index (BMI) and total cholesterol levels in the elderly in Warisa Kampung Baru Village, Talawaan District, North Minahasa Regency.

Research limitations

This research has several limitations that need to be considered. The design of the study using a cross-sectional approach only allowed measurements of body mass index (BMI) and total cholesterol levels to be performed once at a single time point, so that changes in body weight that might affect the results could not be detected. In addition, data collection with the total sampling method faces obstacles because not all elderly people can be included in the measurement. This causes the number of samples obtained to be inconsistent with the research target. The non-participation of some of the elderly can affect the representation of the research results and potentially lead to selection bias, which can ultimately affect the overall interpretation of the data.

CONCLUSION

Based on the results of research conducted on the relationship between body mass index (BMI) and total cholesterol levels in the elderly in Warisa Village, Talawaan District, North Minahasa Regency, several findings were obtained. The majority of the elderly have a BMI value that is classified as normal, namely 22 people (44.0%). In addition, the majority of the elderly also have total cholesterol levels that are in the good category, namely 26 people (52%). However, the results of statistical analysis showed that there was no significant relationship between BMI and total cholesterol levels in the elderly in the region, with a *p value* of 0.491 (*p* > 0.05).

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