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Original Research Article

The Relationship of Body Mass Index with Total Cholesterol and Blood Pressure in Teachers and Staff at Fons Vitae I SMA Jakarta, 2019

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ABSTRACT

Overweight and obesity are disorders that can increase the occurrence of hypercholesterolemia and hypertension. Modern lifestyle trends: a diet high in calories, fat, and cholesterol and a sedentary lifestyle are risk factors for this problem. This study aims to determine the relationship between body mass index, total cholesterol levels, and blood pressure in teachers and staff at SMA Fons Vitae I Jakarta. This research was conducted by the cross-sectional method with a total of 52 respondents. Sample selection with total sampling and the data used is primary data. The results showed that the most criteria for body mass index were overweight (44.23%), the highest total cholesterol was normal (69.23%), the highest systolic blood pressure was normal (55.77%), and the highest diastolic blood pressure was normal (53.85%). In this study, there was a relationship between body mass index and total cholesterol (P-Value = 0.001; r = 0.447), systolic blood pressure (P-Value = 0.000; r = 0.494), and diastolic blood pressure (P-Value = 0.000; r = 0.561) on teachers and staff at SMA Fons Vitae I Jakarta.

Keywords: *body mass index, total cholesterol, blood pressure*

INTRODUCTION

Today, most people experience lifestyle changes such as changes in activity levels and eating patterns. Minimal body movement activities or a sedentary lifestyle and the habit of consuming high-fat foods are often found in people, especially in urban areas. This lifestyle can increase the risk of overweight and obesity. A person can be categorized as overweight or obese based on a body mass index calculation. Body mass index or BMI is a parameter used to classify a person into groups based on anthropometric measures of height/weight in adults. Based on the category, WHO divides BMI into underweight, normal range, overweight, and obese [1; 2].

A person with above average weight or obesity is at risk of cardiovascular disease (primarily heart disease and stroke). Data for Basic Health Research (Riskesdas) of the Ministry of Health of the Republic of Indonesia (2018) shows that the prevalence of obesity in adult men and women (> 18 years) continues to increase every year. In 2018, the majority of obesity in Indonesia reached 21.8%. The province with the highest prevalence of obesity is South Sulawesi and followed by DKI Jakarta [3]. According to the Indonesian Ministry of Health, cardiovascular disease is the number one cause of death from non-communicable diseases. Total cholesterol and blood pressure are indicators to determine the risk of cardiovascular disease [4]. One of the cardiovascular diseases that is closely related to obesity is atherosclerosis. Many risk factors influence the occurrence of atherosclerosis, such as hyperlipidemia, smoking, obesity, and hypertension [2; 5]. Several studies have proven that in various age groups, both women and men, along with increasing BMI, there is an increase in total cholesterol levels and blood pressure [6; 7]. The national prevalence of increased total cholesterol in the population aged 15 years and over in Indonesia, based on the Riskesdas survey in 2013, was 35.9% [8]. Based on the characteristics of residence prevalence, total cholesterol levels in urban residents are 39.5%. Meanwhile, based on the 2013 Riskesdas survey results, the population hypertension prevalence aged 18 years and over was 25.8%, and in 2018 there was an increase to 34.1% [3]. Lifestyle changes in the working class increase the risk of hypercholesterolemia and hypertension. Hypercholesterolemia or elevated total cholesterol levels generally do not cause symptoms, so regular checks of cholesterol levels are needed as a preventive measure for high-risk individuals [5]. Hypertension is a silent killer because it often does not show symptoms for ten to twenty years and is usually only known when complications occur in the target organ [9]. Hypercholesterolemia and hypertension are occupational diseases and are often associated with the workplace. The type of work, work environment, lifestyle, and individual characteristics of workers or employees can be a factor of hypercholesterolemia and hypertension. Employees spend approximately eight hours in five working days, so they do not have the habit of exercising regularly [10]. Researchers are interested in examining whether there is a relationship between Body Mass Index (BMI) with total cholesterol and blood pressure levels in teachers and staff of SMA Fons Vitae I Jakarta.

Based on the background of the problems described above, the researchers formulated the problem in this study, namely, "is there a relationship between body mass index (BMI) with total cholesterol and blood pressure levels in teachers and staff of SMA Fons Vitae I Jakarta" with the aim of research namely to determine the relationship between body mass index (BMI) with total cholesterol levels and blood pressure on teachers and staff of SMA Fons Vitae I Jakarta.

LITERATURE REVIEW

Anthropometry comes from the word "anthro" which means human and "metron" which means measure. Definitively, anthropometry studies the human body dimensions of bone, muscle, and adipose tissue or fat [11]. Humans will have different shapes, sizes, heights, and weights from one. The field of anthropometry includes various measurements of the human body, such as weight, position when standing, when stretching out arms, body circumference, and leg length [12]. According to the World Health Organization (WHO), Body Mass Index (BMI) is a simple index of weight to height used to classify underweight, overweight, and obese adults. BMI is defined as a person's weight in kilograms divided by the square of height in meters (kg/m2).

In general, BMI > 25 carries the meaning of obesity. WHO has classified a BMI below 18.5 as very thin, BMI over 23 as overweight, and BMI over 25 as obese. The ideal BMI for adults is between 18.5 and 22.9. So it can be concluded that the classification of BMI according to WHO is as follows.

Table 1. Classification of Overweight and Obesity in Adults Based on BMI according to WHO

Classification	BMI
Underweight	<18.50
Normal	18.50 – 24.99
Overweight:	≥25.00
Pre-obesity	25.00 – 29.99
Obesity grade I	30.00 – 34.99
Obesity level II	35.00 – 39.99
Grade III obesity	≥40.00

BMI only applies to adults aged > 18 years and cannot be applied to infants, children, adolescents, pregnant women, and sportsmen. Besides that, BMI is not applied to other special conditions (diseases) such as edema, ascites, and hepatomegaly. Many things can affect a person's body mass index, both directly and indirectly. Obesity comes from the Latin word meaning overeating. The term obesity itself, according to the Dorland medical dictionary, is an increase in body weight beyond the limits of physical and skeletal needs due to the accumulation of excessive body fat [13]. According to the World Health Organization, obesity is an abnormal or excessive fat accumulation that can impair health. According to WHO, in the year, 1.9 billion adults (>18 years) were in the overweight category, where 39% were men and 40% were women. Data from WHO states that 650 million adults fall into the obese category, with a prevalence by gender, 11% are male, and 15% are female. The majority of obesity in the world in 2016 rose three times from the prevalence of obesity in 1975 [14]. In Indonesia, based on the 2018 RISKESDAS, 13.6% of adults (>18 years) were in the overweight category, and 21.8% of adults (>18 years) were in the obese category. South Sulawesi Province ranks first with the highest obesity rate in Indonesia, which is as much as 30.2%, and DKI Jakarta ranks second in obesity rates in adults [3]. Obesity occurs when, over time, more kilocalories are taken in through food than are used to support the body's energy needs, with the excess energy being stored as triglycerides in fat tissue. Obesity is caused by many factors, including genetic, environmental, psychological, health, drugs, development, and physical activity [15]. Classification of obesity can be distinguished based on the distribution of fat tissue, namely.

Apple-shaped body - This type of obesity is also known as the android type. The distribution of fat tissue is more in the shoulders, face, arms, neck, chest, and upper abdomen. In this type of obesity, the organs most affected are the heart, liver, kidneys, and lungs. This type of obesity is usually found in men, although it is possible that this type of obesity can also be found in women. Generally, the android type is found in women who are on hormone therapy after giving birth or women who have gone through menopause because of functional disorders of the thyroid gland. Android obesity is one of the risk factors for cardiovascular disease due to hypercholesterolemia. Pear-shaped body - This type of obesity is also known as the gynecoid type. The distribution of fat tissue in this type of obesity is in the lower part of the body (hips and thighs). Lower body obesity is a state of high body fat accumulation in the gluteofemoral region. The organs usually affected are the kidneys, uterus, intestines, and bladder. The Third Type - Some people have a distribution of fat tissue that is spread from head to toe, like a barrel. The fatty tissue residing in their body impedes the movement of all internal organs and consequently affects their functioning. Usually, people with this type of obesity are slower because they are difficult to move.

Obesity can also be divided into several degrees based on the percent of excess fat, including [16]: Mild obesity, moderate obesity, and morbid. Obese patients whose body weight is 60% above the ideal body weight. At this stage, the risk of experiencing respiratory distress, heart failure, and sudden death increases sharply. Cholesterol is a wax-like substance, about 80% of cholesterol is produced by the liver, and the rest is obtained from cholesterol-rich foods such as meat, eggs, and dairy products. Cholesterol is needed for the body and is used to form cell membranes, produce cells, produce sex hormones, and form bile acids, which are needed to digest fats [17]. Cholesterol is highly soluble in fat but only slightly soluble in water and can form esters with fatty acids. Normal cholesterol levels in the blood are < 200 mg/dl, and if cholesterol levels in the blood have reached > 240 mg/dl, it can be said that they are high cholesterol levels.

The following is a classification of total cholesterol levels in humans quoted from ATP III (Adult Treatment Panel III) established by the National Education Program, National Heart, Lung, and Blood

Institutes in 2001. Cholesterol is synthesized from acetyl-CoA by a long pathway that can be divided into five stages, namely [18]: a) Synthesis of mevalonate from acetyl-CoA; b) Formation of isoprenoid units from mevalonate by releasing CO2; c) Condensation of six isoprenoid units to form squalene; d) Squalene undergoes cyclization to produce the parent compound, namely lanosterol; and e) The formation of cholesterol from lanosterol after going through several further steps, including the release of three metal groups. Cholesterol is soluble in water, so it requires a means of transportation to circulate in the blood, namely apoprotein, which is one type of protein. Cholesterol will form a complex with apoprotein to form a bond called lipoprotein [19; 20]. These lipoproteins are divided into four types, namely: chylomicrons, VLDL, LDL, and HDL.

There are three main pathways in cholesterol metabolism; exogenous, endogenous, and reverse cholesterol transport. In the exogenous pathway, dietary fat digestion occurs; Triglycerides and cholesterol in intestinal epithelial cells will combine with phospholipids and apolipoproteins to form lipoproteins called chylomicrons. Chylomicrons will enter the lymph channels to form Apo B, then enter the blood circulation. Triglycerides in chylomicrons will be hydrolyzed into Free Fatty Acid in adipose tissue, and chylomicrons that no longer contain triglycerides will become chylomicrons remnants that will enter the blood circulation. Remnant receptors in the liver will capture chylomicron remnants. In the endogenous pathway, the liver synthesizes VLDL, which contains triglycerides and cholesterol. VLDL will be hydrolyzed by lipoprotein lipase in adipose tissue into VLDL remnants or IDL and Free Fatty Acids.

Furthermore, IDL will be hydrolyzed by hepatic lipase into LDL. LDL contains much cholesterol. The binding of LDL to its receptors results in the absorption and release of free cholesterol. The remaining LDL forms lipoprotein(a), which will then bind to the extracellular matrix to store it in the blood vessels (the condition of excess LDL). Reverse cholesterol transport will bring cholesterol back to the liver. This pathway is essential for maintaining homeostasis because most cells in peripheral organs cannot catabolize cholesterol. The intestines and liver release a lipoprotein-poor lipid called nascent HDL. Nascent HDL will take cholesterol from macrophages and turn it into mature HDL. Cholesterol is selectively removed from the particles by the liver. Excess cholesterol is secreted into bile, and lipid-poor HDL is hydrolyzed or returned to circulation. Many factors affect cholesterol levels, after menopause, LDL in women usually increases, and HDL cholesterol usually decreases. Factors affecting blood cholesterol levels that cannot be modified are as follows: age and gender, genetic factors, liver disease, and hormonal [21; 22]. Factors that affect cholesterol levels and can be modified are food intake, stress, physical activity, and drugs.

Increased levels of cholesterol in the blood beyond normal (> 250 mg/dl) are called hypercholesterolemia.

Hypercholesterolemia is usually found in people with obesity, diabetes mellitus, hypertension, smokers, and people who often consume alcoholic beverages. Abnormalities cause increased cholesterol in the blood in lipoprotein levels of more than 200 mg/dl [23]. Hypercholesterolemia is classified into familial and secondary hypercholesterolemia. Blood pressure is determined by cardiac output and peripheral vascular resistance. An increase in cardiac output and peripheral vascular resistance causes an increase in blood pressure. If the heart increases while peripheral vascular resistance decreases and vice versa, blood pressure will not rise [3]. Cardiac output can vary by changes in heart rate or stroke volume. The innervation of the heart mainly controls heart rate, sympathetic stimulation increases the rate, and parasympathetic stimulation decreases. Stroke content is also partly determined by neural input. Sympathetic stimulation causes the muscle fibers of the myocardium to contract more forcefully for each length, whereas parasympathetic stimulation causes the opposite effect. The strength of cardiac muscle contraction depends on its preload and afterload. Preload is the degree of stretching of the myocardium before the myocardium contracts, and afterload is the resistance the blood faces when it is expelled.

The pressure in the aorta, bronchial arteries, and other large arteries in young adults increases to a peak value (systolic pressure) of about 120mmHg during each cardiac cycle and decreases to a minimum value (diastolic pressure) of about 70mmHg. This pressure is obtained when sitting or lying down. Significantly lower at night and lower in women than men, an increase in cardiac output increases systolic pressure, while an increase in peripheral resistance increases diastolic pressure. Factors affecting blood pressure are divided into two parts: genetic factors, age and gender, stress, body mass index, high salt consumption, and physical activity [24; 25]. Hypertension is a common disease for many people today, especially those who live in urban areas and have various risk factors for this disease. Hypertension is an increase in systolic pressure exceeding 140 mmHg and diastolic pressure exceeding 90 mmHg. Hypertension, better known as high blood pressure, is a state of change in which blood pressure is chronically elevated. In patients with hypertension, symptoms of health problems are not clear and without significant complaints [26]. The causes of hypertension are generally divided into essential hypertension (idiopathic) and secondary hypertension. Essential hypertension is the most common type of hypertension. This type of hypertension tends to occur in a person for many years throughout his life. Essential hypertension is defined as hypertension with no known cause. Essential hypertension alone constitutes 95% of all cases of hypertension [27].

Other medical conditions or certain medications cause secondary hypertension. This type usually resolves once the cause is treated or removed. Hypertension occurs because of vascular response to vasoconstrictor stimulation resulting from various factors. The sympathetic nervous system stimulates the adrenal glands to increase vasoconstrictive activity. The adrenal cortex secretes cortisol and steroids that can amplify the vasoconstrictive response of blood vessels. Vasoconstriction resulting in decreased blood flow to the kidneys can lead to the release of renin. Renin stimulates the formation of angiotensin II, a potent vasoconstrictor that stimulates aldosterone secretion by the adrenal cortex. This hormone causes sodium and water retention by the renal tubules, causing an increase in intravascular volume. All of these factors tend to trigger a state of hypertension.

RESEARCH METHOD

This research is an analytic observational study using a cross-sectional design to make observations and measurements at a certain time. Primary data sources are based on the results of BMI calculations by measuring height and weight, cholesterol levels, and blood pressure on teachers and staff at SMA Fons Vitae I. Collecting data at one time to find the relationship between the dependent variable (total cholesterol levels and blood pressure). blood) and Independent Variables (Body Mass Index). This research was conducted at SMA Fons Vitae I Jakarta in October 2019. The population can be grouped into two parts: the affordable population and the target population. The target population in this study were all teachers and staff at SMA Fons Vitae I Jakarta totaling 59 people. The sample in this study were all teachers and staff of SMA Fons Vitae I who met the inclusion criteria. The sampling technique in this research is total sampling. Total sampling is a technique with the same number of samples as the population. The total sampling was chosen because the population was less than 100. The research instruments used in this study were: identity sheets and respondent data, informed consent sheets, observation sheets, weight, and microtome scales, a multi-function Monitoring System for GCU, and GCU inspection consisting of Easy Touch GCU, Easy Touch GCU chip, handscoon, alcohol, and cotton. The tabulated research data were analyzed using univariate analysis to determine each variable's frequency distribution. The statistical test used to test the normality of the data in this study used the Kolmogorov Smirnov test because the sample size was 50. Furthermore, bivariate analysis was carried out to analyze the relationship between BMI, total cholesterol, and BMI with blood pressure. Here the statistical test used was the Pearson correlation test if the data were normally distributed or the Spearman correlation test if the data were not normally distributed.

RESULT AND DISCUSSION

This univariate analysis aims to explain or describe the characteristics of each variable studied. The univariate data consisted of gender and age as respondents' characteristics, body mass index as independent variables, and total cholesterol and blood pressure as dependent variables.

In Table 1, it can be seen the distribution of respondents by gender and age. Of 52 respondents, it is known that from the gender, there are 20 males (38.46%) and 32 females (61.54%). The age of the respondents was categorized into five groups, namely the age group 25 years, 26-35 years, 36-45 years, 46-55 years, and >55 years. The distribution of the age group 25 years as many as five people (9.62%), the age group 26-35 years as many as nine people (17.31%), the age group 36-45 years as many as 16 people (30.76%), the age group 46-55 years as many as 17 people (32.69%), and the age group >55 years as many as five people (9.62%).

Table 2. Distribution of Characteristics of Teacher and Staff Respondents

No	Characteristics of Respondents	n	%
1	Gender		
	Man	20	38.46
	Woman	32	61.54
	Total	52	100
2	Age		
	25 years	5	9.62
	26-35 years old	9	17.31
	36-45 years old	16	30.76
	46-55 years old	17	32.69
	>55 years old	5	9.62
Total		52	100

Table 3. Distribution of Body Mass Index of Respondents Teachers and Staff

No	Body Mass Index	n	%
1	Underweight	5	9.62
2	Normal	18	34.62
3	Overweight	23	44.23
4	Type I Obesity	4	7.69
5	Type II Obesity	2	3.85
	Total	52	100

Based on the research that has been done, it is obtained from 52 respondents who were included in the underweight category were five people (9.62%). In the regular category were 18 people (34.62%), in the overweight category were 23 people (44.23%), in the obesity category type I were four people (7.69%), and the rest fall into the category of obesity type II were two people (3.85%).

Table 4. Cholesterol Distribution of Total Respondents Teachers and Staff

No	Total cholesterol	n	%
1	Normal	36	69.23
2	Worrying	10	19.23
3	Tall	6	11.54
	Total	52	100

Table 3 shows the distribution of total cholesterol among 52 respondents in the normal category, as many as 36 people (69.23%), the worrying category, as many as ten people (19.23%), and the category with high cholesterol levels, as many as six people (11.54%).

Table 5. Blood Pressure Distribution of Teacher and Staff Respondents

No	Blood pressure	n	%
1	Systolic Blood Pressure		
	Normal	29	55.77
	Pre-hypertension	20	38.46
	Hypertension grade I	3	5.77
	Level II hypertension		
	Total	52	100
2	Diastolic Blood Pressure		
	Normal	28	53.85
	Pre-hypertension	20	38.46
	Hypertension grade I	1	1.92
	Level II hypertension	3	5.77
	Total	52	100

The data from the frequency distribution in Table 4 shows that respondents who have normal systolic blood pressure are 29 people (55.77%), categorical pre-hypertension blood pressure is 20 people (38.46%), and category I hypertension blood pressure is three people (5.77%). The distribution of respondents' diastolic blood pressure showed that 28 people (53.85%) had normal diastolic blood pressure, 20 people (38.46%) were in the pre-hypertension category, there was one person (1.92%) with level I hypertension category, and three people (5.77%) included in the type of hypertension level II.

This research was conducted on all teachers and staff at SMA Fons Vitae I Jakarta in September 2019. Based on the inclusion and exclusion criteria, a sample of 52 people met the requirements.

Table 6. Frequency Distribution of Body Mass Index Based on Gender Criteria

Body Mass Index										
Characteristics	***Underweight***		**Normal**		***Overweight***		**Obesity type I**		**Obesity type II**	
	N	**%**	**N**	**%**	**N**	**%**	**N**	**%**	**N**	**%**
Gender										
Man	2	10	6	30	10	50	1	5	1	5
Woman	3	9.38	12	37.50	13	40.63	3	9.38	1	3.13
Total	5	9.62	18	34.62	23	44.23	4	7.69	2	3.85

The results showed that the total number of teachers and staff of SMA Fons Vitae I from 52 research respondents consisted of 20 men who were included in the underweight category, as many as two people (10%) in the normal category, six people (30%) in the overweight category, ten people (50%) in the category of obesity type I and obesity type II each one person (5%). Meanwhile, consisting of 32 women who were included in the underweight category were, three people (9.38%) were included in the normal category were, twelve people (37.50%) were included in the overweight category were, 13 people (40.63%) in the type I obesity category was three people (9.38%). In category II obesity, there is one person (3.13%).

In the age distribution, the dominant respondents were aged 31-40 years and 41-50 years, each with 15 people with a percentage of 28.5%.

Table 7. Frequency Distribution of Body Mass Index by Age Group

Body Mass Index										
Characteristics	***Underweight***		**Normal**		***Overweight***		**Obesity type I**		**Obesity type Ii**	
	N	**%**	**N**	**%**	**N**	**%**	**N**	**%**	**N**	**%**
Age										
≤25 years	1	1.92	2	3.85	2	3.85				
26-35 years	1	1.92	1	1.92	6	11.54			1	1.92
36-45 years	3	5.77	6	11.54	6	11.54			1	1.92
46-55 years			7	13.46	8	15.38	2	3.85		
>55 years			2	3.85	1	1.92	2	3.85		
Total	5	9.62	18	34.62	23	44.23	4	7.69	2	3.85

Based on age group, out of 52 people consisting of 5 people who belong to the age group 25 years, one person (1.92%) has a BMI in the underweight category, and for normal and overweight BMI, every two people (3.85%). In the 26-35 year age group, one person (1.92%) each had a BMI in the underweight, normal, and type II obesity categories, while six people (11.54%) in this age group had a BMI in the overweight category. In the 36-45 year age group, three people (5.77%) were underweight, and in the normal and heavy categories, six people (11.54%). In the 46-55 year age group, seven people (13.46%) were in the normal category, eight people (15.38%) were in the overweight category, and two people (3.85%) were in the type I obesity category. In the age >55 years, there are two people (385%) each in the normal category and type I obesity, while for overweight, there is only one person (1.92%) only.

The distribution of results from the calculation of body mass index and total cholesterol on teachers and staff of SMA Fons Vitae I are presented in Table 7.

Table 8. Frequency Distribution of Body Mass Index Based on Total Cholesterol

Total Cholesterol	**Body Mass Index**									
	Underweight		**Normal**		***Overweight***		**Obesity type I**		**Obesity type II**	
	N	**%**	**N**	**%**	**N**	**%**	**N**	**%**	**N**	**%**
Normal	5	13.89	15	41.67	14	38.89	2	5.56		
worrying			1	10	8	80	1	10		
High			2	33.33	1	16.67	1	16.67	2	33.33
Total	5	9.62	18	34.62	23	44.23	4	7.69	2	3.85

Table 8. shows the characteristics of Body Mass Index based on total cholesterol levels. There are five people (13.89%) from the underweight group who have normal total cholesterol levels, followed by 15 people (41.67%) from the normal group and 14 people (38.89%) from the normal group. Overweight, and there are two people (5.56%) from the obesity type I group. As for the total cholesterol level that is in the worrying category, there is one person (10%) from the normal BMI group, eight people (80%) from the overweight group, and one person (10%) from the obesity type I group. For total cholesterol levels in the high category, there were two people (33.33%) from the normal group, one person (16.67%) from the overweight group, one person (16.67%) from the obesity type I group, and two people (33.33%) from the type II obesity group.

The results of the calculation of blood pressure on teachers and staff at SMA Fons Vitae I Jakarta for systolic blood pressure are presented in Table 8.

Table 8. Frequency Distribution of Body Mass Index Based on Systolic Blood Pressure

Systolic Blood Pressure	**Body Mass Index**									
	Underweight		**Normal**		***Overweight***		**Obesity type I**		**Obesity type II**	
	N	**%**	**N**	**%**	**N**	**%**	**N**	**%**	**N**	**%**
Normal (N=29)	5	17.24	15	51.72	7	24.14	2	6.90		
Pre-hypertension (N=20)			3	15	14	70.00	1	5	2	10
Hypertension I (N=3)					2	66.67	1	33.33		
Total (N=52)	5	9.62	18	34.62	23	44.23	4	7.69	2	3.85

In this study (Table 8), it showed that most of the respondents who had normal systolic blood pressure came from the normal BMI group, as many as 15 people (51.72%), followed by the overweight group, as many as seven people (24.14%), five people (17.24%) from type 1 obesity group, and two people (6.90%) from the underweight group. Of respondents who had systolic blood pressure in the pre-hypertension category, most of them were in the overweight group, as many as 14 people (70.00%), three people (15%) from the normal BMI group, two people (10%) from the obesity type II group, and one person (5%) from the obesity type I group. Meanwhile, respondents with systolic blood pressure in the category I hypertension category mostly came from the overweight group, with as many as two people (66.67%) and one person (33.33%) from obesity type I. No respondents had systolic blood pressure in the category II hypertension.

Table 9. Frequency Distribution of Body Mass Index Based on Diastolic Blood Pressure

Body Mass Index										
Diastolic Blood Pressure	***Underweight***		**Normal**		***Overweight***		**Obesity type I**		**Obesity type II**	
	N	**%**	**N**	**%**	**N**	**%**	**N**	**%**	**N**	**%**
Normal (N=28)	5	17.86	15	53.57	7	25	1	3.57		
Pre-hypertension (N=20)			3	15	14	70	2	10	1	5
Hypertension I (N=1)					1	100				
Hypertension II (N=3)					1	33.33	1	33.33	1	33.33
Total	5	9.62	18	34.62	23	44.23	4	7.69	2	3.85

Data from the frequency distribution results in Table IV.9 show that respondents who have normal diastolic blood pressure have normal BMI as many as 15 people (53.37%), seven people (25%) from the overweight group, five people (17.86%) from the group underweight, and one person (3.57%) from the obesity type I group. The group with pre-hypertension blood pressure was mostly in the overweight group as many as 14 people (70%), three people (15%) from the group with normal BMI, two people (10%) from the type I obesity group, and one person (5%) from the type II obesity group. Meanwhile, in respondents with diastolic pressure in the category I hypertension, only one person (100%) was from the overweight group. Respondents with diastolic blood pressure in the category II hypertension were one person (33.33%) each from the overweight, obesity type I, and obesity type II groups.

An analysis of the relationship has been carried out using the Pearson test to determine whether there is a relationship between Body Mass Index and total cholesterol and blood pressure. Previously, the data normality test was carried out on the research data using the Kolmogorov-Smirnov test. The results of the data normality test are normally distributed data, and the results of the Pearson correlation test are presented in Table 10.

Table 10. Results of Pearson test analysis of the relationship between body mass index and total cholesterol levels, and blood pressure

		Mean	Std. Deviation	N
BMI		2.6154	.91080	52
Cholesterol		1.4231	.69582	52
Systolic		1.5000	.61037	52
Diastolic		1.5769	.75006	52

Correlations

		BMI	Cholesterol	Systolic	Diastolic
BMI	Pearson Correlation	1	.447**	.494**	.561**
	Sig. (2-tailed)		.001	.000	.000
	N	52	52	52	52

*. Correlation is significant at the 0.05 level (2-tailed).

Correlations

	BMI	Cholesterol	Systolic	Diastolic
BMI Pearson Correlation	1	.447**	.494**	.561**
Sig. (2-tailed)		.001	.000	.000
N	52	52	52	52

*. Correlation is significant at the 0.05 level (2-tailed).

Based on Pearson correlation analysis (Table 6) obtained P-value (0.001) 0.05 for the relationship between BMI and total cholesterol levels, P-value (0.000) 0.05 for BMI with systolic blood pressure, and P-value (0.000) 0.05 for BMI with diastolic blood pressure means that there is a significant relationship between BMI with total cholesterol levels and blood pressure on teachers and staff at SMA Fons Vitae I Jakarta. The correlation value is 0.447 for BMI with total cholesterol levels with a positive correlation direction. The correlation value is 0.494 for BMI with systolic blood pressure, and the correlation value is 0.561 for BMI and diastolic blood pressure with a positive correlation direction.

From the results of the study (Table 5), it was found that the prevalence of body mass index for the underweight category between men and women did not show a prominent difference, while for the normal category, there were more women, as many as 12 people (37.50%) compared to men. In the overweight category, the prevalence of men is higher than women, where as many as ten men (50%) fall into that category. A higher obesity category was found in women and a higher prevalence of overweight in men. Of a total of 32 women, three people (9.38%) were included in the category I obesity category, and one person (3.13%) was included in the type II obesity category, different from the prevalence in men, from a total of 20 men one person was found each. (5%) who fall into the category of obesity type I and obesity type II.

These results are in line with previous research. Several studies have shown a significant relationship between gender and body mass index. Malcolm J. D'Souza's 2015 study found that a normal body mass index was found more in women, while higher BMI numbers, in this case, the overweight category, were more common in men. According to Malcom, women prefer food to be consumed than men, so normal BMI tends to be found more in women. In addition, Karina Araujo Pinto's 2018 research in Brazil also showed a higher prevalence of obesity in women than men, while the prevalence of overweight was higher in men. It is associated with a lack of time for self-care and physical activity in women because working women have to divide their time between work and housework [16]. Another study, also not much different from this study, obtained similar results, that women have twice the tendency to be obese compared to men [28].

In addition to gender, age can also affect a person's body mass index. The results of the study (Table 6) show that the majority of respondents are in the 46-55 year age group, 17 people (34%), followed by the 36-45 year age group with 16 people (30.76%). Based on the BMI category, the age group that has a normal BMI, the highest prevalence is in the 46-55 year age group, which is seven people (41.18%) of the 17 respondents, followed by the age group 25 years and > 55 years which are not much different, respectively. Each has as many as two people (40%) from 5 respondents. Meanwhile, for the overweight category, the highest prevalence was in the age group 26-35 years, with as many as six people (66.77%) from 9 respondents, followed by the age group 46-55 years with as many as eight people (47.06%) of 17 respondents. Type I obesity is only found in the age group of 46-55 years and >55 years, while the type II obesity category is only found in the 26-35 years and 36-45 years. The description of the results of this study proves that the age of 35-60 years has a large enough risk to have a BMI in the overweight and obesity categories.

It illustrates that overweight or obesity tends to occur in the older but productive age group. Various other studies also show the distribution of body mass index according to age group; as many as 84 people (34.6%) of the 108 respondents who fall into the obesity category belong to the 41-65 year age group [50]. Research conducted by Youssef in Al Madina also states that in the 40-60 year age group, obesity is higher than in the age group under 30 years. It is suspected that slow metabolism, lack of physical activity, and frequent food consumption can lead to excess fat accumulation [29].

Eating foods high in fat and carbohydrates can increase total cholesterol levels and increase the risk of being overweight and obese. The results of the frequency distribution in this study (Table 7) showed that the total cholesterol levels in 52 respondents with different BMI groups spread from the normal category (<200 mg/dL) to high total cholesterol levels (≥240 mg/dL). In this study (Table 3), respondents who had the largest normal total cholesterol levels were in the normal BMI group, many as 15 people (41.67% of 36 people who had normal total cholesterol levels) and followed by 14 people (38.89%) from the overweight group. Respondents with the largest worrying total cholesterol levels in the BMI group with the overweight category were eight (80% of 10 people with worrying total cholesterol levels). While the respondents who had the highest total cholesterol levels were in the group of people with normal BMI and type II obesity, there were two people each (33.33% of the six people who had high total cholesterol levels) and the remaining one person

(16.67% of the total cholesterol) each. Six people who have high cholesterol levels) in the overweight and obesity type I group. The description of this study's results proves that the group of people dominates people with total cholesterol levels above the normal limit with a BMI from overweight to obesity type II. Obese people do not always have high total cholesterol levels. High cholesterol is not always influenced by obesity, it is influenced by the consumption of foods that contain a lot of cholesterol, such as consuming meat, offal, and eggs which can increase cholesterol levels in the blood because these foods contain a fairly high cholesterol content [30]. However, overweight and obese people may have high total cholesterol levels. A study by Soegih found that the risk of developing comorbidities began to increase at a BMI of 24.91 Kg/m2 for total cholesterol levels [31].

The results of this study also found people who had normal BMI. Their total cholesterol levels were in the category of worrying too high, and this could be due to genetic factors. Familial hypercholesterolemia occurs because these patients do not have the gene to form the LDL receptor protein, so the cells cannot absorb LDL from the blood [32]. In addition to genetic factors, other factors support hypercholesterolemia in people with a normal BMI, namely diet and physical activity. A diet that is not maintained, in terms of food intake high in fat and carbohydrates consumed high, and the absence of physical activity can lead to the accumulation of cholesterol and fat in the body. Genetic factors cause a person to be fat, but uncontrolled diet and lack of physical activity can cause high total cholesterol levels beyond normal limits [33].

Blood pressure is determined by cardiac output and peripheral vascular resistance. An increase in cardiac output and peripheral vascular resistance causes an increase in blood pressure [34]. Blood pressure consists of systolic blood pressure (TDS), which is the blood pressure when the heart contracts to pump blood throughout the body, and diastolic blood pressure (TDD), which is the blood pressure when the heart relaxes between two contractions [22]. When viewed based on systolic blood pressure (Table 8), this study showed that 29 people (55.77%) had normal blood pressure, the largest of the group of people who had a normal BMI of 15 people (51.72% of 29 people who had normal TDS), 20 people (38.46%) had pre-hypertension, and the largest was in the overweight group as many as 14 people (70% of 20 people with pre-hypertension TDS), and three people (5.77%) had hypertension. When viewed based on diastolic blood pressure (Table IV.9), 28 people had normal blood pressure, and the largest was in the group of people with normal BMI, as many as 15 people (53.57% of 28 people who had normal TDD), 20 people (38.46%) had preeclampsia. Hypertension, most of the overweight people were 14 people (70% of 20 people with TDD pre-hypertension), only one person (1.92%) had blood pressure with level I hypertension category being in the overweight group, and three people (5.77 %) who have blood pressure in the category II hypertension are in the overweight, obesity type I, and type II obesity groups.

The dominant factor causing hypertension, being overweight, can increase a person's risk of developing hypertension. The greater the body mass, the more blood is needed to supply oxygen and food to the body's tissues. It means that the volume of blood circulating through the blood vessels increases, putting more pressure on the artery walls. In this study, it was found that people who had systolic blood pressure in the category of pre-hypertension to level II hypertension were the most from overweight to obesity, as well as people who had systolic blood pressure [35]. In a study who examined the relationship between body mass index and blood pressure in patients with hypertension, from 63 respondents, 39 people (61.9%) were in the overweight category, and the rest were in the obesity category I and typed II [36].

The sample data analysis using the Pearson test (Table 10) shows a significant relationship between BMI and total cholesterol and blood pressure levels for staff and teachers at SMA Fons Vitae I Jakarta. It is also supported by the age of the respondents who are 36-55 years old, lack of physical activity, irregular eating patterns, and genetics. In Table 6, the Pearson correlation value is 0.447 for the relationship between BMI and total cholesterol levels, 0.494 for the relationship between BMI and systolic blood pressure, and 0.561 for the relationship between BMI and diastolic blood pressure. With a significant value of d P-value (0.001) 0.05 for the relationship between BMI and total cholesterol levels, P-value (0.000) 0.05 for BMI with systolic blood pressure, and P-value (0.000) 0.05 for BMI with diastolic blood pressure. This study is the same as the results of research by Musdalifa et al., examined the relationship between BMI and total cholesterol levels in teachers and staff at SMAN 1 Kendari. Statistical tests showed a P-value = 0.001 and a degree of significance = 0.05, which means a significant relationship exists between BMI and total cholesterol levels [5]. The number of respondents studied was 51 people, and the age of the largest respondents was >35 years, according to the research on teachers and staff of SMA Fons Vitae I Jakarta. In comparison, the respondents in the research of Musdalifa et al. (2017) did not have a history of regular exercise [5]. Likewise, the staff and teachers of SMA Fons Vitae I Jakarta have less physical activity, rarely exercise, and rarely do routine health checks [37].

Data obtained from respondents showed that physical activity and frequency of exercise respondents were low. It allows cholesterol not to undergo a complete metabolic and combustion process. In this case, the cholesterol is increasingly piling up in the blood vessels. In addition to a lack of physical activity, an unhealthy diet, which usually contains high fat and low fiber, plays a role in hypercholesterolemia. It is due to an increase in the amount of Acetyl CoA in liver cells to produce cholesterol [38]. Age factors can also affect a person's total cholesterol levels. Listiana et al., state that cholesterol levels correlate with a person's age. The total cholesterol level is relatively higher at an older age than at a young age. The older a person eats, the LDL receptor activity also decreases. LDL itself functions as a hemostasis regulator of cholesterol circulating in the blood. If these receptor cells are disturbed, the cholesterol in the blood will increase.

The amount of fat in old age tends to be more than the young age [39]. Most Fons Vitae I Jakarta Senior High School staff and teachers have an age range of 35-55 years. The study's results on the relationship between BMI and blood pressure align with Audiya et al., there is a relationship between BMI and blood pressure in teachers aged 26-56 years at a private high school in Santo Thomas I. Statistical tests using the Spearman correlation test show P- value = 0.022 and the degree of significance = 0.05 for the relationship between BMI and systolic blood pressure. Meanwhile, the relationship between BMI and diastolic blood pressure shows a P-value = 0.001 with a degree of significance = 0.05 [59]. The results of research on the relationship between BMI and blood pressure are also following the results of research conducted by Ardani on the community in the Pakuncen Wirobrajan village, Yogyakarta, which stated that there was a significant positive relationship between body mass index and blood pressure (P-value = 0.019). [40]. The description of the results of this study supports the research conducted by Nurmalina which states that obesity is a major factor affecting blood pressure and the development of hypertension [41]. The Framigham study found that a 15% increase in body weight could lead to an 18% increase in systolic blood pressure. Compared with those of normal weight, overweight people who were 20%

overweight were eight times more likely to have hypertension. Obesity can affect blood pressure in two mechanisms: increased sympathetic nerve activity caused by alpha and beta stimulation in the periphery after consumption of high-fat foods and increased activity of the renin-angiotensin system caused by increased levels of angiotensinogen produced by adipose tissue [42].

As with total cholesterol levels, the age factor also affects the increase in blood pressure. According to Harahap et al. (2008), who examined the blood pressure of civil servants in Pekanbaru, i.e., every year increase in age will increase systolic blood pressure by 0.493 mmHg and diastolic by 0.189 mmHg [43]. In addition, genetic factors also play an important role in improving a person's blood pressure. Another factor obtained from the respondents is smoking habits, especially in men, in this case, the staff and teachers of SMA Fons Vitae I Jakarta. From the data obtained, seven respondents are active smokers. Four of the seven respondents who are active smokers have abnormal total cholesterol levels and lack exercise. According to Neufeld, cigarettes can reduce HDL cholesterol levels by about 4.5-6%. As a result, LDL cholesterol levels are higher, affecting relatively higher total cholesterol levels [44].

The same is valid for blood pressure; three out of seven smoke respondents have blood pressure in the pre-hypertension category. According to WHO, smoking can cause hypertension due to chemicals contained in tobacco that can damage the inner lining of the artery walls, making the arteries more susceptible to plaque buildup (atherosclerosis). It is mainly due to nicotine, which can stimulate the sympathetic nerves, stimulate the heart to work harder, and causes constriction of blood vessels [45].

CONCLUSION

Based on the results and discussion described in the previous chapter, several conclusions were drawn, as follows: a) From the results of the study, it was found that 9.62% of teachers and staff of SMA Fons Vitae I were underweight, 34.62% had a normal BMI, 44.23% were overweight, 7.69% had type I obesity, and 3.85% had type II obesity; b) From the results of the study, it was found that 69.23% of teachers and staff of SMA Fons Vitae I had normal total cholesterol levels, 19.23% had total cholesterol levels in the worrying category, and 11.54% had high total cholesterol levels; c) As many as 55.77% of teachers and staff of SMA Fons Vitae I Jakarta have normal TDS, 38.46% have TDS in the pre-hypertension category, and as many as 5.77% have TDS in the category I hypertension; d) As many as 53.85% of teachers and staff of SMA Fons Vitae I Jakarta have normal blood pressure, 38.46% have TDD in the pre-hypertension category, 1.92% have TDD in the category I hypertension category, and as many as 5.77% have TDD in the category II hypertension category; e) The correlation between BMI and total cholesterol was analyzed using the Pearson correlation test, the results obtained P-Value = 0.001; r = 0.447. It shows a significant positive correlation between BMI and total cholesterol with a solid correlation strength; f) The correlation between BMI and systolic blood pressure was analyzed using the Pearson correlation test, and the results were P-Value = 0.000; r = 0.494. It shows a significant positive correlation between BMI and TDS with a solid correlation strength, and g) The correlation between BMI and diastolic blood pressure was analyzed using the Pearson correlation test. The results obtained P-Value = 0.000; r = 0.561. It shows a significant positive correlation between BMI and TDD, with a strong correlation strength.

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