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Relationship between menopausal status, fat intake, and fiber intake with women cholesterol level

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ABSTRAK

Latar Belakang: *Kadar kolesterol yang tinggi merupakan faktor risiko penyakit kardiovaskular. Kadar kolesterol yang tinggi disebabkan oleh berbagai faktor antara lain asupan lemak dan status menopause. Wanita menopause rentan mengalami kadar kolesterol tinggi karena pada wanita pascamenopause terjadi penurunan produksi hormon estrogen yang berfungsi mengatur metabolisme lipid. Asupan lemak yang tinggi mempengaruhi kadar kolesterol. Namun mengonsumsi asupan serat yang cukup dapat mengontrol kadar kolesterol agar tetap stabil. Banyak penelitian telah dilakukan mengenai hubungan antara asupan lemak dan serat dengan kadar kolesterol. Namun, hanya sedikit yang melakukan penelitian pada wanita, terutama mengenai status menopause.*
Tujuan: *Tujuan penelitian ini adalah untuk mengetahui apakah terdapat hubungan antara status menopause, asupan lemak, dan asupan serat dengan kadar kolesterol wanita di indonesia.*
Metode: *Desain penelitian ini adalah cross sectional dengan subjek perempuan berusia 15-54 tahun di 10 provinsi di Indonesia. Kadar kolesterol darah diperoleh dari pengukuran darah kapiler dan asupan lemak dan serat diperoleh dari wawancara dengan metode SQ-FFQ yang dilakukan oleh tenaga kesehatan terampil. Status menopause diperoleh dari wawancara yang dilakukan oleh enumerator terlatih yang menanyakan riwayat menstruasi dalam satu tahun. Klasifikasi status menopause dibedakan menjadi belum menopause, pra menopause, dan pasca menopause.*
Hasil: *Dari total 606 subjek, 122 subjek mempunyai kadar kolesterol tinggi. Terdapat hubungan yang signifikan antara status menopause dengan kadar kolesterol ($p<0,05$) dengan tingkat korelasi $r=0,013$. Dan tidak terdapat hubungan yang bermakna antara asupan lemak dan asupan serat dengan kadar kolesterol ($p>0,05$) dengan tingkat korelasi masing-masing $r=0,060$ dan $r=0,297$.*
Kesimpulan: *Status menopause mempunyai pengaruh yang signifikan terhadap kadar kolesterol.*

KATA KUNCI*: asupan lemak, asupan serat, kadar kolesterol, status menopause, wanita*

ABSTRACT

Background: *High cholesterol levels are a risk factor for cardiovascular disease. High cholesterol levels are caused by various factors including fat intake and menopausal status. Menopausal women are susceptible to high cholesterol levels because in postmenopausal women there is a decrease in the production of the hormone estrogen which functions to regulate lipid metabolism. High fat intake affects cholesterol levels. However, consuming sufficient fiber intake can control cholesterol levels so that they remain stable. Many studies have been conducted on the relationship between fat and fiber intake and cholesterol levels. But, only a few have studied in women, especially regarding menopausal status).*

Objectives: *The aim of this study was to determine whether there is a relationship between menopausal status, fat intake and fiber intake with cholesterol levels in Indonesian women.*

Methods: *The design of this study was cross sectional with female subjects aged 15-54 years in 10 provinces in Indonesia. Subject selection will be carried out using purposive sampling methode. Blood cholesterol levels were obtained from capillary blood measurements and fat and fiber intake were obtained from interviews using SQ-FFQ method conducted by skilled health workers. Menopausal status was obtained from interviews conducted by trained enumerators who asked about menstrual history within one year. The classification of menopausal status is divided into not yet menopausal, pre-menopausal, and post-menopausal.*

Results: *Of the total 606 subjects, 20,1% subjects had high cholesterol levels. The average fat intake of the subjects was 47.5 g or 75%. The average fiber intake of the subjects was 12.5 g or 42.6%. There is a significant relationship between menopausal status and cholesterol levels ($p<0.05$) with a correlation level of $r=0.013$. And there was no significant relationship between fat intake and fiber intake and cholesterol levels ($p>0.05$) with correlation levels of $r=0.060$ and $r=0.297$ respectively.*

Conclusions: *Menopausal status has a significant effect on cholesterol levels.*

KEYWORD*:* *cholesterol level, fat intake, fiber intake, menopausal status, women*

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INTRODUCTION

Non-communicable or degenerative diseases are one of the biggest public health problems in the 21st century. According to WHO in 2016, around 71% of deaths in the world are caused by non-communicable diseases which kill 36 million people per year. Based on the WHO profile of non-communicable diseases in Southeast Asia, there are five infectious diseases with the highest morbidity and mortality rates, namely cardiovascular disease, cancer, chronic respiratory disease, diabetes mellitus and injuries(1). The accumulation of fatty plaque on the walls of the arteries (arteriosclerosis) is a risk factor for Coronary Heart Disease (CHD). High total cholesterol levels are the main cause of atherosclerosis and it has also been proven that increasing total cholesterol levels is associated with an increased risk of cardiovascular disease. The prevalence of hypercholesterolemia in the world is around 45%, in Southeast Asia around 30% (WHO 2019) . The 2018 riskesdas results show that the prevalence of total cholesterol levels above normal in the population aged ≥ 15 years is 24% in women and 18.3% in men. The average cholesterol level in women is higher than in men (3).

Risk factors that influence cholesterol levels can be classified into two, namely risk factors that can be changed and risk factors that cannot be changed. Risk factors that can be changed include nutritional intake, nutritional status and physical activity. Meanwhile, risk factors that cannot be changed include age, gender, menopausal status and genetics(4). Menopausal status has a

significant relationship with increasing cholesterol levels(5). The increase in total cholesterol levels is also influenced by increased consumption of fat intake. High consumption of fatty acids causes LDL cholesterol levels to increase. One thing that can be done to prevent high cholesterol levels is to reduce risk factors. Risk factors that can be changed include nutritional intake. By consuming foods that can lower cholesterol levels, one of them is by consuming foods high in fiber. Fiber has an important role in reducing blood cholesterol levels. There is no research on the relationship between menopausal status, fat intake and fiber intake with cholesterol levels who researches on a range aged 15-54 years and 10 provinces in Indonesia. This research is expected to provide a specific picture regarding the proportion and relationship between menopausal status, fat intake and fiber intake with cholesterol levels in women aged 15-54 years in Indonesia.

MATERIALS AND METHODS

Research Design, Time, and Place

The research design used in this study was a cross sectional study involving women aged 15 – 54 years. This research was carried out in September 2023–December 2023 in 10 provinces in Indonesia. The selection of 10 provinces is based on the largest population in Indonesia. So it is obtained that the 10 provinces with the largest population in Indonesia are Sumatera Utara, Riau, Sumatera Selatan, Lampung, Banten, DKI Jakarta, Jawa Barat, Jawa Timur, Jawa Tengah, and Sulawesi Selatan. Submission of a code of ethics for this research through the Ethics Committee for Research Involving Human Subjects IPB University with No: 907/IT3.KEPMSM-IPB/SK/2023 .

Number and Method of Sampling

The subjects in this study were obtained from several participants who met the inclusion criteria in research in collaboration with the SEAFEST Center IPB . Subject selection at the provincial and city/district levels used the purposive sampling method, while at the sub-district/ward level the random sampling method was used. The inclusion criteria in this study were women aged 15-54 years and able to communicate well. The exclusion criteria in this study were subjects who withdrew. Based on calculations using the Lameshow formula , it was found that the minimum number of subjects that had to be met in this study was 308 people . Subjects were selected by selecting 10 provinces with the largest population in Indonesia based on data BPS 2021 . Assuming that the minimum proportion that must be achieved is 70% so that the sampling area can be considered representative of the entire population. 10 provinces were selected with a total of 195,664,900 residents or 71.5% of the total population of Indonesia. Based on the Slovin formula calculation (n = N/1 + Ne 2) with a margin of error of 3%, the sample size is 1036 people with an addition of 10% , the sample size is 1200 people, male and female, with an age range of 15-54 years. with age groups, namely: teenagers (15-18 years), early adults (19-28 years), middle adults (29-40 years) and late adults (41-54 years).

Table 1. Types and methods of data collection

Variabel	Category	Source
Menopausal Status	1 : Not Yet Menopausal 1 : Pre-Menopausal 2 : Post-Menopausal	Report of the Reproductive Stagw of Aging Workshop (STRAW+10) in 2011
Cholesterol Level	1 : <200 mg/dl 2 : ≥200 Hight mg/dl	Ministry of Health (2018)
Fat Intake	1 : Less < 20% AKE 2 : Sufficient 20%-30% AKE 3 : More > 30% AKE	Ministry of Health (2018)
Fiber Intake	1 : Sufficient ≥ 25 g 2 : Less < 25 g	

The types of data collected in this research are primary data and secondary data. Primary data includes data menopausal status, cholesterol levels, fat intake and fiber intake while secondary

data includes subject characteristics obtained from the SEAFAST Center IPB research.Cholesterol levels were measured by taking capillary blood (mg/dl) and data on fat intake and fiber intake were obtained from interviews using the SQ-FFQ , while menopausal status data was obtained through interviews conducted by trained enumerators with specific questionnaire who asked about the subject's menstrual history within a year.

Processing and analysis of data

Data processing goes through the stages of editing, coding, entry, cleaning, data categorization and data analysis. Data processing used Microsoft Excel 2019 and analyzed using the IBM Statistical Program for Social Sciences (SPSS) version 22 . Analysis to determine whether the data is normally distributed or not uses the Kolmogorv-Smirnov test . The Spearman test was used to see the relationship between menopausal status, fat intake and fiber intake with cholesterol levels. If the p-value is <0.05, it is stated that there is a significant relationship between the variables being tested.

RESULTS AND DISCUSSIONS

Subject Characteristics

Subject characteristics in this study included age, province, education, and occupation. The distribution of subject characteristics is presented in **Table 1.**

Table 3. Average value of organoleptic test results for edamame flour and tuna fph biscuits

Subject characteristics	Number of subjects (n = 606)	%
Age		
15-18 years old	145	23.9
19-28 years old	154	25.4
29-40 years old	149	24.6
41-54 years old	158	26.1
Province		
North Sumatra	56	9.24
Riau	21	3.47
South Sumatra	11	1.82
Lampung	26	4.29
Banten	24	3.96
DKI Jakarta	61	10.07
West Java	140	23.10
East Java	112	18.48
Central Java	126	20.79
South Sulawesi	29	4.79
Education		
No school	3	0.5
Elementary School	78	12.9
Junior Hight School	135	22.3
Senior Hight School	304	50.3
D3/S1/S2/S3	86	14.2
Work		
Civil servants, TNI and POLRI	14	2,3
Private employees	40	6.6
Self-employed	46	7.6
Farmer laborer	28	4.6
Housewife	264	43.6
Other	214	35.3

Based on the descriptive test results in **Table 1**, it can be seen that the largest number of subjects were in the 41-54 year age group (26.1), more than a quarter of all subjects in this study

were in the late adult age group. Most of the subjects came from West Java province (23.1 %), the education level of the majority was high school/vocational school (50.3%) and the occupation was predominantly housewife (43.6 %).

Cholesterol Levels

Normal total cholesterol levels in the blood are below 200 mg/dl. If there is too much cholesterol in the body, it will accumulate in the walls of the blood vessels, resulting in *atherosclerosis*, namely narrowing of the blood vessels, which is a risk factor for cardiovascular disease. Increasing cholesterol consumption by 100 mg/day can increase total cholesterol levels by 2-3 mg/dl, conversely, reducing cholesterol consumption by 100 mg results in a decrease of 0.13 mmol/L cholesterol in the blood. Therefore, increased cholesterol levels must be immediately addressed and treated. The cholesterol levels of the subjects in this study are described in **Table 2**.

Table 2. Distribution of subjects' cholesterol levels, menopausal status, fat and fiber intake

Variable	n = 606	%
Cholesterol levels		
Normal	484	79.9
Hight	122	20.1
Mean (mg/dl) ± SD	176.37 ± 57	
Menopausal Status		
Not Menopause yet	494	81.5
Pre menopause	43	7.1
Post menopause	69	11.4
Fat Intake		
Not enough	414	68.3
Enough	115	19.0
More	77	12.7
Mean (g) ± SD	47.5 ± 102	
Fiber Intake		
Enough	60	9.9
Not enough	546	90.1
Mean (g) ± SD	12.5 ± 22	

Table 2 shows that the average cholesterol level of the subjects was 176.37 (mg/dl) ± 57. The distribution of subjects' cholesterol levels in the table shows that almost a quarter of the total subjects in this study had high cholesterol levels, namely 20.1%.

Menopause Status

Many factors influence a woman's menopausal status, including psychological factors, anxiety, age at the start of menstruation, age at birth, smoking, use of contraception, and economic status.. In **Table 2**, it is explained that the most numerous subjects were those who had not yet reached menopause, namely 494 subjects or around 81.5%. It is estimated that subjects who have not yet reached menopause are subjects aged 15-40 years. Meanwhile, for premenopausal and postmenopausal subjects it is less than 20%. Postmenopausal subjects were only slightly more numerous than premenopausal subjects.

Fat Intake

Table 2 shows the distribution of subjects' fat sufficiency levels. The average fat intake of the subjects was 47.5 g ± 102. A total of 414 subjects had insufficient levels of fat and only 115 subjects had enough. Less than 20% of subjects had sufficient fat intake and almost 70% of subjects had insufficient fat intake. The subject's fat intake was still below the recommended Nutritional Adequacy Intake (AKG), which was 63 g. Based on the results of the SQ-FFQ, the most consumed sources of fat are cow's milk, meatballs, egg yolks, chicken thighs and chicken breasts. Very few subjects consume beef, beef liver, tripe and tendons. Subjects are more dominant in consuming chicken than red meat.

Fiber Intake

The average fiber intake of subjects in table 5 is 12.5 g ± 22. Only 60 subjects had sufficient fiber intake and 546 subjects had insufficient fiber intake. Very few subjects had sufficient fiber intake, namely 9.9% or not even 10%. The subjects in this study were mostly housewives who did not really understand the importance of meeting daily fiber needs and what food sources are high in fiber. In this study, the tendency of fiber consumption is only focused on vegetables and fruits which are only consumed in small amounts. Not so many subjects consume fiber from nuts such as peanuts, peas, soybeans and so on.

Relationship between menopausal status and blood cholesterol levels

The Indonesian Ministry of Health (2009) explains that productive women are women who are still menstruating, aged between 15-40 years. After the age of 40, a woman will experience a decrease in the production of mature egg cells and the ovaries will begin to produce less of the hormone estrogen and at this age, menopause begins in women. There are two phases experienced by women during menopause. Premenopause is the first phase of the menopause stage. Premenopause is the period of 4-5 years before menopause occurs. This phase begins when a woman is 40 years old, which is characterized by the menstrual cycle starting to become irregular, elongated, menstrual blood coming out a little or a lot, and sometimes accompanied by pain.

The postmenopausal phase is a condition experienced by women, in this phase the menstrual cycle has stopped permanently. This change occurs suddenly, namely at the age of 45-55 years. The occurrence of the postmenopausal phase is the result of hormonal changes in the body, where these hormones are chemicals produced by certain glands in the body, the effect of which will be to influence the work of other body organs. The production of estrogen hormone will decrease when women enter the age of 40 because at that age there is a decrease in the production of mature egg cells so that the ovaries begin to produce less estrogen hormone. Postmenopausal women have a higher risk of cardiovascular disease (CVD) compared to premenopausal women, this increase is caused by changes in lipid or lipoprotein profiles during menopause. One of them is an increase in blood cholesterol levels caused by decreased estrogen hormone production in postmenopausal women.

Table 3. Relationship between menopausal status, fat intake, fiber intake, and blood cholesterol levels

Variable	Cholesterol levels	
	r	p-value
Menopause Status	0.103	0.011
Fat Intake	0.060	0.141
Fiber Intake	0.042	0.297

Spearman test results (table 6), a significance value of 0.011 (p>0.05) was obtained, which states that there is a significant relationship between menopausal status and cholesterol levels.e The results of this study are in line with research by Aswin (2012) that there is a significant relationship between menopausal status and total cholesterol levels. Then the research results of Susilowati (2017) also stated that total cholesterol levels also increased in women who had gone through menopause. In this study, almost 50% of menopausal women had high cholesterol levels. However, the results of this study are not in line with Yuni's (2019) study which stated that there was no relationship between blood cholesterol levels and menopause status because many menopausal women had normal blood cholesterol levels compared to high blood cholesterol levels. The reason is because menopausal women in this research environment do a lot of physical activity and there is a balance between diet and exercise so that most menopausal women in the area have normal blood cholesterol levels(4). In the Health Women Study, it was found that cholesterol levels increased in menopausal women. During the 2 year gap after their last menstruation, their

average LDL increased by around 9% and cholesterol increased by 6% (Rizki 2018) . In a Nationwide Women's Health Study (a longitudinal, community-based, multi-ethnic population study) it was explained that total cholesterol and LDL cholesterol levels increased significantly within one year after the last menstruation . After the age of 40 a woman will experience decreased production of mature egg cells and the ovaries have begun to produce less of the hormone estrogen. Increased cholesterol levels are one of the consequences of decreased production of the hormone estrogen in postmenopausal women (9). Decreased levels of the hormone estrogen can cause increased risk factors for atherosclerosis due to increased levels of total cholesterol, triglycerides, Low Density Lipoprotein (LDL), and decreased blood levels of High Density Lipoprotein (HDL) which are cardioprotective. After menopause, the ovaries stop producing very significant amounts of estrogen. The hormone estrogen has broad physiological effects beyond the reproductive system so that a decrease in the production of the hormone estrogen during menopause affects the cardiovascular system.

Relationship between fat intake and blood cholesterol levels

Fat is one of the sources of energy for the body, fat has a function as a producer of energy needed by the body, as a former of body structure, regulating processes that occur directly and indirectly, fiber carries vitamins that dissolve in fat. Fat consists of heterogeneous compounds, including fats and oils in food, phospholipids, sterols and other similar bonds contained in food and the human body (10)**.** Spearman test results (**Table 3**), there is no significant relationship between fat intake and cholesterol levels, which is indicated by a significance value of 0.141 (p>0.05). The results of this study are in line with research conducted by Adhiyani (2013) which stated that there was no relationship between fat intake and cholesterol levels in the elderly in Serengan Village, Surakarta (p=0.057). And this research is also in line with research conducted by Rini (2015) which stated that there was no relationship between fat intake and total cholesterol levels in outpatient coronary heart patients at RSUD Dr. Moewardi (p=0.257). The subject's fat intake is still not met according to the AKG which is 63 g. Based on the results of the SQ-FFQ, it was found that the subject's fat intake is still classified as lacking. More than 50% of subjects have insufficient fat intake. This insufficient fat intake is influenced by subjects who consume very varied and very little food. So that the subject's fat intake is not met properly. So in this study, there was no relationship between fat intake and total cholesterol levelst. While according to Sastriamidjojo states that consuming foods high in fat and cholesterol will increase total cholesterol levels. Research conducted by Nurrahmi states that people who are at risk of having high cholesterol levels are those who apply a diet that contains high fat levels. The more a person consumes high-fat foods, the more fat will be stored in the liver which will result in increased cholesterol synthesis. Excess cholesterol will be excreted from the liver into the bile as cholesterol and bile salts.

Relationship between fiber intake and blood cholesterol levels

Fiber has an important role in reducing blood cholesterol levels, this occurs because cholesterol is bound by fiber in the stomach and intestines. This fiber forms gelatin and through digestion binds bile acids and binds cholesterol which is then excreted in the feces. By pulling cholesterol out of the digestive system, the level of cholesterol entering the blood decreases. Consuming fiber regularly can reduce cholesterol levels by 15-19 percent (11). According to the results of individual food consumption survey data processing (SKMI), it is said that around 94.8% of Indonesians consume vegetables and only 33% of Indonesians consume fruit with an average of 70g/person/day and for vegetables only 38.8g/person /day for fruit consumption. When compared with nutritional adequacy, consumption of vegetables and fruit is still relatively low.

Spearman test (**Table 3**), there is no significant relationship between fiber intake and cholesterol levels, indicated by a significance value of 0.297 (p>0.05). The results of this study are in line with Nadia's (2016) research which states that there is no relationship between fiber intake and cholesterol levels. This research is also in line with the results of research by Kharismawati

(2009) which stated that there was no relationship between fiber intake and cholesterol levels. This research is also in line with research by Pertiwi (2020) which states that there is no relationship between fiber intake and cholesterol levels.

In this study, the tendency of fiber consumption only focused on vegetables and fruits which were only consumed in small amounts. Not many subjects consumed fiber from nuts such as peanuts, peas, soybeans and so on. Based on various studies, there are several main mechanisms that are quite accepted to explain the decrease in cholesterol levels by dietary fiber. First, preventing the reabsorption of bile salts from the small intestine causes increased excretion of bile salts in the feces. Second, reducing the glycemic response causes low insulin stimulation of cholesterol synthesis in the liver. Third, the physiological effects of fermentation of water-soluble dietary fiber products, especially propionate (short chain fatty acids).

CONCLUSIONS AND RECOMMENDATIONS

The subjects in this study were 606 women aged 15-54 years. The number of subjects who had not yet reached menopause was 494 subjects, 43 premenopausal subjects and 69 postmenopausal subjects. The number of subjects who have a high school education is greater than any other level of education. The average subject works as a housewife and student. A total of 484 subjects had normal cholesterol levels and 122 subjects had high cholesterol levels.

Menopausal status was related to cholesterol levels (p=0.011, r=0.013). Fat intake was not related to cholesterol levels (p=0.141, r=0.060). Fiber intake was also not related to cholesterol levels (p=0.042, r=0.297). High cholesterol levels are one of the factors causing coronary heart disease, especially in women. Women who have gone through menopause are at higher risk of coronary heart disease because cholesterol levels are difficult to control. In this study, age was one of the factors most related to cholesterol levels. However, there are also other factors that can influence cholesterol levels that were not examined in this study.

Suggestions for further research are expected to examine other factors such as BMI, physical activity, carbohydrate intake in more detail. And it is also hoped that further research can examine male samples so that different tests can be carried out regarding what factors are most related to cholesterol levels in men and women.

CONCLUSIONS AND RECOMMENDATIONS

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