

THE RELATIONSHIP OF FATTY ACID CONSUMPTION WITH TOTAL CHOLESTEROL LEVEL IN CORONARY ARTERY DISEASE PATIENTS

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ABSTRACT

Coronary artery disease is one of the significant causes of death and is still a health problem for developed and developing countries. Increased cholesterol in the blood is caused by heredity and high-fat consumption. The effect of dietary fat on artery disease is related to the impact of fatty acid components and cholesterol on blood cholesterol. This study aims to determine the relationship between consumption of Saturated Fatty Acids (SFA), Monounsaturated Fatty Acids (MUFA), and Polyunsaturated Fatty Acids (PUFA) with total cholesterol levels in patients with coronary artery disease. The research design used was descriptive-analytic in clinical nutrition with a cross-sectional approach. The population in this study were 405 patients with coronary artery disease at the artery clinic of RSUD Dr. M. Yunus Bengkulu. The sample was 32 patients collected using a purposive sampling technique. Using the Chi-Square test, data analysis was used to determine the relationship between the consumption of SFA, MUFA, and PUFA with total cholesterol levels in patients with coronary artery disease. The study's results found a significant relationship between SFA consumption and coronary artery disease. Still, conversely, there was no significant relationship between MUFA and PUFA consumption with total cholesterol level in coronary artery disease patients, namely that SFA consumption was inadequate (p-value = 0.043, OR = 0.407), inadequate MUFA consumption (p-value = 0.710), and inadequate of PUFA consumption (p-value= 0.465). The conclusion is that saturated fatty acids are related to total cholesterol in coronary artery disease while conversely to monounsaturated fatty acids and polyunsaturated fatty acids.

Keywords: coronary artery disease, total cholesterol, SFA, MUFA, PUFA

INTRODUCTION

Coronary Artery Disease (CAD) is a disease that causes many deaths and is still a health problem for developed and developing countries (Susilo, 2015). This death often occurs with a sudden artery attack and without any previous symptoms (Santosa & Baharuddin, 2020). Coronary artery disease is a type of artery disease caused by plaque in the artery arteries (Purnama, 2020). This condition is caused by narrowing or plaque blockage in the coronary arteries, otherwise known as coronary artery atherosclerosis. One of the components that make up this plaque is cholesterol crystals. Therefore, one of the risks of atherosclerosis is high blood cholesterol levels (Sianturi and Evi, 2019). Several risk factors cause coronary artery disease. Some of them are smoking, unhealthy eating lifestyle, lack of physical activity, high blood pressure, diabetes and dyslipidemia. However, other factors have an influence, such as genetic and environmental factors (Santosa & Baharuddin, 2020).

The World Health Organization (WHO) estimates that CAD is the leading cause of death worldwide, with 17 million deaths per year in 2008 and will increase to 23.4 million deaths in 2030, with more than 80% occurring in countries developing (Setyaji et al., 2016). According to Riskesdas 2013, the prevalence of coronary artery disease based on a doctor's diagnosis in Indonesia is 0.5%, and based on doctor diagnosis or symptoms is 1.5% (Litbangkes, 2013). Based on data on the prevalence of artery disease diagnosed by Indonesian doctors is 1.5% and 1.3% based on doctor diagnosis in residents of all ages, according to Bengkulu Province (Litbangkes, 2018). The data explanation shows that the prevalence of artery sufferers is the same as it was from 2013 to 2018. According to data from RSUD Dr. M. Yunus Bengkulu, 1080 patients were undergoing outpatient care at the cardiac polyclinic in 2021.

The prevalence of CAD based on interviews with those whom a doctor has diagnosed and those diagnosed by a doctor or symptoms increases

with age, the highest in the 65-74 year age group, namely 0.2% and 3.6% and decreases in the age group ≥ 75 years. The prevalence of CAD that a doctor or symptoms have ever diagnosed is higher in women (0.5% -1.5%). The prevalence of CAD is higher in people who do not attend school and do not work. Based on CAD that a doctor has diagnosed, the prevalence is higher in urban areas, but based on the doctor's diagnosis and symptoms, it is higher in rural areas and at the lowest ownership index (Litbangkes, 2013).

Hereditary factors and high-fat consumption cause increased cholesterol in the blood. The effect of dietary fat on artery disease is related to the impact of fatty acid components and cholesterol on blood cholesterol, especially LDL cholesterol. Increased saturated fat and cholesterol consumption can increase low-density lipoprotein (LDL) cholesterol concentration. Bad fats such as saturated fat can be converted into cholesterol, thereby increasing blood cholesterol levels, especially LDL, by reducing its breakdown or catabolism (Yuliantini et al., 2015).

The research by Rukmasari & Sumarni, (2018) concluded that the consumption of nutrients in coronary artery disease patients varies greatly. Cholesterol consumption and fat consumption in this study were above the recommended requirement. Excessive consumption of fat has a huge effect on blood cholesterol. Fat in the diet works together with cholesterol to reduce the activity of LDL receptors in the liver. This will cause a reduction in the disposal of LDL in the blood so that total cholesterol and LDL in the blood rise. Increased cholesterol in the diet causes an increase in plasma cholesterol concentration and is associated with the risk of cardiovascular disease.

Consumption of fat, incredibly saturated fat, will increase plasma cholesterol levels. It is estimated that for every 1% addition of saturated fatty acids from total energy, blood cholesterol will increase by 1.9 mg/dL. Consuming large amounts of saturated fat in the human body will increase total blood cholesterol (Hairuddin et al., 2019). Monounsaturated fats generally benefit blood cholesterol levels, mainly when used as a substitute for saturated fatty acids. Monounsaturated fatty acids (MUFA) are more effective in lowering blood

cholesterol levels than polyunsaturated fatty acids (PUFA) (Sartika, 2008).

Consumption of polyunsaturated fats in patients with CAD can increase bad cholesterol (LDL), as seen from the chemical structure of polyunsaturated fats, which are easily oxidized and trigger a change in fatty acid isomers from cis to the transform. Polyunsaturated fatty acids in trans form also increase LDL cholesterol levels and reduce HDL cholesterol levels (Bertalina, 2015).

The results of research conducted by Zahroh & Bertalina, (2014) show that continuous consumption of polyunsaturated fats will be a problem related to the benefits of polyunsaturated fatty acids, which can reduce blood cholesterol levels. However, the study found that 37.5% of patients who consumed good polyunsaturated fatty acids experienced high blood cholesterol levels. This is because patient daily cholesterol consumption is ≥ 200 mg, causing blood cholesterol levels to increase. Based on the above background, the researchers are eager to know the relationship between the consumption of saturated fatty acids, monounsaturated fatty acids, and polyunsaturated fatty acids and total cholesterol levels in patients with CAD at the artery clinic of RSUD Dr. M. Yunus Bengkulu.

METHODS

This research used a cross-sectional approach by examining the dynamics and risk factors and their impacts through direct observation and data collection. The population in this study were 405 patients with coronary artery disease at the artery clinic of RSUD Dr. M. Yunus Bengkulu. The sample was 32 patients using a purposive sampling technique. Several criteria, namely the inclusion criteria consisted of residing in Bengkulu, men and women aged 25-65 years, having been diagnosed by a doctor as suffering from coronary artery disease, willing to be interviewed about food consumption, weight and height measurements, taking statin medication, able to communicate well, having lipid profile examination results for total cholesterol levels, and exclusion criteria during the research process for patients having complications such as Acute renal failure dan chronic kidney disease, patients who were not

willing to be interviewed and were not willing to be sampled. SFA, MUFA and PUFA consumption data were collected using the Semi Quantitative Food Frequency Questionnaire (SQ-FFQ) consumption survey. Consumption data was obtained using interview techniques by enumerator to patients accompanied by their families regarding their consumption habits of SFA, MUFA and PUFA fats for the last one-month. Non-random sampling was used using the purposive sampling technique—the Chi-Square test analysis data. The Research ethics were issued by the Bengkulu Ministry of Health Polytechnic Ethics Commission with No. KEPK. BKL/204/05/2023.

RESULTS AND DISCUSSION

Based on Table 1, it is known that the description of consumption of saturated fatty

Table 1. Overview of Consumption of SFA, MUFA, and PUFA with Total Cholesterol Levels in CAD Patients at the Artery Polyclinic of RSUD Dr. M. Yunus Bengkulu

Consumption of Fatty acids		n (%)
Saturated Fatty Acids (SFA)	Inadequate	27 (84.4)
	adequate	5 (15.6)
Monounsaturated Fatty Acids (MUFA)	Inadequate	21 (65.6)
	adequate	11 (34.4)
Polyunsaturated Fatty Acids (PUFA)	Inadequate	20 (62.5)
	adequate	12 (37.5)

acids (SFA) in patients with coronary artery disease shows that almost all of them (84.4%) are inadequate, consumption of monounsaturated fatty acids (MUFA) in patients with coronary artery disease shows that the majority (65.6%) are inadequate, the consumption of saturated fatty acids (PUFA) in coronary artery disease patients shows that most (62.5%) are inadequate.

At Table 2, statistical test results obtained p-value = 0.043 (<0.05; OR = 0.407), meaning there is a significant relationship between consumption of SFA and total cholesterol level in patients with coronary artery disease at the artery clinic of RSUD. Dr. M. Yunus Bengkulu, the analysis results showed that most of the consumption of SFA was inadequate, with abnormal total cholesterol levels of 59.2%, and none of the consumption of SFA was adequate for abnormal total cholesterol levels.

Based on Table 3. The statistical test results obtained P-value = 0.710 (<0.05; OR = 0.758), meaning there is no significant relationship between consumption of MUFA and total cholesterol levels in patients with coronary artery disease at the artery clinic. RSUD. Dr. M. Yunus Bengkulu, the analysis results showed that almost half of the inadequate MUFA consumption experienced abnormal total cholesterol levels of 47.6% and the majority of consumption of MUFA, which both experienced abnormal total cholesterol levels of 54.5%.

Table 2. The relationship between SFA, MUFA, and PUFA consumption with total cholesterol level in CAD patients at the Artery Polyclinic RSUD. Dr. M. Yunus Bengkulu

Fatty acid	Total cholesterol						P-value	OR 95%
	Abnormal		Normal		Total			
	n	%	n	%	n	%		
SFA consumption								
inadequate	16	59.2	11	40.7	27	100	0.043*	0.407 (0.259-0.642)
adequate	0	0.0	5	100.0	5	100		
Total	16	50.0	16	50.0	32	100		
MUFA consumption								
inadequate	10	47.6	11	52.3	21	100	0.710*	0.758 (0.175-3.274)
adequate	6	54.5	5	45.4	11	100		
Total	16	50.0	16	50.0	32	100		
PUFA consumption								
inadequate	9	45.0	11	55.0	20	100	0.465*	584 (0.138-2.483)
adequate	7	58.3	5	41.6	12	100		
Total	16	50.0	16	50.0	32	100		

*Chi-Square test.

Table 3. The relationship between the consumption of SFA and total cholesterol level in CAD patients at the Artery Polyclinic RSUD. Dr. M. Yunus Bengkulu

Consumption of Saturated fatty acids	Total Cholesterol (mg/dL)				Total		p-value	OR
	Abnormal		Normal		n	%		
	n	%	n	%				
Inadequate	16	59.2	11	40.7	27	100	0.043	0.407
Adequate	0	0.0	5	100.0	5	100		

Table 4. The relationship between consuming MUFA and total cholesterol level in CAD patients at the Artery Polyclinic RSUD. Dr. M. Yunus Bengkulu

Consumption of MUFA	Total Cholesterol (mg/dL)				Total		p-value	OR
	abnormal		normal		n	%		
	n	%	n	%				
Inadequate	10	47.6	11	52.4	21	100	0.710	0.758
Adequate	6	54.5	5	45.5	11	100		

Table 5. The relationship between the consumption of PUFA and total cholesterol level in CAD patients at the Artery Polyclinic RSUD. Dr. M. Yunus Bengkulu

Consumption of Polyunsaturated fatty acids (PUFA)	Total Cholesterol (mg/dL)				Total		p-value	OR
	Abnormal		Normal		n	%		
	n	%	n	%				
Inadequate	9	45.0	11	55.0	20	100	0.465	0.584
Adequate	7	58.4	5	41.6	12	100		

At Table 4 the statistical test results obtained p-value = 0.465 (<0.05 ; OR = 0.584) meaning that there is no significant relationship between consumption of PUFA and total cholesterol levels in patients with coronary artery disease at the artery clinic of RSUD. Dr. M. Yunus Bengkulu's analysis showed that almost a portion of those consuming bad PUFA experienced abnormal total cholesterol levels of 45%, and most of those consuming adequate PUFA experienced Abnormal total cholesterol levels of 58.3%.

The Relationship of Consumption of SFA with Total Cholesterol Levels in CAD Patients

Based on the results of this study, it was found that there was a significant relationship between the consumption of SFA and total cholesterol levels in patients with coronary artery disease at the artery clinic at RSUD Dr M. Yunus Bengkulu Year 2023. Most patients who consume bad SFA have abnormal total cholesterol levels, and none

consume good SFA with abnormal total cholesterol levels.

The results of interviews found that the source of food high in SFA, which is often consumed with a frequency of $\geq 1x$ a day (every meal), is palm oil. This aligns with research by Sayon-Orea et al. (2015) that the consumption of palm oil significantly influences CVD risk. Interview results showed that respondents often consumed foods that contained a lot of fat, such as coconut milk and fried dishes. Consumption of fried foods has a direct link to a higher risk of CVD, as oil has different health effects depending on the form in which it is eaten (used for sauces, cooking, or frying). The frying process can affect the quality and amount of fat consumed. This oil uptake has been shown to differ depending on the frying time (Sayon-Orea et al., 2015).

Food items stuffed with SFA that respondents rarely consume are coconut milk, young coconut meat, shrimp and rapeseed. Shellfish (Lokan) also contain bioactive compounds, including prostaglandins, fatty acid derivatives, alkaloids,

and other compounds. These substances have certain types of activity. Based on Hasyimi, there is another type of shellfish, namely *Anadaragranosa*, which has a reasonably high cholesterol content of around 177.295 mg/100 gr. This amount can still be said to be suitable for consumption if it refers to the provisions of WHO and NCEP (National Cholesterol Education Program), but it is possible that it could increase total cholesterol levels in shellfish after processing, which affects body cholesterol.

High consumption of saturated fatty acids significantly increases LDL cholesterol levels and reduces HDL levels. This automatically increases total blood cholesterol (which is a combination of LDL and HDL cholesterol) and reduces the ratio between LDL and HDL (Bertalina, 2015). Most adults need to reduce saturated fatty acids to reduce CVD risk. The recommended implementation strategy to achieve this reduction is to shift food choices from those high in saturated fatty acids to those high in monounsaturated and polyunsaturated fatty acids. Reducing SFA and replacing it with vegetable oils rich in PUFA, especially soybean oil, reduces CAD by 29% (Sacks et al., 2017). This is the same as research from Mozaffarian (2016) that increasing the consumption of PUFA-rich vegetable oils is an evidence-based strategy to reduce the risk of CAD and, as a substitute for saturated animal fats, reduces the incidence of CAD.

The National Institute of Clinical Excellence (NICE) reports that dietary energy derived from SFA is likely associated with CAD mortality and emphasizes that reducing SFA intake is essential for CAD prevention. NICE claims that 30,000 lives could be saved each year by replacing SFA with PUFA. Reducing SFA intake and replacing it with PUFA is more beneficial for preventing CVD. These findings provide evidence that consuming PUFA as a substitute for SFA minimizes the incidence of CAD and suggests that a shift towards greater consumption of PUFA compared to SFA will significantly reduce CAD rates (Valk, 2022).

The Relationship between MUFA Consumption and Total Cholesterol Levels in CAD Patients

Based on the results of this study, it was found that there was no significant relationship between

the consumption of MUFA and total cholesterol levels in patients with coronary artery disease at the artery clinic at RSUD Dr M. Yunus Bengkulu Year 2023. Almost a portion of those consuming MUFA that are not good experience abnormal total cholesterol levels, and the majority of those consuming MUFA that are good experience abnormal total cholesterol levels. This is seen in MUFA consumption habits and the portions consumed.

The results of interviews with 32 respondents found that canola oil, peanuts, and avocado are food sources of MUFA that are rarely consumed. Meanwhile, olive oil is never consumed. According to Doloksaribu (2016), food ingredients found in monounsaturated fats are oleic acid and its sources, as well as liquid animal and vegetable fats, mainly olive oil and avocado. Research by Sayon-Orea et al. (2015) proves this, as they state that consumption of olive oil, vegetable oil, and mustard oil does not increase the risk of CVD. This aligns with Ryan et al. (2013) research that a diet high in MUFA can reduce LDL oxidation and increase HDL.

The results of direct interviews with respondents during the research revealed that most respondents never consumed oil sources from plants. In this study, only two people consumed canola oil with a consumption frequency of 1-3x a day because the price was unaffordable, so causing the consumption of MUFA in the majority of respondents to fall into the wrong category (Lidiyawati & Kartini, 2014).

The Relationship between PUFA Consumption and Total Cholesterol Levels in CAD Patients

Based on the results of this study, there was no significant relationship between the consumption of PUFA and total cholesterol levels in patients with coronary artery disease at the artery clinic at Dr RSUD. M. Yunus Bengkulu in 2023. Almost half of those consuming bad PUFA experience abnormal total cholesterol levels, and most of those consuming good PUFA experience abnormal total cholesterol levels.

Through the results of direct interviews with 32 respondents during the research, it was discovered that the food sources for PUFA, which are often consumed with a food frequency of $\geq 1x$

a day (every meal), are tofu and tuna. This research is in line with Handayani, et al., (2021) which states that reducing total cholesterol levels and increasing HDL levels is based on the influence of omega-3 fatty acids PUFA obtained when consuming fish.

They are consuming unhealthy foods, such as excessive consumption of fat and cholesterol, while low levels of PUFA can cause an increase in cholesterol levels in the blood and the risk of coronary artery disease (Rukmasari & Sumarni, 2018). This is in line with the results of research by Sacks, Lichtenstein, et al (2017), increasing PUFA intake can reduce cholesterol levels in the blood. The lack of PUFA may be due to the patient's need for knowledge regarding the food ingredients that should be consumed. So, patients need to be referred to a nutrition consultation clinic to understand eating arrangements so that consumption of PUFA is as required; with appropriate consumption, it can reduce cholesterol levels (Zahroh & Bertalina, 2014).

CONCLUSION

Based on the research results and discussion regarding the description of respondents' food consumption, almost all of their consumption of SFA is not good; most of their consumption of MUFA and PUFA is not good. Meanwhile, a significant relationship existed between the consumption of SFA. Still, conversely, there was no significant relationship between the consumption of MUFA and PUFA and total cholesterol levels in patients with coronary artery disease.

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