

ORIGINAL ARTICLE

The duration of Mediterranean diet affects the levels of the lipid profile in dyslipidemia patients

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ABSTRACT

Dyslipidemia is a lipid metabolism disorder that indicates abnormal levels of lipid profile in plasma. The most notable lipid profile abnormalities include increased levels of total cholesterol, low-density lipoprotein cholesterol (LDL), triglycerides, and a decrease in high-density lipoprotein cholesterol (HDL). One of the non-pharmacological management for dyslipidemia is diet modification with the Mediterranean diet. This study aims to determine the relationship between the duration of the Mediterranean diet and lipid profile levels in Prolanis patients who experience dyslipidemia in a clinic in Bandung. The research method was analytical with cohort observations. Sampling was done by consecutive sampling. Subjects in this study were 30 dyslipidemic patients who followed a Mediterranean diet and were examined for lipid profile levels in the first and third months. Data on total cholesterol, LDL, HDL, and triglycerides were analyzed using the T-dependent test. Total cholesterol and Triglycerides decreased significantly, and HDL increased significantly in the first and third month. The duration of the Mediterranean diet shows a reduction effect of total cholesterol, LDL, triglycerides and significantly increase HDL in patients with dyslipidemia because the recommended foods are high in monounsaturated fatty acids (MUFA) and polyunsaturated fatty acids (PUFA), which can correct abnormalities in lipid profile levels.

Keyword: HDL, LDL, Mediterranean diet, Total cholesterol, Triglycerides

INTRODUCTION

Dyslipidemia is a lipid metabolism disorder characterized by increased levels of

total cholesterol, LDL, and triglycerides, as well as a decrease in HDL cholesterol (Anwar 2006; Wahjuni 2015). Dyslipidemia

is classified into primary dyslipidemia and secondary dyslipidemia. Primary dyslipidemia is a condition of abnormal lipid fraction levels in the blood caused by genetic and inherited disorders (Hamam 2017). Secondary dyslipidemia is a disorder of lipid fraction levels in the blood caused by other diseases such as nephrotic syndrome, hypothyroidism, diabetes mellitus, kidney failure, and liver disease. In addition, dyslipidemia is also a major factor in increasing the risk of cardiovascular disease, therefore, in cases of dyslipidemia, it is necessary to diagnose as early as possible to reduce the risk of complications (Anwar 2006; Riskesdas 2013). Based on data from the Global Health Observatory (GHO) from the World Health Organization (WHO) shows that the prevalence of dyslipidemia in 2008 was 37% in the male population and 40% in the female population, this data shows that women suffer from dyslipidemia more than men. Data from the 2013 National Basic Health Research (RISKESDAS) recorded that 35.9% of the Indonesian population aged 15 years had abnormal cholesterol levels (based on NCEP ATP III, cholesterol levels 200mg/dL) and 15.9% of the population aged 15 years also had a very high proportion of LDL (≥ 190 mg/dL), 22.9% had HDL which is less than 40 mg/dL and 11.9% had very high triglyceride levels (≥ 500 mg/dL), in addition, urban residents have more prevalence of cases when compared to rural residents (Labibah 2016).

The Mediterranean diet is a diet that describes the lifestyle characteristics of European people living in the area around the Mediterranean Sea. The Mediterranean diet involves a wide variety of nutritious foods and is characterized by a diet high in olive oil, fruit, nuts, vegetables, cereals, sufficient fish, low in dairy products, red meat, processed meats and sugary foods, and moderate consumption of wine. Observations made by Ancel Keys in his book show the lowest rates of cardiovascular disease among residents around the Mediterranean Sea when compared to other regions (Estruch 2010; Sofi 2013; Tuttolomondo 2019; John 2006).

Management of dyslipidemia is divided into two, namely non-pharmacological management and pharmacological management, it is recommended that all dyslipidemic patients prioritize non-pharmacological management first such as nutritional therapy except in patients who already have cardiovascular disease or who have very high LDL levels. Non-pharmacological therapy must be combined with pharmacological therapy (Wiyono 2003; Corradi 2016; Anneke 2018). Guidelines for the management of dyslipidemia recommend LDL as the main target in the therapy of dyslipidemia, patients with high total and LDL cholesterol levels are strongly recommended to reduce saturated fat intake and increase intake of monounsaturated fats/MUFA and double-chain/PUFA while reducing carbohydrate and alcohol intake can be recommended to reduce triglyceride levels (Wiyono 2003; Rhee 2019). The 2013 AHA guidelines recommend avoiding saturated fat intake up to 5-6% of total energy intake and avoiding trans-fat intake, this is recommended by the Mediterranean diet (Lestari 2018).

METHODS AND SUBJECT

This is an analytical study to determine the relationship between the length of the Mediterranean diet and total cholesterol, LDL, HDL, and triglycerides in dyslipidemic patients. This study was conducted on dyslipidemic patients on a Mediterranean diet with data collection in a cohort. Subjects on a Mediterranean diet were identified using the Mediterranean Adherence Screener (MEDAS) questionnaire. The sampling method was carried out using a consecutive sampling technique by determining subjects who met the research criteria for further research to be carried out for a certain period. In this study, there is a baseline obtained from medical records, here in referred to as T_0 , then the first month of examination of lipid profile levels is referred to as T_1 , while the third month of examination of lipid profile levels is referred

to as T₃.

Inclusion criteria:

1. Dyslipidemic patients with total cholesterol 200 mg/dL, LDL 100 mg/dL, HDL 40 mg/dL, and triglycerides 150 mg/dL.
2. Subjects who were on the Mediterranean diet for 1 month known as the Mediterranean Adherence Screener (MEDAS).

Exclusion Criteria:

1. Subjects who are not willing to follow all research procedures.
2. Subjects who have complications in the form of cardiovascular disease known from medical record data.

Drop Out Criteria:

1. Subjects who did not continue the study.
2. Subjects who did not continue the diet

DISCUSSION AND RESULTS

Table 1. Age of dyslipidemic patients with the Mediterranean diet

	Age				
	Mean	Median	Standard Deviation	Minimum-Maximum	(95% Confidence Interval)
Mediterranean Diet	54,20	51,00	11,217	38-84	50,01 – 58,39

Based on the results of the study, the average age of the patients was 54.20 years. This is following the incidence of dyslipidemia in old age because the older a person is associated with a decrease in the function of body organs such as the liver which plays a role in lipid metabolism where the formation of cholesterol, phospholipids, and lipoproteins will be disrupted so that it can cause abnormalities in lipid profile levels in dyslipidemic patients (Steinberg 2010).

The decreased liver function also affects the decrease in LDL receptor activity because LDL receptors are found on the surface of almost all hepatocyte cells so that LDL will be oxidized a lot and atherosclerosis occurs in blood vessels which can cause elderly patients to experience coronary heart disease, with the Mediterranean diet it will inhibit the occurrence of dyslipidemia and prevent patients from coronary heart disease (Tautik 2011).

Table 2. Gender of dyslipidemic patients with the Mediterranean diet

	Man		Woman		N	%
	N	%	N	%		
Mediterranean Diet	11	36,7	19	63,3	30	100

Description: N = Total

Gender in the study showed that the majority of patients were female, as many as 19 patients or 63.3%, while male as many as 11 patients or 36.7%. This is consistent with the incidence of dyslipidemia in older women

than men because in older women there is a decrease in the hormone estrogen (Steinberg 2010). Estrogen is a hormone that has a direct effect on protection in preventing LDL oxidation in lipoprotein metabolism if LDL is oxidized in

the body. A large number will cause the formation of foam cells and the occurrence of atherosclerosis in the blood vessels, causing coronary heart

disease, therefore the incidence of dyslipidemia in older women is more frequent than in men (Tautik 2011; Nugraheni 2012).

Table 3. Distribution of mean total cholesterol after the Mediterranean diet for 1 and 3 months

Variable	N	Mean	Standard Deviation	p-value
T0	30	236,43	39,336	
T1	30	197,90	43,421	0,000
T3	30	178,27	37,039	

Description: N = Total

Statistical test results obtained p-value = 0.000 which means there is a significant difference in the results of reducing total cholesterol in patients who follow the Mediterranean diet for 1 month.

Statistical test results obtained p-value = 0.000 which means that there is a significant difference in the results of reducing total cholesterol in patients who follow the Mediterranean diet for 3 months.

The Mediterranean diet has a high content of unsaturated fatty acids such as MUFA contained in olive oil, MUFA in olive oil has a hypocholesterolemic effect that can

suppress the accumulation of cholesterol in the liver by inhibiting the HMG-CoA Reductase enzyme so that the use of olive oil which contains High MUFA can inhibit the activity of 3-hydroxy3-methylglutaryl (HMG)-CoA reductase which is an enzyme that functions to metabolize and produce cholesterol so that when the activity of 3-hydroxy3-methylglutaryl (HMG)-CoA reductase is inhibited by foods high in MUFA will be associated with the occurrence of a decrease in total cholesterol levels (Mekki 2010; Pachyrrhizus 2014).

Table 4. Distribution of mean LDL after the Mediterranean diet for 1 and 3 months

Variable	N	Mean	Standard Deviation	p-value
T0	30	134,73	29,856	
T1	30	122,60	29,724	0,079
T3	30	119,47	18,332	0,026

Description: N = Total

Statistical test results obtained p-value = 0.079 which means there is no significant difference in the results of reducing LDL levels in patients who follow the Mediterranean diet for 1 month.

Statistical test results obtained p-value = 0.026, which means there is a significant difference in the results of reducing LDL levels in patients who follow the Mediterranean diet for 3 months.

The Mediterranean diet recommends foods high in nuts and foods high in fruits such as avocados, which contain vitamin B3 and nicotinic acid, which works by inhibiting the hormone-sensitive lipase enzyme in adipose tissue, which can reduce the amount of free fatty acids when free fatty acids are reduced. This will lead to reduced VLDL synthesis in the liver because free fatty acids are the source of VLDL formation, resulting in a decrease in

VLDL thereby preventing the formation of IDL and LDL when the hydrolysis process occurs in lipoprotein metabolism (Wiyono 2003).

Table 5. Distribution of mean HDL after the Mediterranean diet for 1 and 3 months

Variable	N	Mean	Standard Deviation	p-value
T0	30	39,03	6,631	
T1	30	40,80	5,641	0,298
T3	30	43,43	5,519	0,009

Description: N = Total

Statistical test results obtained p-value = 0.298, which means there is no significant difference in the results of increasing HDL levels in patients who follow the Mediterranean diet for 1 month.

Statistical test results obtained p-value = 0.009 which means there is a significant difference in the results of increasing HDL levels in patients who follow the Mediterranean diet for 3 months.

The Mediterranean diet has a high content of PUFA and MUFA, besides that

there is also oleic acid in MUFA which can increase HDL cholesterol where HDL cholesterol has an anti-atherosclerosis effect that is beneficial for the reverse cholesterol transport pathway so that cholesterol can be carried from all over the body to the liver. The Mediterranean diet contains nuts, fruits, and isoflavones that can increase the production of nascent HDL. Increased nascent HDL can prevent dyslipidemia with the Mediterranean diet (Mekki 2010; Oldways 2012).

Table 6. Distribution of mean triglycerides after the Mediterranean diet for 1 month

Variable	N	Mean	Standard Deviation	p-value
T0	30	266,97	48,565	
T1	30	139,03	46,737	0,000
T3	30	129,10	31,529	

Description : N = Total

The results of the statistical test obtained p-value = 0.000 which means there is a significant difference in the results of decreasing triglycerides in patients who follow the Mediterranean diet for 1 month.

The results of the statistical test obtained p value = 0.000 which means that there is a significant difference in the results of reducing triglycerides in patients who follow the Mediterranean diet for 3 months.

The Mediterranean diet contains PUFA which contains Omega 3 such as fish, nuts, and seeds, the PUFA content in the Mediterranean diet can increase VLDL clearance so that there is a decrease in VLDL secretion which causes a decrease in triglyceride levels. (Dernini 2016; Boucher

2017; Widmer 2015) The Mediterranean diet also limits the intake of simple carbohydrates. (Nutrition Clinics 2019) When the body consumes too many carbohydrates it will cause carbohydrates to be broken down into glucose further with the help of the glucokinase enzyme converted to glucose 6 phosphate through the breakdown of dihydroxy acetone phosphate which is reduced with the help of NADH to glycerol-3-phosphate where glycerol-3. This phosphate will undergo esterification to form diacylglycerol-3-phosphate which is known as a constituent of triglycerides in the body so that the Mediterranean diet can reduce triglyceride levels. (Meslier 2020).

CONCLUSION

Based on the results of the research above, the researcher concludes as follows:

1. There is a long-standing relationship between the Mediterranean diet and decreased levels of significant total cholesterol in dyslipidemic patients undergoing Mediterranean diet for 1 month and 3 months.
2. There is a long-standing relationship between the Mediterranean diet and the reduction of LDL levels significant in dyslipidemic patients following the Mediterranean diet for 3 months.
3. There is a long-standing relationship between the Mediterranean diet and increased HDL levels significant in dyslipidemic patients following the Mediterranean diet for 3 months.
4. There is a long-standing relationship between the Mediterranean diet and decreased levels of significant triglycerides in dyslipidemic patients on diet Mediterranean for 1 month and 3 months.

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DECLARATION OF INTERESTS

The authors declared that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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