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Effect of Consumption Chocolate (*Theobroma Cacao L*) on Cholesterol Levels in Patients With Hypercholesterolemia (study in the UPTD Puskesmas Jatiroto)

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***Abstract*—The prevalence of hypercholesterolemia continues to increase every year and is a risk factor for heart disease which is the cause of global death to date. The use of compounds in an effort to prevent and reduce cholesterol levels is very important, namely by using chocolate which contains flavonoid compounds as antioxidants and is able to reduce cholesterol levels in the blood. This study aims to determine the effect of chocolate consumption on blood cholesterol levels in hypercholesterolemic patients. This study is a Quasi Experiment with a Pre and Post Test Design with Control Design Group with a total of 32 respondents. The control group was given simvastatin according to a doctor's prescription, while the intervention group was added 60 grams of chocolate per day for 15 days. The results of this study indicate that consuming 60 grams of chocolate per day for 15 days accompanied by consumption of simvastatin can affect blood cholesterol levels with results (p = 0.001). Consumption of 60 grams of chocolate per day for 15 days affects the decrease in blood cholesterol levels.**

Keywords—Chocolate (Theobroma Cacao L), Blood Cholesterol Levels, Hypercholesterolemia

I. INTRODUCTION

The health problem that often occurs in society, both in developed and developing countries, is the increase in degenerative diseases. The cause is due to lifestyle changes such as smoking habits, diet, environmental factors, lack of physical activity, consumption of foods high in fat and cholesterol, lack of fiber intake and genetic factors that trigger degenerative diseases. Degenerative diseases that can cause damage to tissues or organs in the body to cause death, one example is cardiovascular disease, which is the cause of the disease due to high levels of cholesterol in the blood.[1]

Hypercholesterolemia is a metabolic disorder that occurs due to various diseases that can contribute to various types of diseases, especially cardiovascular disease. Hypercholesterolemia is closely related to hyperlipidemia and hyperlipoproteinemia. Hypercholesterolemia can occur due to abnormalities in blood lipoprotein levels, which in the long term accelerate the incidence of arteriosclerosis and hypertension, which are manifested in various cardiovascular diseases.[2] Cholesterol is one component that has a major effect on plasma lipid levels. The National Cholesterol Education Program Adult Panel III (NCEP-ATP III) has established a lipid profile value that can be used as a guideline for the general public. The value of normal total cholesterol levels according to NCEP-ATP III is <200 mg / dl [3].

High cholesterol is a condition where total cholesterol is 190 mg / dl or more, according to data obtained from the Ministry of Health of the Republic of Indonesia through the non-communicable disease profile in 2016, it was found that the male gender was 48% while for women it was 5.3%. According to provincial data, the highest percentage in Indonesia is West Papua province, namely 70%, while the province with the lowest percentage of cholesterol prevalence is 8.8%, namely Bali province [4].

Degenerative diseases such as hypercholesterolemia rarely show signs and symptoms at an early stage, so it is necessary to detect early with regular blood pressure checks. Trigger factors that cause the higher prevalence of hypercholesterolemic patients are influenced by an unhealthy lifestyle such as smoking, alcohol consumption, lack of activity / exercise, stress, high fat intake patterns [5]. Other supporting factors such as less public knowledge about health, ignorance in the presentation of food and life patterns are very influential on this disease [6].

As the prevalence of hypercholesterolemic cases increases and the complications that occur due to inaccurate handling are carried out, the use of drugs in hypercholesterolemic patients is one of the important elements in achieving the quality of health according to the expected standards. In addition to using anti-cholesterol drugs, the management of hypercholesterolemia can use natural ingredients produced by Indonesian commodities as an alternative therapy in managing hypercholesterolemia. The result of a natural commodity that provides benefits to lower cholesterol is chocolate. Chocolate

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is an ingredient that is used by the community for food and beverage ingredients. The active ingredients in chocolate that can have an effect on cholesterol levels in the blood are flavonoids, which are derived from polyphenols. Polyphenol compounds contribute to vasodilation of blood vessels, so they can improve circulation of blood flow, as well as antioxidants that work to inhibit the formation of endogenous mediators derived from phospholipid peroxidation by blocking the production of enzymatic free radicals and inhibiting platelet aggregation so as to prevent lipid peroxidation [7].

Research conducted by Livia De Paula (2012) shows that consumption of dark chocolate 50 grams per day for 4 weeks shows results on total cholesterol checks (before: 199.00 ± 7.41 and after: 195.15 ± 9.25) p = 0.55 HDL cholesterol examination (before: 50.85 ± 2.31 and after: 48.75 ± 2.64) p = 0.43 LDL examination (before: 122.25 ± 6.71 and after: 122, 00 ± 9.24) p = 98 and the triglyceride test showed (before: 132.80 ± 11.80 and after: 122.00 ± 9.24) p = 29. The study proved that consumption of chocolate at a dose of 50 grams on blood cholesterol levels showed a decrease in components of total cholesterol levels. Based on this research, it can be concluded that, it is necessary to increase the dose from 2x30 grams to 60 grams for 15 days in the hope that this dose can provide better results on blood cholesterol levels

II. METHOD

This research is a Quasi Experiment research type with pre and post-test design with control group design, with the aim of knowing the effect of 60 grams of chocolate on changes in blood cholesterol levels of hypercholesterolemic patients at UPT Puskesmas Jatiroto. In the intervention group and the control group, they received recommended anti-cholesterol drug therapy, but the intervention group was given 60 grams of chocolate per day for 15 days. The study population was all patients with a diagnosis of hypercholesterolemia who were treated at the UPT Puskesmas Jatiroto. Sampling in this study used a probability sampling technique, with a stratified random sampling method with the criteria for the inclusion of total cholesterol levels> 200 mg / dl, willing to be respondents and not currently using other complementary therapies. The total sample size is 32 respondents, the intervention group is 16 respondents and the control group is 1 respondent [8][9][10].

III. RESULT

This research was conducted at UPT Puskesmas Jatiroto with a total population of 46 respondents, but according to the research criteria, 38 respondents were divided into 2 groups, namely the intervention group received 60 grams of chocolate consumption drug therapy for 15 days while the control group received drug therapy only. After the 7th day of the 38 respondents, there were 6 respondents grouping out so that the total number became 32 respondents. Against 32 respondents on the 15th day, a laboratory examination was carried out again at the Amal Sehat Slogohimo Hospital, Wonogiri to determine changes in cholesterol levels which were described in the form of a frequency distribution table as follows:

A. Descriptive gender characteristics of respondents.

Based on table 1, it is found that most of the respondents were female, amounting to 10 respondents (58.8%) while as many as 8 respondents (53.3%) were in the control group. Whereas for male gender, both the intervention group and the control group had the same number.

Table 1 Frequency distribution and percentage of responden characteristics based on gender demographic characteristics in the control group and the intervention group at the UPT Puskesmas Jatiroto (n = 32)

Karakteristik	Kelompok intervensi (n=16)		Kelompok kontrol (n=16)		Total		P
	n	%	n	%	n	%	
Jenis Kelamin							0,592
Laki-laki	7	41,2	7	46,7	14	43,8	
Perempuan	10	58,8	8	53,3	18	56,2	

B. Descriptive characteristics of respondens age.

Table 2 Frequency distribution and percentage of responden characteristics based on age demographic characteristics in the control group and the intervention group at the UPT Puskesmas Jatiroto (n = 32)

Karakteristik	Kelompok intervensi (n=16)		Kelompok kontrol (n=16)		Total		P
	n	%	n	%	n	%	
Usia (mean±SD)	56,76±9,731		57,07±9,33				0,791
Min-Max	38-72		41-74		38-74		
26-45	3	17,6	2	13,3	5	15,6	
46-65	11	64,7	11	73,3	22	68,8	
>65	3	17,6	2	13,3	5	15,6	

Homogeneity of variance significant >0,05

Based on table 2, it is found that the average age of the respondents is mostly both in the intervention group and the control group with an age range of 46-5 years, amounting to 22 respondents (8.8%).

C. Descriptive frequency of total blood cholesterol levels in the intervention group and the control group at the UPT Puskesmas Jatiroto.

Table 3 Descriptive of the Frequency of Total Cholesterol Value in the Intervention Group and the Control Group at the UPT Puskesmas Jatiroto (n = 32).

Pengukuran kolesterol total	Kelompok intervensi (n=17)		Kelompok kontrol (n=15)		P
	mean±SD	Min-max	mean±SD	Min-max	
Pre	250,18±31,078	204-298	236±24,2	207-271	0,286
Post	193,12±43,552	98-260	222,40±30,5	178-278	0,320
Beda rerata	-57,06±41,499		-14,40±24,833		

Table 3 shows the data on the average cholesterol value in the intervention group, namely 250.18 at the pre-test and 193.12 at the post-test with a mean difference of -57.06. Whereas in the control group, the total cholesterol value was 236 at the pre-test and 222.40 at the post-test with a mean difference of -114.40

D. The difference in total cholesterol value between the intervention group and the control group at UPT Puskesmas Jatiroto.

Table 4 shows that the p value <0.05, which means that there is a significant difference in total cholesterol values between the intervention group and the control group.

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Table 4 Analysis of differences in total cholesterol values between the intervention group and the control group at UPT Puskesmas Jatiroto.

Variabel	Kelompok	mean±SD	Mean perbedaan	P
Kolesterol	Intervensi	-57,06±41,499	-37,06±40,437	0,02
	Kontrol	14,40±24,833		

Independent t-test

E. The difference in total cholesterol values before and after in the intervention group and the control group

Table 5 Differences in total cholesterol levels before and after in the intervention group and the control group

Variabel	Pengukuran	Intervensi		Pengukuran	Kontrol	
		Mean perbedaan	P		Mean perbedaan	p
Kolesterol total	Pre test Post test	- 57,06±41,499	0,001	Pre test Post test	14,40±24,833	0,04

Dependent t-test

Table 5 shows the results of the dependent t-test, the value of total cholesterol levels in each intervention group and the control group during the pre-test and post-test, namely p <005, which means that there is a significant difference.

IV. Discussion

The results of the independent t-test analysis of blood cholesterol levels in the intervention group and the control group showed a p value of 0.02, which means that there is a difference in good values in the treatment group. While the analysis of the dependent-test value of total cholesterol levels in each intervention group and control group during the pre-test and post-test was p <005. In the intervention group, the mean value was -57.06 before being given treatment with conventional drug consumption and 60 grams of chocolate intake for 15 days, the value was 41.499, so the difference between before and after treatment was p: 0.001. The measurement also applies to the control group with the results before treatment with conventional drug consumption the value is 14.40, while after being given the treatment the result is 24.833 so that the difference value in the control group between before treatment and after treatment is p: 0.041.

Consumption of 60 grams of chocolate for 15 days is given to see total cholesterol levels. Measurement of total cholesterol levels was carried out before consumption of chocolate and re-measured after consumption of chocolate. The results of the study on total cholesterol levels between the intervention group and the control group showed a significant value, and the results of measuring blood cholesterol levels in each group at the time of the test and post test also showed a significant difference with p value <0.05.

The results of this study are in line with previous research by Livia de Paula (2012) in evaluating the intake of 50 grams of chocolate on the lipid profile in drajad I hypertension and overweight showed a decrease in the average value of total cholesterol levels before (199.00 ± 7.41).) and the average results after treatment (195.15 ± 9.25), although the results stated that there was no significant difference, there was a decrease. (14) The decrease in blood cholesterol value is caused by chocolate containing flavonoids which work to reduce the levels of 3-hydroxy-3-methylglutaryl-KoA (HMG KoA) reductase which later causes the effect of lowering cholesterol levels in the blood [11].

Research conducted by Shiina in 2007 on the intake of flavonoid-rich dark chocolate on heart flow in adults, with cholesterol testing as a component of laboratory tests. The results obtained after the treatment group respondents as many as 11 people with a consumption of 45 grams in a period of 14 days are the average value before 180 and the average value after 29, then there is a considerable difference after being given chocolate consumption [12].

The results of this study are supported by research conducted by Hartono and siti Handayani (2017) with the use of celery to reduce hypercholesterolemia in the elderly. The intervention was given celery extract as much as 1.7 gr / day divided into 2 doses, namely 850 mg in the morning and 850 mg in the afternoon after meals showed a p value of 0.029 which means that it has an effect on the administration of celery extract [13].

Celery plants have a high content of flavonoids which are the same as chocolate which has the function of improving cholesterol levels in the blood. Flavonoid compounds which are classified as polyphenol compounds can reduce total plasma cholesterol levels by inhibiting cholesterol absorption by the intestine and increasing the reaction of bile acid formation from cholesterol then excreted through feces. Phenols and polyphenols play a role in reducing the secretion of lipoproteins found in the liver and intestines as well as reducing the esterification process of cholesterol resulting in a decrease in cholesterol ester levels, where cholesterol ester is the main formation component of chylomichrome and VLDL [14].

V. Conclusions and Suggestions

The results of this study showed that the total cholesterol value between the intervention group and the control group at UPT Puskesmas Jatiroto showed p: 0.02 so that the results of the study with a value of p <0.05, which means that there is a significant difference in total cholesterol values between the intervention group and the control group. Furthermore, the total cholesterol value before and after in the intervention group p: 0.001 and the results from the control group p: 0.041 from the total cholesterol level value in each intervention group and the control group at the time of the pre-test and post-test, namely p <005, which means that there is a difference significant. For researchers and further development, can use an experimental design by giving graded doses and checking cholesterol levels regularly.

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