

Differences in Total Cholesterol Levels after Administration of Green Tea in Patients with Hypercholesterolemia

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ABSTRACT

Cholesterol is a component of fatty acids found in the blood. This substance is needed by the body for certain processes for survival. Among them to form hormones, cells and treat nerve cells. Hypercholesterolemia is excess fat in the blood. Hypercholesterolemia can be overcome by consuming herbal medicines (natural ingredients, such as medicinal plants including green tea. Green tea (*Camellia sinensis*) contains polyphenols in the form of catechins, especially *epigallocatechin-3-gallate* (EGCG). It is a biologically active ingredient that can inhibit the pathogenicity of several chronic diseases, especially in cardiovascular diseases which can play an important role in reducing blood cholesterol levels. This type of research is *quasi experiment (Quasi experiment)* by design *Pretest-Posttest with Control Group* ((Latuconsina, 2018). The implementation of this study was to measure total cholesterol levels taken before and after giving green tea for 2 weeks. The study was conducted on hypercholesterolemia sufferers in the city of Padang. The material used in this study was 3 grams of clean and good quality green tea. The results of statistical analysis using the T-test 2 mean Independent to see the effect of changes in total cholesterol levels on green tea administration in the treatment group and without green tea administration in the control group obtained statistical test results p value <0.05, there was a difference between changes in total cholesterol in the treatment group with the control. The conclusion of this study was that there was a significant difference in initial and final total cholesterol in the treatment group (p<0.05). There was a significant difference of initial and final total cholesterol in the control group (p<0.05). There was a significant difference in changes in total cholesterol between the treatment and control groups ((p<0.05).

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1. INTRODUCTION

Cardiovascular disease has always been a world challenge by becoming the leading cause of death in the world. According to data recapitulation of the World Health Organization (WHO), more than 17 million people in the world have died due to heart disease and vascular disorders. According to the 2018 Basic Health Survey (Riskesdas), figure *incident* heart disease and vascular disorders increase every year. It is known from the data obtained that around 2,784,064 Indonesian residents suffer from heart disease. Coronary Heart Disease (CHD) is one of the three main causes of death in the world from year to year. The presence of CHD is inseparable from the process that causes coronary vessel stenosis, increased total cholesterol values in the body, increased levels of bad cholesterol lipoprotein (LDL), increased levels of triglycerides (TG), and decreased levels of good cholesterol lipoprotein HDL ¹. Blood contains 80% of cholesterol produced in the body while 20% comes from food intake received in the body. Cholesterol is a component of fatty acids found in the blood. This substance is needed by the body for certain processes for survival. Among them to form hormones, cells and treat nerve cells. Hypercholesterolemia usually does not show typical symptoms, often someone just finds out they have hypercholesterolemia when they go for a health check to a health service or other complain ².

High cholesterol can cause atherosclerosis (narrowing and hardening of the arteries). The disease correlation between atherosclerosis and total cholesterol levels in the blood is very clear, which mainly reflects the cholesterol content in LDL ³. Globally, the prevalence of hypercholesterolemia is around

Differences in Total Cholesterol Levels after Administration of Green Tea in Patients with Hypercholesterolemia. Weni Kurnia Sari

45%, around 30% in Southeast Asia, and 35% in Indonesia, including in the city of Padang. According to *Studi Multinational Cardiovascular Disease Trend Monitoring*, the incidence of hypercholesterolemia in Indonesia is 13.4% in women and 11.4% in men. A leading multinational monitoring of cardiovascular disease trends found an increase of 16.2% for women and 14% for men⁴. Hypercholesterolemia is excess fat in the blood. Total blood cholesterol level should not exceed 240 mg/dL. Cholesterol does not dissolve in water, so it is transported in the blood as lipoproteins. Disturbances in cholesterol metabolism, especially LDL and total cholesterol levels, can increase the risk of atherosclerosis and eventually cause coronary heart disease⁵. Increased cholesterol has been shown to change the structure of blood vessels which results in impaired endothelial function causing lesions, plaques, occlusions, and embolism. The impact of increasing cholesterol in the body can trigger complications such as hypertension, diabetes mellitus, heart disease and stroke. Hypercholesterolemia can be overcome by consuming herbal medicines (natural ingredients, such as medicinal plants including green tea⁶. Green tea is one of the traditional medicinal ingredients that has the potential to act as hypolipidemia⁷.

Green tea (*Camellia sinensis*) contains polyphenols in the form of catechins in particular *epigallocatechin-3-gallate* (EGCG). It is a biologically active ingredient that can inhibit the pathogenicity of several chronic diseases, especially in cardiovascular diseases which can play an important role in reducing blood cholesterol levels. Green tea has pharmacological effects including being able to lose weight, reduce cholesterol, triglyceride levels, and blood sugar levels in the body⁸. Tea polyphenols (*catechins and theaflavins*) is also a strong antioxidant that can protect against oxidation of LDL cholesterol by free radicals⁹. Many studies state that there are significant differences in cholesterol levels between the treatment group and the control group after administration of green tea¹⁰. Research on the effect of consuming green tea on cholesterol levels shows that green tea lowers levels of *low density lipoprotein* (LDL) cholesterol, bad cholesterol¹¹. Based on this, the researchers wanted to know the difference in total cholesterol levels after administration of green tea in hypercholesterolemia sufferers.

2. METHOD

This type of research is *quasi experiment (Quasi experiment)* by design *Pretest-Posttest with Control Group*¹². The implementation of this study was to measure total cholesterol levels taken before and after giving green tea for 2 weeks. The study was conducted on hypercholesterolemia sufferers in the city of Padang. The material used in this study was 3 grams of green tea which was clean and of good quality. The amount of green tea needed for 16 treatment samples is 1600 gr with the brand purchased at the supermarket. The tools used are 1 regular scale, 1 spoon, 1 measuring cup, and a serving utensil, 1 cup of tea. The number of samples in the study was divided into 2 groups, namely 16 people in the treatment group and 16 people in the control group. The research sample was taken by purposive sampling. The green tea is given to people with hypercholesterolemia in powder form. This tea was given by the researchers to the patient as much as 3 grams brewed with 150 ml of warm water and drunk 2 times a day, namely at 09.00 and 16.00 for 14 consecutive days by visiting the patient's house. The data collected are primary and secondary data. Primary data about total cholesterol levels of hypercholesterolemic sufferers and secondary data were collected from patient medical records including the patient's name, gender, and age. Researchers used the results of interviews obtained from informants regarding the research topic as primary data¹³. Univariate data analysis: initial and final cholesterol in the treatment and control groups were displayed in the form of average total cholesterol (mg/dl), the change in initial total cholesterol in the treatment group with the final total cholesterol in the treatment group, the change in the initial total cholesterol in the control group and the total cholesterol level final treatment group, sample name, age, gender, occupation, and education to see the frequency distribution. Bivariate data analysis: differences in changes in total cholesterol levels at the beginning and end of the treatment group and the control group using the T-test with two different means of the dependent, differences in changes in total cholesterol levels in the treatment and control groups using the T-test with two different averages are independent, To see the effect of giving green tea before and after in the treatment and control groups on differences in initial and final cholesterol, you can do a T-test with two dependent average differences, to see the effect of giving green tea on

Differences in Total Cholesterol Levels after Administration of Green Tea in Patients with Hypercholesterolemia. Weni Kurnia Sari

differences in changes in total cholesterol in the treatment and control groups, you can do a T-test. the difference between the two independent means.

3. RESULTS AND DISCUSSION

At the time of the study, there were 32 samples that met the criteria for the study, 16 samples were given green tea (treatment) and 16 samples were not given green tea (control).

1. Initial total cholesterol description in the treatment group and the control group

The results of the initial total cholesterol examination in the treatment group and control group can be seen in table 1

Table 1. Initial total cholesterol of the treatment and control group samples

Group	N	Mean	SD	Minimum	Maximum
Treatment	16	227,38	21,272	201	260
Control	16	222,56	15,845	201	256

Table 1 can be seen that the average initial total cholesterol in both the treatment and control samples was less than the normal value

Final Total Cholesterol Overview in the Treatment and Control Groups

The results of the final total cholesterol examination in the treatment and control groups can be seen in table 2

Table 2. Initial total cholesterol of the treatment and control group samples

Group	N	Mean	SD	Minimum	Maximum
Treatment	16	209,00	18,730	183	245
Control	16	212,06	20,898	189	262

Table 2 can be seen that the final mean total cholesterol in the treatment group decreased, but only slightly.

1. Changes in Initial Total Cholesterol before and after in the Treatment and Control Groups

Changes in total cholesterol before and after in the case and control groups can be seen in table 3

Tabel 3. Changes in total cholesterol in the treatment and control groups before and after consumption of green tea and non-green tea

Group	N	Mean	SD	Minimum	Maximum
Treatment	16	18,38	7,293	5	33
Control	16	10,5	11,866	-10	30

Table 3 shows that both the treatment and control groups experienced changes in total cholesterol, the treatment group experienced a greater decrease in cholesterol than the control group.

2. Differences in Changes in Initial and Final Total Cholesterol in the treatment and control groups

The results of statistical analysis using the T-test 2 mean dependent to see changes in total cholesterol levels at the beginning and end of the green tea administration in the treatment group and without green tea administration in the control group can be seen in table 4.

Tabel 4. Differences in Changes in Total Cholesterol at the Beginning and at the End in the Treatment and Control Groups

Group	Analysis of total cholesterol levels	N	Mean	SD	P value
	Baseline total cholesterol level	16	227,38	21,272	

Differences in Total Cholesterol Levels after Administration of Green Tea in Patients with Hypercholesterolemia. Weni Kurnia Sari

Treatment	Final total cholesterol level	16	209,00	18,730	0,000
Control	Baseline total cholesterol level	16	222,56	15,845	
	Final total cholesterol level	16	10,5212,06	20,898	0,003

Table 4 shows that both the treatment group and the control group experienced a decrease in total cholesterol levels. The statistical test results obtained a p value <0.05 for the treatment group, so it can be concluded that there was a difference between the initial and final blood cholesterol in the treatment group, while in the control group the statistical test results were obtained $p < 0.05$, it can be concluded that there is a difference between blood cholesterol the beginning and end of the control group.

3. Differences in Changes in Total Cholesterol Levels in the Treatment Group and the Control Group.

The results of statistical analysis using the T-test 2 mean Independent to see the effect of changes in total cholesterol levels on green tea administration in the treatment group and without green tea administration in the control group can be seen in table 5.

Tabel 5. Differences in total cholesterol changes in the treatment and control groups

Changes in	Group	N	Mean	SD	P value
total cholesterol	Treatment	16	18,38	7,293	
	Control	16	10,5	11,866	0,03

The statistical test results obtained a p value <0.05 , so it can be concluded that there was a difference between changes in total cholesterol in the treatment group and the control.

Based on the results of this study, it can be concluded that the treatment group that was given green tea experienced a decrease in cholesterol for 2 weeks, although the decrease was not too much, while the samples that were not given the treatment also experienced a decrease and some experienced an increase in total cholesterol. This was because the control group samples were not given green tea so that there were samples whose cholesterol eventually increased. This is in line with Astari Sinta's research which found that the average test result before consuming green tea was 241.4 mg/dL, while the average total cholesterol level after consuming green tea was 214.1 mg/dL. There was a decrease in total cholesterol levels after the respondents consumed green tea drinks. The decrease in total cholesterol levels was due to the presence of secondary metabolites in green tea leaf extract. Green tea leaves contain flavonoids, saponins and tannins. The sub-class of flavonoids includes flavones, flavonols, flavanones, flavanols (catechin), chalcones, anthocyanidins, and isoflavone¹⁴. Research conducted by Carolyn¹⁵ examined the potential of giving soy isoflavones to cholesterol levels in obese patients and the results showed a decrease in total cholesterol levels. Reducing cholesterol levels is a direct and indirect effect of green tea. Several studies suggest that the flavonoids in green tea have been shown to improve blood lipid profiles and have a vasoprotective effect¹⁶. Catechins increase energy expenditure causing a reduction in body fat which has an effect on reducing cholesterol levels. Another mechanism is a decrease in cholesterol levels that occurs due to inhibition of the absorption of cholesterol and triglycerides. Catechins can also maintain and regenerate other antioxidants and function to restrain the formation of free radicals. Another mechanism by which polyphenols reduce cholesterol levels is by reducing HMG-CoA reductase activity, enzyme activity *acyl-CoA cholesterol acyltransferase* (ACAT), and reduce the absorption of cholesterol in the digestive tract¹⁷.

4. CONCLUSION

The initial mean total cholesterol for the treatment group was 227.38 mg/dl. The initial mean total cholesterol for the control group was 222.56 mg/dl. The initial mean total cholesterol for the treatment group was 227.38 mg/dl. The average total cholesterol at the end of the treatment group was 209 mg/dl. The average total cholesterol at the end of the control group was 212.06 mg/dl. There was a significant difference in the initial and final total cholesterol in the treatment group ($p < 0.05$). There was a significant difference of initial and final total cholesterol in the control group ($p < 0.05$). There was a significant difference in changes in total cholesterol between the treatment and control groups ($p < 0.05$).

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