Effect of Green Apple on Total Cholesterol Levels in Hypercholesterolemic Patients

Hery Prambudi[1,] and Supriyatin[2,] Fiki Setiawan[3,]

[1]*Akademi Analis Kesehatan An Nasher Cirebon*
[2]*Akademi Analis Kesehatan An Nasher Cirebon*
[3] *Akademi Analis Kesehatan An Nasher Cirebon*

[a)]heryprambudi@aakannasher.ac.id
[b)]supriyatin@aakannasher.ac.id
[c)]fikisetiawan@aakannasher.ac.id

Abstract. Cholesterol is formed naturally in the body, the basis for forming hormones that regulate growth and the body's working mechanisms. Hypercholesterolemia occurs when cholesterol levels exceed normal limits (> 200 mg/dL). This condition will increase the occurrence of several diseases, such as coronary heart disease and stroke. Consuming fruits and vegetables is one of the non-pharmacological therapies for maintaining cholesterol levels. Apples contain many beneficial nutrients for the body, one of which is quercetin, which acts as an antioxidant to combat bad cholesterol (LDL). This study aimed to determine the effect of green apples on total cholesterol levels in hypercholesterolemic patients. The research used the quasi-experiment research method with the one-group pretest-posttest design, where this experiment only used one treatment group. The sampling technique used in this study was purposive sampling, where a sample of 25 patients was obtained. The measuring instrument used is the Easy Touch GCU cholesterol test, and. The T-test tests the data. The average value of the Pretest is 256.76 mg/dL, and the average value of the Posttest is 189.24 mg/dL. The T-test's results (p-value = 0.000) significantly reduced blood cholesterol levels after being given green juice apples. There is an effect of giving green apple juice (Malus Sylvetreis Mill) to decrease blood cholesterol levels in hypercholesterolemic patients.

INTRODUCTION

The rising frequency of Non-Communicable Diseases is attributable to an unhealthy lifestyle fueled by urbanization, modernization, and globalization. The rise of degenerative diseases is a consequence of socioeconomic development and the expansion of health care. With the advancement of technology, numerous processed meals have become widespread. Consuming meals and beverages that are sugary, salty, grilled or baked, caffeinated, preserved, flavored, and heavy in fat increases the chance of developing degenerative diseases. High-fat foods can influence a person's lipid profile, including triglycerides, HDL, LDL, VLDL, and total cholesterol. High cholesterol, also known as hypercholesterolemia, is hazardous to one's health because it can lead to life-threatening conditions such as heart disease and atherosclerosis.

High cholesterol (200 mg/dL) or hypercholesterolemia is a condition in which total cholesterol levels in the body are elevated over the normal range (Widia, 2017). Cholesterol is the primary sterol in the body and a non-isolable lipid group (Damayanti, 2016). The prevalence of hypercholesterolemia globally is 45% (World Health Organization, 2018). In Indonesia, 40% of women and 30% of men have high total cholesterol (>200 mg/dl)

(Hatma, 2018). The prevalence of cholesterol is 66.41% in Indonesia. Cholesterol is present in more than 50% of 18 of 20 provinces in Indonesia and 23 of 27 ethnic groups (Herningtyas, 2019). In the Indonesian population, women have a greater cholesterol prevalence than men, 45.3% in women and 28.6% in men (Sigit et al., 2020).

Both pharmaceutical and non-pharmacological methods exist for overcoming high blood cholesterol levels. Green apple juice is one of the non-drug ways to lower the amount of cholesterol in the blood. Pectin, which is found in green apples, is known as an anticholesterol because it can bind bile acids, which are made when cholesterol is broken down. The more bile acids bind to pectin and are wasted throughout the body, and the more cholesterol is metabolized, resulting in a net decrease in cholesterol levels. Apples also have flavonoids, which are possible antioxidants that stop free radicals from being made. This chemical can inhibit blood cell adhesion and HDL destruction. After cholesterol blocks blood vessels, flavonoids from food dilute the blood again and keep HDL levels at the right level (Darsini, 2017).

Consuming apples is a non-pharmaceutical therapy for lowering and balancing blood cholesterol levels Apples are a type of fruit that is produced by apple trees. When an apple is ripe and ready for consumption, its skin will turn red. Nonetheless, there are also green and yellow apples. Apples contain dietary fiber. The fiber in apples is beneficial for binding lipids and bad cholesterol and eliminating them from the body. The fiber in apples will compete with fat in the intestines, thereby lowering levels of LDL (Low-Density Lipoprotein) and increasing absorption of HDL (High-Density Lipoprotein) (High-Density Lipoprotein). In addition to fiber, apples contain phytochemicals that can help reduce cholesterol levels. Green apples, sometimes known as manage apples, help reduce cholesterol levels, which are a leading cause of heart disease. Pectin molecules known as anticholesterol can bind bile acids, a byproduct of cholesterol metabolism. The more cholesterol is metabolized, the more bile acids are bound to pectin. Pectin can prevent the reabsorption of bile acids, causing cholesterol levels to be expelled through feces rather than urine.

There is research dealing with hypercholesterolemic patients. Troup (2015), Zukhri (2018), and Harsono (2021) After the intervention, the average cholesterol levels of both groups fell, according to the data. Vitamin C, water, protein, carbs, calcium, potassium, and salt are the constituents of guava juice, which was administered to hypercholesterolemic individuals for seven days at 400 ml/g per day. Older women who consume apples every day were found to have an average of 23% reduced LDL cholesterol levels within six months and a 4% increase in HDL cholesterol.

Izzati (2018), Djamaludin (2020), and Selek (2022) all did their own research on green apples. Apples are commonly taken for weight loss, are rich in phytochemicals, and epidemiological studies have revealed a correlation between apple consumption and a decreased risk of some malignancies, cardiovascular illnesses, asthma, and diabetes. In addition, the other objective was to determine the weight of specific organs (liver, kidney, and spleen), lipid ratios (in serum, liver, and kidney), and oxidative stress parameters, as human and animal studies. Obesity has been shown to cause lipidosis in classical adipose tissues, as well as in other tissues and organs, and oxidative stress. Triglyceride levels may go down in older people who drink 200 ml of Manalagi and Fuji apple juice every day for 14 days. Triglyceride levels decreased significantly more in the group that received Fuji apple juice than in the group that received manalagi apple juice. Pectin is also known as an anti-cholesterol agent that, when combined with vitamin C, can lower the amount of cholesterol in the blood. Pectin can also soak up extra water in the colon, soften poop, and bind and get rid of toxins in the digestive tract. The goal of this study is to find out if there is a big difference between total cholesterol levels before and after eating green apples.

METHODOLOGY

This quantitative study employs a pre-experimental research with a one grup pretest-posttest design. This design lacks a comparison group (control) but has made the initial observation by doing a pretest before administering treatment or intervention. Then, a posttest is administered to compare the changes that occurred before and after receiving treatment. This study's independent variable was green apple juice, whereas its dependent variable was total cholesterol levels. The treatment was administered beginning in September 2022 to 25 respondents. Non-probability sampling in purposive sampling will be utilized as the sampling technique. Purposive sampling is based on specific considerations made by the researchers themselves, depending on previously established population traits or features. Those who did not take cholesterol-lowering medications and had total cholesterol levels below 200 mg/dL were considered. The intervention was provided up to 200 ml each day for twenty-eight days.

RESULT AND DISCUSSION

This study aimed to determine the effectiveness of green apples in reducing total cholesterol levels in hypercholesterolemic patients. In this study, there is one experimental group. This section presents a discussion of the overall research results. Statistical analysis was used to answer research questions and test hypotheses. Before treatment, two trials were conducted to describe the validity and reliability of the test—participation questionnaire in the trial. The results showed that all items in the questionnaire were valid and reliable. Based on the study results obtained, as many as 25 samples were examined for total cholesterol levels before treatment. The treatment was carried out for 28 days starting in October. The amount of one treatment is 200 ml of green apple juice. The following results were obtained:

Table 1. Pre-test score

	N	Minimum	Maximum	Mean	Std. Deviation
Pre_Test	25	241	290	256.76	13.470
Valid N (listwise)	25				

According to the preceding, it was found that the lowest value was 241 mg/dl. While the highest value is 290 mg/dl. After getting the preliminary test results, the treatment was processed by the researchers. The following are the results of the study after the treatment.

Table 2. Post-test score

	N	Minimum	Maximum	Mean	Std. Deviation
Post_Test	25	146	271	189.24	27.062
Valid N (listwise)	25				

According to the primary data, it was found that the lowest value was 146 mg/dl. In contrast, the highest value was 271 mg/dl. Based on the table data, comparing cholesterol levels before and after consuming green apple juice in people in Cirebon was calculated statistically using the *Paired Sample T Test*. From the data output in the Paired Sample T Test table, it can be seen that the Asymp value. Sig (2-tailed) is 0.000. Because the significance value < 0.05, then, H1 is accepted. So it can be concluded that patients with hypercholesterolemia substantially vary their total cholesterol levels before and after ingesting green apple juice.

Based on the results of research that has been carried out on hypercholesterolemic patients consisting of 25 samples. The results showed that the average cholesterol level of respondents before consuming green apple juice was 256.76 mg/dl. The average cholesterol level of respondents after consuming green apple juice was 189.24 mg/dl, with an average difference in cholesterol level reduction of 67.52 mg/dl.

Among the variables that affect total cholesterol levels after consuming green apple juice are family history factors or the link between genetics and cholesterol levels known as FH (familial hypercholesterolemia) or extremely high cholesterol levels in one family. In addition to heredity, it depends on respondent interviews' findings. High cholesterol levels can be caused by lifestyle choices that influence the increase in total cholesterol levels after consuming green apple juice, such as high-fat foods without exercise and proper water intake.

In addition to lifestyle factors, the increase in cholesterol levels in the sample is in line with research conducted by Fahyu Widia in 2017 that the higher the age, the higher the cholesterol level. This is caused by aging factors that will cause a decrease in the work of the body's organs. This is an example of a natural risk factor. In old age, coronary arteries are likened to pipes; the longer, the more plaque builds up. In premenopausal women, women are protected by the hormone estrogen so that it can prevent the formation of atherosclerosis. Nevertheless, after menopause, estrogen levels in women decrease.

The decrease in cholesterol levels in respondents apart from consuming green apple juice for 28 days was also because the respondents followed the researchers' directions not to eat foods that are high in fat and adopt a healthy lifestyle and exercise. Researchers assume that green apples can reduce cholesterol levels, as seen from the results after giving green apple juice. Patients with high cholesterol to regularly consume apple juice green according to the recommended dose so that Cholesterol levels in the blood can decrease.

It is in line with the previous research conducted by Antoni et al. (2013) stated that cholesterol can be lowered by consuming 100 grams of green apple juice every day for one month, decreasing cholesterol levels below 200 mg/dl. Another study presented by Yusuf et al. (2010) found that cholesterol can be reduced by consuming 150 grams of guava juice every day for two weeks has decreased cholesterol levels below 240 mg/dl. Guava contains flavonoids that can reduce blood cholesterol levels. Green Apples contain two ingredients that can reduce cholesterol levels in the blood: pectin and vitamin B3. This study aims to compare which is more effective for lowering cholesterol between guava fruit and green apples.

CONCLUSION

Consuming green apple juice reduces blood cholesterol levels in hypercholesterolemic patients with a difference of 67.52 mg/dL with the result (p-value = 0.000). It is hoped that the public can increase awareness of health care, especially in patients with hypercholesterolemia, and be able to make apples as an additional dietary therapy to reduce cholesterol levels.

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