THE EFFECT OF GARLIC EXTRACT (*Allium sativum*) ON TOTAL CHOLESTEROL LEVELS IN HIGH SCHOOL ADOLESCENT WITH OVERNUTRITION

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ABSTRAK : PENGARUH EKSTRAK BAWANG PUTIH (Allium sativum) TERHADAP KADAR KOLESTEROL TOTAL PADA REMAJA SMA DENGAN GIZI BERLEBIHAN

Latar Belakang Prevalensi obesitas penduduk Indonesia berusia ≥15 tahun cenderung meningkat dari 18,8% pada tahun 2007 menjadi 31% pada tahun 2018 dengan risiko gangguan kolesterol, penyakit kardiovaskular, sindrom metabolik, dan kanker.

Tujuan penelitian untuk mengetahui rata-rata kadar kolesterol total setelah pemberian ekstrak bawang putih pada remaja SMA dengan gizi lebih di Kecamatan Tanjung Karang Pusat.

Metode penelitian ini adalah penelitian pra eksperimen dengan rancangan one group pretest-posttest design pada populasi remaja SMA yang mengambil 30 subjek secara purposive sampling dari bulan Mei sampai Juli. Kriteria inklusi: usia 15-18 tahun, gizi lebih, kolesterol total 170 mg/dL. Dikecualikan jika kritis/menderita komplikasi/komorbid, menolak atau tidak mendapat persetujuan orang tua, diketahui memiliki alergi terhadap bawang putih, atau sedang menggunakan terapi lain untuk menurunkan kolesterol. Analisis niat untuk mengobati dilakukan, uji normalitas dilakukan dengan Shapiro-Wilk, dan perbedaan rata-rata kolesterol total dianalisis menggunakan uji Wilcoxon.

Hasil Diketahui bahwa rata-rata kadar kolesterol sebelum dan sesudah diberikan ekstrak bawang putih adalah 192,37 vs 175,00 mg/dL, nilai SD 17,94 vs 31,42; SE 3.27 vs 5.73; minimum 170 vs 131 mg/dl, maksimum 238 vs 268 mg/dl.

Kesimpulan Ada pengaruh pemberian ekstrak bawang putih terhadap penurunan kolesterol total pada remaja SMA dengan gizi lebih (p-value = 0,005). Tidak adanya pemantauan pola makan dan aktivitas fisik selama penelitian, oleh karena itu perlu diperhatikan pada penelitian selanjutnya.

Saran Disarankan untuk melakukan pemeriksaan kolesterol total pada remaja SMA dengan gizi lebih dan memberikan edukasi terkait resiko yang mungkin terjadi kedepannya.

Kata kunci: Ekstrak Bawang Putih, Gizi Lebih,Kolesterol Total,Remaja SMA

ABSTRACT

Backgraound The obesity prevalence of the Indonesian population aged ≥15 years tended to increase from 18.8% in 2007 to 31% in 2018 with the risk of cholesterol disorders, cardiovascular disease, metabolic syndrome, and cancer.

The purpose of the study was to determine the average level of total cholesterol after garlic extract administration to high school adolescents with overnutrition in the Tanjung Karang Pusat sub-district.

MethodsThis was pre-experimental research with a one-group pretest-posttest design in a population of high school adolescents who took 30 subjects by purposive sampling from May to July. Inclusion criteria: age 15-18 years, overnutrition, total cholesterol 170 mg/dL. Excluded if critical / suffering from complications / comorbid, refused or did not get parental consent, known to have allergies against garlic, or were using other therapies to lower cholesterol. Intention to treat analysis was performed, a normality test was carried out with Shapiro-Wilk, and the difference in average total cholesterol was analyzed using the Wilcoxon test.

Result It was known that the average cholesterol levels before and after being given garlic extract were 192.37 vs. 175.00 mg/dL, SD value 17.94 vs. 31.42; SE 3.27 vs 5.73; minimum 170 vs 131 mg/dl, maximum 238 vs 268 mg/dl.

Conclusion There was an influence administration of garlic extract to reduce total cholesterol in high school adolescents with overnutrition (p-value = 0.005). There was no monitoring of diet patterns and physical activity during the study, therefore it must be considered in further research.

Suggestion It was recommended to check total cholesterol in high school adolescents with overnutrition and provide education related to risks that might occur in the future.

Keywords: High school adolescents, overnutrition, garlic extract, total cholesterol

INTRODUCTION

Adolescence is defined by WHO as a transitional period between children and adults (ages 10-19 years). Based on the latest report from the WHO in 2021, the number of adolescents is 16% of the total world population. While in Indonesia itself, UNICEF data in 2021 states that the number of teenagers in Indonesia is 17% of the total 270,203,917 population.

UNICEF presented an overview of Indonesian youth in 2021 as an age group that is vulnerable to being exposed to the COVID-19 pandemic, tobacco consumption, air pollution, mental health, and the burden of malnutrition. The literature review concluded that the Covid-19 pandemic affected the type of nutritional intake from the food consumed, reduced physical activity and tended to rely on online activities, and increased stress (Sendow, 2021). This condition opens up opportunities for overnutrition problems, in the form of excess body weight (fat) and obesity.

With regard to nutritional problems, in the period 1990-2016, there were increasing cases of overweight and obesity in adolescents (UNICEF, 2021). The global incidence of overweight and obesity in children increased from 4.2% in 1990 to 6.7% in 2010. (IDAI, 2014). The latest Riskesdas in 2018 stated that nationally the prevalence of central obesity in the Indonesian population aged 15 years and over tends to increase from 18.8% in 2007 to 31% in 2018. At the regional level, the 2018 Riskesdas report for Lampung Province, based on status BMI according to age, the prevalence of overweight and obesity for the 5-12 year age group was 10.52% and 8.37%, respectively, 13-15 years old was 8.88% and 3.0%, respectively. and ages 16-18 years at 9.42% and 2.17%, respectively. As for Bandar Lampung City 2018, based on BMI status by age, the prevalence of overweight and obesity for the age group of 5-12 years was 12.20% and 12.16%, aged 13-15 years was 8.63% and 6.10%, and aged 16-18 years respectively by 11.15% and 2.16%.

Overweight and obesity in adolescents tend to have a risk to continue into adulthood (Desmukh-Taskar, 2006; The NS, 2010). Other studies have also shown that obesity that occurs in adolescents aged 10-17 years is more likely to continue into adulthood when compared to the onset of obesity at the age of 1-9 years (Whitaker, 1997).In fact, several studies have shown that overweight and obesity in adolescents will increase the risk of metabolic syndrome as a young adult and the risk of cardiovascular disease and cancer in late adulthood (Biro, 2010; Reilly, 2011; Febyan, 2015).

The problem that often arises in adolescents who suffer from excess nutrition is hypercholesterolemia. National data in 2018 in Indonesia shows that the proportion of total cholesterol levels in adolescents aged 15-24 years is found in a borderline and high position of 7.2% and 1.9%, respectively (Riskesdas, 2018). The increase in body weight reflected in the body mass index was directly proportional to the increase in total cholesterol levels in adolescents. Martuti, et al found that the prevalence of dyslipidemia in obese children of primary school age in Surakarta was 45%, while Himah, et al obtained data that obese children had a higher risk of developing dyslipidemia than non-obese children. The National Heart, Lung, and Blood Institute (NHLBI), the American Academy of Pediatrics recommends that all children have their cholesterol levels checked between the ages of 9-11 years and 17-21 years, in fact, it is highly recommended to check cholesterol in children aged 2 years and over if being. The National Cholesterol Education Program (NCEP) recommends that the lipid status of children aged 2-18 years who are borderline (total cholesterol 170-199 mg/dL and LDL 110-129 mg/dL) should be watched out because if left unchecked it can lead to high cholesterol levels (total cholesterol 200 mg/dL or LDL level 130 mg/dL).

The best way to lower a child's cholesterol level is to change their eating habits and exercise regularly. Because of the great role of HMG-CoA reductase in the biosynthesis of cholesterol, many drugs, for example from the statin group, whose working point is as an inhibitor of HMG-CoA reductase for 10-year-old and above with LDL levels reaching 190 mg/dL or higher (IDAI, 2014). Not infrequently problems arise when given to teenagers with a high level of resistance to taking medical drugs on a regular basis. Potential alternative therapy is traditionally using various plants in Indonesia such as garlic. The main content of garlic is an amino acid called "alliin".which turns into allicin will decompose into diallyl-disulfide (DADS) which will further inhibit HMG-CoA reductase resulting in a decrease in mevalonate levels which is a cholesterol precursor, with the end result being a decrease in total serum cholesterol levels (Gebhardt, 2021; Singh, 2006). So far better there is a lot of literature on the effect of garlic on total cholesterol levels and other lipid profiles in adult research subjects, both those with normal and high total cholesterol levels. Singh, et al have studied various clinical studies related to the effect of garlic on lipid profiles, whether randomized or not and blinded or not. There were 8 studies that showed an increase in HDL and a decrease that varied in total cholesterol, LDL, triglycerides, or a

combination of all parameters. However, there were 11 studies that showed no effect of giving garlic on total cholesterol levels and other lipid parameters. So that the effect of giving garlic extract on changes in cholesterol levels still requires further study. It is very difficult to get literature on teenagers both from within and outside the country. The only study that found the effect of garlic on adolescents was the Double-Blind Randomized Controlled Trial conducted by McCrindle, et al to see the effect on their lipid profile. Subject aged 8-18 years old who has been diagnosed with dyslipidemia with fasting total cholesterol >185 mm/dL, and has a family history of hypercholesterolemia or mild cardiovascular atherosclerotic disease. In Indonesia, perhaps even globally, until now researchers have not found studies related to the effect of giving garlic on the total cholesterol levels of adolescents with overnutrition, either overweight or obese.

RESEARCH METHODS

This is a quantitative pre-experiment with a one-group pretest-posttest design in a population of high school teenagers taking 30 subjects by purposive sampling from May to July 2022. Inclusion criteria: age 15-18 years, overweight, total cholesterol ≥170 mg/dL. Excluded if critical / suffering from complications/comorbidities refused or did not get parental consent, known to be allergic to garlic, while other therapies to lower cholesterol. Intention to treat analysis was performed, a normality test was performed with Shapiro-Wilk, and differences in average total cholesterol were analyzed using the Wilcoxon test.

RESEARCH RESULT

Table 1
Basic Characteristics of Research Subjects

Characteristics	n(%)	Total cholesterol (mg/dL)*	Blood pressure (mmHg)	
			Systolic**	Diastolic*
Age (years)				
15 – <16	6 (20)	187.67 (21.77); (170 – 229)	125.33 (12.67)	80.17 (3.48); (75 – 86)
16 – <17	9 (30)	194.67 (14.06); (171 – 223)	134.78 (14.66)	87.78 (8.77); (74 – 100)
17 – 18	15 (50)	192.87 (19.27); (172 – 238)	129.73 (19.71)	86.67 (12.99); (71 – 119)
Gender				
Boy	15 (50)	185.93 (11.25); (170 – 206)	140.27 (15.69)	89.47 (11.76); (75 – 119)
Girl	15 (50)	198.80 (21.25); (173 – 238)	120.47 (11.67)	81.93 (8.08); (71 – 100)
Nutritional status				
Overweight	6 (20)	187.0 (11.48); (172 – 206)	136.83 (21.89)	89.33 (15.35); (75 – 119)
Obese	24 (80)	193.71 (19.18); (170 – 238)	128.75 (15.58)	84.79 (9.32); (71 – 102)

Note: *Data is presented in average (SD);(range)
   **Data is presented in average (SD)

The average age of the subjects was 16 years 9 months with the lowest age being 15 years and the highest age being 17 years 10 months. The middle adolescent group (14-16 years), is as much as the late adolescent group (17-19 years). The number of male subjects is as much as the number of females. As many as 80% of the research subjects were obese while the remaining 20% were overweight with an average BMI of 32.4. The minimum BMI value is 25.10 and the maximum is 39.98. Overall the average value of total cholesterol in adolescent subjects with overweight is 192.37 mg/dL with a minimum value of 170 mg/dL and a maximum of 238 mg/dL. The average systolic blood pressure was 130.37 mmHg with the minimum systolic pressure being 100 mmHg and the maximum 179 mmHg. The average diastolic was 85.70 mmHg with a minimum value of 71 mmHg and a maximum of 119 mmHg.

Univariate Analysis

The average cholesterol levels before and after being given garlic extract respectively were 192.37 vs 175.00 mg/dL, the standard deviation value was 17.94 vs 31.42, the standard error value was 3.27 vs 5.73, the minimum value for adolescent cholesterol levels is 170 vs 131 mg/dl, the maximum value for adolescent cholesterol levels is 238 vs 268 mg/dl.

Table 2
Average Cholesterol Levels Before and After Giving Garlic Extract To High School Adolescents With Overnutrition In Tanjung Karang Pusat District, Bandar Lampung City In 2022

Total Cholesterol Level	*mean*	*SD*	*SE*	*Min*	*Max*	*N*
Before intervention	192.37	17.94	3.27	170	238	30
After intervention	175.00	31.42	5.73	131	268	30

Bivariate Analysis

Table 3
The Effect of Giving Garlic Extract (Allium sativum) on Total Cholesterol Levels in High School Adolescents with Overnutrition in Tanjung Karang Pusat District, Bandar Lampung City in 2022

Total Cholesterol Level	N	mean	SD	p-value*
Before intervention	30	192.37	17.94	0.005
After intervention		175.00	31.42	

Note: *) based on the Wilcoxon test; data are presented in terms of mean and standard deviation.

From table 3, the average value before being given garlic extract was 192.37 mg/dL, and after being given garlic extract was 175.00 mg/dL. The result of p-value 0.005 < (0.05) means that H_0 is rejected and H_a is accepted, which means that there is an effect of giving garlic extract on reducing total cholesterol levels in high school adolescents with overnutrition. When considering the characteristics of the subject, can be seen in table 4 below.

Table 4
Comparison of total cholesterol levels before and after administration of garlic extract based on the characteristics of the subjects

Characteristics	Total cholesterol		p-value*
	Pre-intervention	Post-intervention	
Age (years)			
15 – 15.9	180.5 (170 – 229)	173 (155 – 268)	0.753
16 – 16.9	192.0 (171 – 223)	175 (140 – 232)	0.066
17 – 18	185.0 (172 – 238)	164 (131 – 216)	**0.007**
Gender			
Man	185 (170 – 206)	155 (131 – 218)	**0.007**
Woman	192 (173 – 238)	187 (144 – 268)	0.280
Nutritional status			
Fat	184.5 (172 – 206)	168.0 (144 – 218)	0.345
Obesity	189.5 (170 – 238)	170 (131 – 268)	**0.008**

Note: *) based on the Wilcoxon test; data is presented in median and range.

The table above shows that the administration of garlic extract has more effect on reducing total cholesterol levels in adolescents with overnutrition in the age group of 17-18 years (late adolescent), males, and adolescents with obesity (p<0,05).

DISCUSSION
Univariate Analysis
Is known the average total cholesterol level before being given garlic extract was 192.37 mg/dL, the standard deviation value was 17.94, the standard error value was 3.27, the minimum value for adolescent cholesterol levels was 170 mg/dl, the maximum value for adolescent cholesterol levels of 238 mg/dl. As quoted from the guidelines of the Indonesian Pediatrician Association (IDAI), the normal total cholesterol value according to the National Cholesterol Education Program (NCEP) is below 170 mg/dL. This data reminds us to pay more attention to total cholesterol levels in adolescents with overnutrition. Obesity occurs due to an imbalance between energy intake and energy expenditure, resulting in excess energy which is then stored in the form of fat tissue. The excess energy

can be caused by high energy intake or low energy output. High energy intake is caused by excessive food consumption, while low energy output is caused by low body metabolism, physical activity, and the thermogenesis effect of food which is determined by food composition (UKK NPM IDAI, 2014). Table 1 shows that obese adolescents have higher average total cholesterol and maximum total cholesterol values than overweight adolescents (193.71 vs 187.0 mg/dL and 238 vs 206 mg/dL). This value may be in accordance with the previous literature. Himah, et al obtained data that obese children had a higher risk of developing dyslipidemia than non-obese children. However, when tested for non-parametric Spearman's rho correlation, it was seen that before being given garlic extract, the BMI/nutritional status variable did not correlate with total cholesterol levels of adolescents with overnutrition (p = 0.413).

Adolescence can be said to be a period of vulnerability to various problems. The transition period is unstable both from the psycho-emotional aspect and the immunity aspect. Psycho-emotional instability can be an obstacle to behavior / healthy lifestyle. Lifestyle changes, such as children being less active, playing too much on gadgets or watching television, especially during the COVID-19 pandemic, intake of foods that are high in calories, high in salt, and drinks containing alcohol and caffeine, smoking habits, mental stress, and sleep deprivation can trigger pathological weight gain (Sendow, 2021). Most teenagers use their free time for inactive activities, a third of teenagers eat factory-made snacks or processed foods, while another third regularly consume cakes, wet bread, fried foods, and crackers. Changes in lifestyle also occur with the increasingly connected youth to internet access, so adolescents make more independent choices which are often not appropriate, thus indirectly causing nutritional problems. (Kurdanti, 2015). Adolescents who have an excessive intake of energy, fat, and carbohydrates, frequency of consumption of fast food, inactive physical activity, have mothers and fathers with obesity status, and do not eat breakfast, have a higher risk of obesity (Aini, 2012).

In accordance with the UNICEF 2021 report that there is an increase in cases of overweight and obesity in adolescents (UNICEF, 2021). This study also found a group of middle and elderly adolescents who are still in high school and experience overnutrition with a higher percentage of obese adolescents than overweight. This needs serious attention because various pieces of literature state that overweight and obesity in adolescents tend to have a risk to continue into adulthood (Desmukh-Taskar, 2006; The NS, 2010). Obese adolescents

tend to have LDL and apolipoprotein-B levels above normal values(Kaniawati, et al. 2018). Excessive body fat in obesity is associated with increased health risks, especially cardiovascular risk factors (UKK NPM IDAI, 2014). A metabolic syndrome is a group of abdominal symptoms, dyslipidemia, hyperglycemia, and hypertension. This syndrome is often found in adults. The increasing prevalence of metabolic syndrome in children and adolescents is in line with the increasing prevalence of obesity (IDAI, 2014). The increasing prevalence of metabolic syndrome in children and adolescents raises concerns about a future cardiovascular disease epidemic in this age group. As quoted by IDAI, there is evidence that obese adolescents have a thicker carotid intima tunica than adolescents with normal weight. The criteria for metabolic syndrome according to IDAI are the presence of abdominal obesity measured by waist circumference, plus the presence of disturbances in $\geq$ 2 criteria: blood pressure parameters (hypertension), HDL cholesterol and triglycerides (dyslipidemia), and fasting blood sugar levels (Diabetes Mellitus). After being given garlic extracts known the average total cholesterol level is 175.00 mg/dL and the standard deviation is 31.42. The principle of managing overweight and obesity in children is to apply the right diet, proper physical activity, and behavior modification with parents as role models (IDAI, 2014). In accordance with the recommendations of the Center for Disease Control and Prevention, IDAI recommends that children and adolescents should do physical exercise every day for 60 minutes or more, which consists of aerobic activity (such as brisk walking or running), muscle strengthening (such as gymnastics or push-ups), and bone strengthening (such as jumping rope or running). Meanwhile, intensive therapy in the form of pharmacotherapy and surgical therapy can be applied with requirements for obese children and adolescents who have comorbidities and do not respond to conventional therapy.

Bivariate Analysis

Especially for cholesterol disorders/dyslipidemia, IDAI recommends giving anti-cholesterol based on the adolescent's LDL level (if blood LDL cholesterol is 130 mg/dL) and the presence of comorbidities (IDAI, 2014). In general, pharmacotherapy for obesity is grouped into three, namely appetite suppressants (sibutramine), inhibitors of absorption of nutrients (orlistat), and recombinant leptin for obesity due to congenital leptin deficiency, as well as a group of drugs to treat comorbidities (metformin). The lack of research on

the long-term effects of pharmacotherapy on obesity in children has resulted in none of the aforementioned pharmacotherapy being approved for use in children under 12 years of age by the US Food and Drug Administration to date. Various kinds of literature on adult subjects show the effect of giving garlic extract on reducing total cholesterol, LDL and triglyceride levels. Garlic (Allium sativum) contains an amino acid called "alliin" which turns into the active substance "allicin". Allicin will decompose into diallyl-disulfide (DADS) which inhibits HMG-CoA reductase resulting in a decrease in levels of a cholesterol precursor called mevalonate, with the final result in the form of a decrease in total serum cholesterol levels (Gebhardt, 2021; Singh, 2006). In the present study, the average value of total cholesterol after administration of garlic extract was 175.00 mg/dL with a standard deviation of 31.42. Wilcoxon test results show p-value = 0.005 which means H_0 is rejected and H_a is accepted, or in other words, there is an effect of giving garlic extract on reducing total cholesterol levels in adolescents with overnutrition. These results are in line with previous studies related to the effect of giving garlic. Most of the research on the therapeutic effect of garlic is on adults who suffer from hypercholesterolemia and use oral preparations in the form of oil or powder. A preliminary study found that giving garlic to healthy adults significantly reduced serum lipid and lipoprotein levels (Touhidi, 2001). Sobenin et al. found a 7.6% decrease in total cholesterol, 11.8% LDL, and an 11.5% increase in HDL in a 12-week study in adults with hyperlipidemia. Steiner et al found a 6.1% reduction in total cholesterol and 4% in LDL. Mader, et al found a reduction in total cholesterol and triglyceride levels by 12% and 17%, respectively. Meanwhile, in our current study, there were 22 adolescent subjects with overnutrition who experienced a decrease in total cholesterol levels after administration of garlic extract. Overall, there was an average decrease in total cholesterol levels of 17.36 mg/dL (8.96%) after being given garlic extract for 8 weeks. However, this study showed different results from the only garlic extract research on the adolescent age group conducted by McCrindle, et al. Their research was a Double-Blind Randomized Controlled Trial to see the effect of garlic extract on the lipid profile of adolescent subjects. We have not been able to conclude whether the difference in results is related to the characteristics of the subjects, namely the wider age range of the Mc Crindle, et al study subjects (8-18 years), or because their subjects have been diagnosed with dyslipidemia with fasting total cholesterol >185 mm/dL and have a history of hypercholesterolemia or mild atherosclerotic cardiovascular disease in the family, or because their subject's BMI was smaller than the current study and met the criteria for normal nutritional status (22.6±5.3 vs 32.5±3.44). Or it may also be related to the differences in study design and the total daily dose of garlic extract which was 100 mg smaller than our current study.

Regarding side effects, besides the problem of unpleasant aroma due to the sulfur content, garlic is reported to have other relatively mild side effects such as belching, bloating, or reflux in the first week of consumption. In this study, there were no reports of severe side effects experienced by the subjects. The side effect of increasing appetite after consuming garlic extract was conveyed by 8 subjects and it turned out that 5 of them experienced an increase in total cholesterol levels after 8 weeks of giving garlic extract. Another side effect was complaints of fullness in 3 subjects, but only occurred in the first week of consumption of garlic extract and then the symptoms disappeared by themselves so the subjects remained obedient to consuming garlic extract for up to 8 weeks.

LIMITATION

This study uses a one-group pre-test and post-test design that only uses the intervention group without a comparison (control) group, so it is necessary to review whether changes in total cholesterol levels are purely due to the intervention or whether are there other factors that play a role. In this study, it was found that several subjects experienced an increase in total cholesterol levels which were thought to be associated with an increase in appetite during the intervention, but it still needs to be studied in further research whether this is purely influenced by changes / dietary patterns and or there are other factors such as a daily physical activity that is not closely monitored. Other factors such as waist circumference, LDL and triglyceride levels, and fasting blood sugar need to be studied and used as a reference for further research to describe the incidence of metabolic syndrome in high school adolescents because the medical management will be much more complex with a greater risk of morbidity and mortality.

CONCLUSION

The average total cholesterol level before being given garlic extract in high school adolescents with overnutrition was 192.37 mg/dL with a minimum value of 170 mg/dL and a maximum of 238 mg/dL. The average total cholesterol level after being given garlic extract in high school adolescents with

overnutrition was 175.00 mg/dL with a minimum value of 131 mg/dL and a maximum of 268 mg/dL. The results of the Wilcoxon test p-value of 0.005 < $\alpha(0.05)$ means that H_0 is rejected and H_a is accepted, which means that the administration of garlic extract has an effect on the average level of total cholesterol in adolescents with overnutrition.

SUGGESTION

For research place/population So that health workers are more active in the adolescent clinic or other health facilities to check total cholesterol levels in high school teenagers with overnutrition and provide education regarding the risks of various complications that may occur in the future. For educational institutions So that adolescent health can be used as a branch of special courses that continue to be explored in educational institutions.

For the next researcher It is necessary to do further research by considering the monitoring of diet and physical activity during the study. Assessment of other variables such as levels of LDL, HDL, triglycerides, and fasting blood sugar. Selection of a design with a control group, a larger number of subjects, and a longer study time.

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