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Utilization of Green Bean Juice (Vigna Radiata) Added with Cinnamon Powder (Cinnamomum Burmanii) in Lowering Cholesterol Levels in Hypercholesterolemia Sufferers

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ABSTRACT

Background: *Elevated cholesterol levels are a risk factor for cardiovascular disease, overweight/obesity, and stroke, which has a predicted death rate of around 2.6 million worldwide. One way to reduce cholesterol levels is to regulate the consumption of foods containing fat (saturated, trans, cholesterol), exercise regularly, and choose foods with a high isoflavone content, for example, green beans.*

Research Methods: *The research method uses a quasi-experiment and a non-equivalent control group design. The research used 20 subjects, 10 of whom were treated and 10 of whom were controls. This study also considered data on fat and fiber intake. Intake data was collected twice before and during the research using the food recall method. The independent T-test was used to determine the product's effect on reducing cholesterol levels.*

Research Result: *The results showed differences in cholesterol levels before and after the study (p=0.00). The treatment group had a reduced cholesterol level of 57.8 mg/dL, and the control group had a reduced cholesterol level of 34.3 mg/dL. However, the benefits of green bean juice with cinnamon powder in lowering cholesterol levels were not statistically significant (p=0.074).*

Conclusion: *Drinking green bean juice with the addition of cinnamon powder has not been statistically proven to reduce cholesterol levels.*

BACKGROUND

Hypercholesterolemia is still a health problem. As many as 2.6 million deaths and 29.7 million disabilities per year occur due to increased cholesterol levels. Hypercholesterolemia occurs due to the accumulation of fat in the blood, which is commonly called atherosclerosis. This condition often results in the narrowing of the blood vessels, which disrupts blood flow (Ariani, 2016). This is because too high cholesterol levels can change the structure of the blood vessels so that endothelial function is disrupted, giving rise to lesions, plaques, occlusions, and embolisms (Kurniasih et al., 2021).

Based on WHO data in 2019, the prevalence of hypercholesterolemia is still high. The prevalence of hypercholesterolemia globally is around 45%, and in Southeast Asia, it is around 30% (Subandrate et al., 2020). In 2018, according to 2018 Basic Health Research (Riskesdas) data, the national prevalence of high cholesterol in the population aged ≥15 years in Indonesia was 15.8%, namely 5.4% for men and 9.9% for women (Ministry of Health, 2019). The results of the Integrated Development Post (Posbindu) report stated that in West Nusa Tenggara, the percentage of cholesterol levels was 19.4% (Kemenkes RI, 2016).

Elevated cholesterol levels are a risk factor for cardiovascular disease, obesity, and stroke. While the world death toll due to increased cholesterol levels has reached up to 2.6 million, in Southeast Asia itself, the figure is around 29% (Al-Rahman & Fadjri; n.d., 2016).

Based on Nadesul's research in 2010, hypercholesterolemia is more common in women than men; this is because women tend to become overweight more easily. This is also caused by hormonal factors in women, namely estrogen, which can affect the process of protein formation in the body, thereby triggering obesity. Another risk factor is that the amount of fat in women's bodies is more significant than in men, especially in the breasts, hips, and thighs, which allows for a higher buildup of cholesterol in the body. In addition, women have less muscle mass than men, so their metabolism is slower. As a result, the body will take longer to burn fat (Kurniasih et al., 2021).

Factors that can reduce cholesterol levels are reducing fat and cholesterol intake. According to Suharyati 2019, the dyslipidemia diet is one type of diet that can be used to control cholesterol levels. This diet is the primary therapy for overcoming fat profile disorders by modifying fat intake, incredibly saturated fat, trans fat, and cholesterol when combined with regular exercise and Choosing foods that contain isoflavones. Isoflavones are a type of flavonoid that has been shown to regulate lipogenesis in the liver. The isoflavones genistein and daidzein are found in nuts such as green beans and soybeans. Genistein can inhibit hydrogen peroxide production and increase the activity of antioxidant enzymes such as catalase, peroxide dismutase, glutathione peroxidase, and glutathione reductase. Low-density lipoproteins (LDL) interact with isoflavones, reducing lipoprotein oxidation and suppressing the production of lipid peroxides and thiobarbituric acid reactive substances. The mechanism for reducing cholesterol levels through isoflavones is by increasing the breakdown of fat cells for energy production, thereby reducing total cholesterol levels (Abarca, 2021).

Green beans are a legume plant that is easy to find in Indonesia. Green beans are often consumed as a snack or as a drink. Green beans contain good carbohydrates and fiber. Carbohydrates are the most significant component of green beans, namely 62-63%. The fat content in green beans means 0.7-1 gr/1 kg of fresh green beans, which consists of 73% unsaturated fat and 27% saturated fat, so it is safe for consumption by people who experience hypercholesterolemia. This plant contains high levels of isoflavone bioactive compounds. The isoflavone content in fresh green beans is 70.74 mg per 100 grams of ingredients. The type of fiber in green beans is a water-soluble fiber that binds fat in the intestines, reducing blood cholesterol levels by 5% or more (Sulistyaningsih & Mulyati, 2015). In Sulistyaningsih and Mulyati's research, giving 75g/day of green bean extract for 14 days affected total cholesterol levels. The statistical test results showed differences in changes in total cholesterol levels before and after the intervention ($p<0.05$). This research is in line with research conducted by Agnes T (2013), which states that consuming 100 gr/day of green beans in 300 ml of juice for 14 days in hypercholesterolemic women can reduce total cholesterol levels from 219.2 mg/dl to 210.73 mg. /dl (Jus et al., 2022).

One food ingredient that can be processed into functional food is cinnamon. Cinnamon is a natural ingredient that can lower cholesterol levels in the blood. Cinnamon bark contains alkaloids, flavonoids, tannins, and essential oils consisting of camphor, safrole, eugenol, cinnamaldehyde, cinnamylacetate, terpenes, cineol, citronellal, polyphenols, and benzaldehyde. After research by Pratiwi in 2011, cinnamon can reduce blood glucose levels, total cholesterol, and triglyceride levels and increase HDL levels (Pratiwi, 2011). Based on the results of the research above, it can be seen that overall, giving a functional drink of boiled bay leaves containing 300 mg cinnamon extract/kg body weight to mice was able to reduce total cholesterol and LDL cholesterol levels and increase HDL cholesterol levels in mice with hypercholesterolemia (Zahra, 2018). Based on the description above, researchers are interested in determining the effect of green bean juice with cinnamon powder on reducing cholesterol levels as a formula for functional food for cholesterol sufferers.

RESEARCH METHODS

The research was conducted in the Babakan Community Health Center working area, Mataram City, from 8 February to 15 February 2023. Before carrying out the product administration intervention, the researcher had obtained ethical clearance approval from the ethics commission of the Health Polytechnic of the Ministry of Health of Mataram with no: LB.01.03/6/451/ 2023, and also obtained a research permit from the Mataram City National Unity and Domestic Politics Agency with number: 070/050/Bks-Pol/I/2023, as

well as a research permit from the Research and Development Agency with number: 070/050/Balitbang-Kt /I/2023.

This research is quasi-experimental with a non-equivalent control group design. The research sample consisted of 20 people and consisted of 10 treatment groups, as well as ten control groups. The treatment group was given green bean juice with the addition of cinnamon powder every seven days. In contrast, the control group was not given the interventional salt but the intervention after completion. This green bean juice is given in the amount of 200 ml, which is given twice (morning and evening), for a total of 400 ml a day. The inclusion criteria in determining the sample are the following:
1. Domiciled in Mataram City and have a complete address
2. Women or men aged 45 years to ≥ 60 years
3. Willing to participate in research by signing informed consent
4. Have cholesterol levels > 200 mg/dl

Sample collection is carried out using purposive sampling. Researchers collected data on subject characteristics, intake of fat and fiber nutrients, and cholesterol levels before and after green bean juice administration with cinnamon powder. Data analysis was carried out using a paired t-test to see differences in one group's cholesterol levels before and after. Next, an independent t-test was conducted to see the differences in the two groups' cholesterol levels before and after.

RESULTS

Characteristics of Research Subjects

The subjects consisted of 20 people, 10 in the treatment group and 10 in the control group. The subjects were outpatient hypercholesterolemia patients in the Babakan Health Center working area who met the criteria. The characteristics of the research subjects are presented in Table 1.

Table 1. Distribution of Research Subject Characteristics

Characteristics	Intervension		Control		*P*
	n =10	%	n = 10	%	
Age (Year)					
45-59	7	70	8	80	0.615
>60	3	30	2	20	
Gender					
Man	2	20	3	30	0.615
Woman	8	80	7	70	
Family history of illness					
Yes	4	40	40	40	1.00
No	6	60	60	60	
Drug Consumption					
Yes	4	40	3	30	0.648
No	6	60	7	70	
Nutritional Status					
Thin	0	0	0	0	0.301
Normal	4	40	6	60	
Over weight	1	10	1	10	
Obesitas I	4	40	3	30	

Table 1 shows that the results of statistical tests were (p>0.05), which means there were no significant differences in the characteristics of age groups, gender, family history of illness, drug consumption, and nutritional status.

Level of Nutrient Intake (Fat, Fiber)

Nutrient intake data was obtained from the food recall method of 1 x 24-hour meal consumption, carried out four times before the intervention and two times during the study. The average intake before and during the intervention was then compared with the nutritional requirements, namely fat and fiber. The subjects' nutritional intake levels are presented in Table 2.

Table 2. Nutrient Intake Levels

Nutrient Intake Levels	Group				*p*
	Interven sion (n= 10)		Cont rol (n=10)		
	Mean± SD	*p*	Mea n±SD	*p*	
Fat Intake					
Before	48.41±7.938	0.00[b]	41.18±6.724	0.00[b]	0.04[a]
During	21.03±5.872		29.98±5.385		0.002[a]
Fiber Intake					
Before	12.60±4.499		14.54±3.925		0.319[a]
During	13.62±3.109	0.557[b]	13.00±2.402	0.175[b]	0.627[a]

Based on Table 2, it can be seen that there was a significant difference in the level of consumption of fat nutrients before and during the study in both the intervention and control groups (p=0.00). Meanwhile, there were differences in the level of fiber intake before the study (p=0.557) and during the study (p=0.175).

Level of Cholesterol

Cholesterol levels in the intervention and control groups were checked twice before and after the research using a GCU meter. Data on checking total cholesterol levels for both groups before and after the study are presented below.

Table 3. Test Results for Different Cholesterol Levels

Choles ter ol Levels	Intervension (n=10) X±SD	Control (n= 10) X±SD	*p*
Before	267,50±14,378	261,80±16,206	0,416[a]
After	209,70±23,880	227,50±36,090	0,21[a]
Δ	57,8	34,3	
P	0,00[b]	0,01[b]	

Based on table 3 shows that there is no significant difference between the cholesterol levels of the intervention group and the control group before the study, p=0.416 (p>0.05), and after the study, p= 0.21 (p>0.05).

The results of statistical tests on cholesterol levels in the intervention group showed a significant difference, namely p=0.00 (p<0.05), with the average total cholesterol level in the intervention group before the study being 267.50 mg/dl and after the study 209.70 mg /dl. There was a significant difference in cholesterol levels in the control group, p=0.01 (p<0.05), with an average cholesterol level before the study of 261.80 mg/dl and 227.50 mg/dl after the study.

Effect of Giving Green Bean Juice with the Addition of Cinnamon Powder

An independent t-test can determine the effect of giving green bean juice with cinnamon powder. The data tested were the difference in cholesterol levels between the intervention and control groups before and after the study. Table 4 presents the test results on the effect of giving green bean juice with the addition of cinnamon powder.

Table 4. Effect of Giving Green Bean Juice with the Addition of Cinnamon Powder Against Total Cholesterol Levels

Total Cholesterol Levels (mg/dl)	Int er vension (n= 10)	Cont rol (n= 10)
X±SD	57,80±18,896	34.30±33.635
P	0,074	

Table 4 shows a decrease of 57.8 mg/dl in the intervention group and 34.3 mg/dl in the control group. However, the statistical test results stated that the p-value was insignificant, p = 0.07 (p>0.05).

DISCUSSION

Characteristics of Research Subjects

1. The dominant age range of the research subjects was 45-59 years. This supports the theory that increasing age can cause a decrease in body function related to muscle mass. This can result in a buildup of energy in the form of body fat, which is often called atherosclerosis (Aryani et al., 2021).
2. The gender of the subjects in this study was predominantly female. In line with research (Sulistyaningsih & Mulyati, 2015), women's total cholesterol levels in the blood increase with age, especially at 40 years and over, due to the decreasing function and production of estrogen hormone levels. Decreased estrogen production in menopausal women can cause disorders of blood lipid metabolism and increased body weight due to decreased activity due to changes in body fat distribution, including an increase in total fat mass; a decrease in the hormone estrogen in the body can result in a risk of increasing total cholesterol levels.
3. Someone who has a family history of hypercholesterolemia is at risk of experiencing the same thing. Usually, this disorder is inherited from both parents. Familial hypercholesterolemia is a rare genetic disorder caused by damage to the gene that codes for the LDL receptor. Heterozygous offspring have only half the average number of LDL receptors. Because the number of hepatic LDL receptors is reduced or absent, sufferers of familial hypercholesterolemia cannot regulate LDL levels in the blood (Utami & Zuraida, 2020).
4. Of the 20 research subjects who took anti-cholesterol drugs, only seven people took an average of 10 mg of simvastatin. Simvastatin functions to help reduce LDL and triglyceride levels and increase HDL levels in the blood. Statins work by inhibiting the HMG-CoA reductase enzyme and are an effective drug of choice for lowering LDL cholesterol (Hariadini et al., 2020).
5. Based on the research results, it can be seen that of the 20 subjects, the average nutritional status was in the normal category in the treatment group, four people (40%), and 6 people in the control group (60%). This research aligns with Tri Wahyuni, 2020, which stated that respondents with a BMI in the obesity category do not always have high cholesterol levels. On the other hand, high cholesterol levels were found in respondents with a normal BMI category. Based on the results of this research, the current tendency for high cholesterol can occur in people with normal nutritional status (BMI), which can be caused by poor eating patterns, in terms of consuming foods high in cholesterol, lack of exercise, prolonged stress, increased age (Shabah & Dhanny, 2021).

Level of Nutrient Intake (Fat, Fiber)

The average fat intake before and during the study showed (p<0.05), so it can be concluded that there are significant differences related to the level of fat consumption between the treatment and control groups. This research also supports this research (Pratiwi, 2018), which states that there is no relationship between fat intake and cholesterol levels. The food processing process also influences the fat content contained in food.

Subjects' fiber intake during the study in the treatment group increased to 13.62 but was still classified as a severe deficit with p = 0.627. So, there is no significant difference between the treatment and control groups. This research is in line with (Septianggi et al., 2013), that there is no relationship between fiber intake and cholesterol levels; this is because the subjects did not consume sufficient amounts of vegetables and fruit, so the fiber intake of all subjects was in the deficient category.

Based on the research results, most samples had less fiber intake and cholesterol levels in the high-limit category. Fiber in food is related to cholesterol levels; this is related to the function of fiber, which can

bind fat that occurs in the intestines and stomach. Fiber can reduce cholesterol levels because soluble fiber can bind bile acids, which are the end result of cholesterol metabolism.

Effect of Giving Green Bean Juice with the Addition of Cinnamon Powder

There was no significant effect after administering green bean juice with the addition of cinnamon powder due to several factors, one of which was the level of fiber consumption, which did not meet the daily fiber intake requirements, namely 25-30 gr/day so the subject's fiber consumption level was still classified as a severe deficit. Fiber can generally reduce blood cholesterol levels by more than 5%. Fiber in the digestive tract can bind bile salts, which are then excreted in the feces. Increasing cholesterol excretion in feces will reduce the cholesterol levels that go to the liver, increasing the uptake of cholesterol in the blood, which will be synthesized to become bile acids (Sinulingga, 2020).

CONCLUSIONS

Drinking green bean juice with cinnamon powder has not been statistically proven to reduce cholesterol levels.

SUGGESTION

Further research needs to be carried out with a higher dose and a longer number of days so that green bean juice with the addition of cinnamon powder can reduce cholesterol levels.

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