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The effectiveness of Jicama Yogurt (*Pachyrhizus erosus*) to lipid profile and triglyceride levels

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ABSTRACT

Background: *Cardiovascular disease is the number one cause of death in the world. One of the causes is hypercholesterolemia. The management of hypercholesterolemia can be done through non-pharmacological efforts by consuming hypocholesterolemic foods, including jicama and probiotic drinks. Probiotic and jicama drinks contain active compounds inulin and lactic acid bacteria which can control total cholesterol levels.*
Objectives: *to determine the effectiveness of jicama yogurt probiotics on lipid profile and trygliceride levels of hypercholesterolemic employees of the Campus I Health Polytechnic of the Ministry of Health Padang.*
Methods: *This study used a quasi-experimental study with pre-posttest design. The sample was 18 people from the Campus I Health Polytechnic of the Ministry of Health Padang with hypercholesterolemia, the study was conducted in January - November 2019. Respondents were given 120 ml of jicama yogurt probiotic for 14 days. Analysis using the dependent t-test.*
Results: *The results showed that the average initial total cholesterol level was 218.33 mg/dL, HDL 51.11 mg/dL, LDL 145.11 mg/dL, triglycerides 111.39 mg/dL and the final total cholesterol level was 217.78 mg/dL, HDL 56.67 mg/dL, LDL 139.56 mg/dL, Triglycerides 109.22 mg/dL. The average reduction in total cholesterol levels in the group was 0.56 mg/dL, LDL was 5.56 mg/dL, triglycerides 2.17 mg/dL, an average increase in HDL levels was 5.56 mg/dL. The results of statistical tests showed that there was a significant difference between HDL levels before and after intervention (p <0.05). There was no significant difference in cholesterol, LDL and triglycerides levels before and after intervention (p> 0.05).*
Conclusion: *Jicama yogurt probiotics are more effective in positively modifying the lipid profile levels. Jicama yogurt probiotic can be used as an alternative complementary therapy for hypercholesterolemic sufferers.*

KEYWORDS: *Hypercholesterolemia; jicama; Lipid profile; probiotics*

INTRODUCTION

Hypercholesterolemia is a fat metabolism disorder characterized by an increase in total cholesterol levels to ≥200 mg/dl. Hypercholesterolemia is a risk factor for cardiovascular disease. Cardiovascular disease is the number one cause of death in the world (5).

In 2008, 17.8 million (30%) people died due to cardiovascular disease. Of these, 7.3 million were caused by coronary heart disease (CHD) and 6.2 million were caused by stroke (1). Based on World Health Statistic 2012, the death rate due to heart and blood vessel disease in Indonesia for 100,000 people aged 30-70 years is 308 cases (1). The prevalence of coronary heart disease according to diagnosis or symptoms in Indonesia is 1.5%, while in West Sumatra Province it is 1.2% (2).

Based on gender and place of residence, it was found that the proportion of the population with cholesterol levels above normal in women (39.6%) was higher than that in men (30.0%), and in urban areas (39.5%) it was higher. compared to rural areas (32.1%) and based on occupation the highest level was employees (40.5%) (3).

The management of hypercholesterolemia can be done by consuming hypocholesterolemic

foods. One example of a hypocholesterolemic food is jicama (1). Jicama is a type of tuber that is often consumed by the community, easy to obtain and has a relatively cheap price. West Sumatra, especially the city of Padang, has a large enough potential for jicama (4).

One form of modification of jicama is processed into probiotic yoghurt jicama (5). In the jicama juice there is a source of vitamin C, polyphenols and flavonoids, all of which function as antioxidants (1). Polyphenols and flavonoids have an effect on reducing the risk of heart and blood vessel disease. In addition, there are also saponins which can bind to bile acids and cholesterol (from food) to form micelles which are also not absorbed by the intestine (6). Research in humans has shown that giving jicama juice as much as 250 ml/day for 21 days can reduce total cholesterol levels by 20% (1).

Apart from jicama juice, yogurt also has a hypocholesterolemic effect. Yogurt fermented using lactic acid bacteria has high antioxidant activity due to the presence of *β-glucosidase enzymes*. In addition, lactic acid bacteria are probiotic bacteria in humans that can reduce levels of total cholesterol, LDL, and triglycerides (7). In the study of giving yogurt to rabbits, it was found that fermented yogurt using lactic acid bacteria such as *Lactobacillus casei*, *Streptococcus thermophillus* and *Lactobacillus bulgaricus* had high antioxidant activity. *Lactobacillus casei bacteria* are also probiotic bacteria found in the human body that can reduce levels of total cholesterol, LDL, and triglycerides (8).

Meanwhile, Jicama probiotic drink has been studied at the Padang Industrial Research and Standarization Center in 2015. Based on this research, it can be seen that the Jicama yogurt probiotic drink stored in cold temperatures (2-5^{0}C) still meets the criteria for functional food and is good for consumption until the third week. with the number of lactic acid bacteria 6.4 log cycles, total acid 0.67%, calcium content 122.5 mg/kg, inulin content 0.607%, moisture content 99.79%, ash content 0.18%, protein content 15 , 65%, fat content of 1.52%, antioxidant content of 1.97% and safe from pathogenic microbial contamination of *coliform* and *salmonella*. From the organoleptic test in market trials, it was found that the probiotic drink of jicama yogurt was well received by the community (10).

Based on the description above, the aim of this research to conduct research on the Effectiveness of Probiotic Yogurt Jicama (*Pachyrhizus erosus*) on Lipid Profile (Cholesterol, LDL, HDL) and Triglycerides Levels for employees of Campus I Health Polytechnic of the Ministry of Health Padang who are hypercholesterolemic in 2019.

MATERIALS AND METHODS

This research method is a quasi-experimental with pre-post test design, by comparing the levels of lipid profiles (total cholesterol, LDL, HDL) and triglycerides before being given treatment with after being given treatment. The independent variable in this study was the provision of jicama yogurt. Meanwhile, the dependent variable is Lipid profile (Cholesterol, LDL, HDL) and triglycerides levels.

The subjects in this research were 18 employees of the campus I Health Polytechnic of the Ministry of Health Padang. To anticipate the subjects dropping out at the time of the research, the subjects who will be taken are 21 people with inclusion criteria having one or more abnormal levels of lipid profiles and triglycerides, domiciled in the city of Padang, willing to be research respondents until the study ends by signing a letter of approval. The subjects of this study were taken by purposive sampling.

Researchers identified factors or problems related to controlling the levels of the lipid profile (total cholesterol, LDL, HDL) and triglycerides of the respondents. The identification carried out is shown on the intake of nutrients and food consumption of the respondents. The types of nutrients that are controlled are fat and cholesterol. The method used to control the problem is 3x24 hours recall, namely on day-1, day-8 and day-15.

Jicama filtrate is made from jicama that has been cleaned, then blanched and blended with the addition of 1: 1 water which is then filtered. The detailed jicama filtrates are shown in Figure 1 (10).

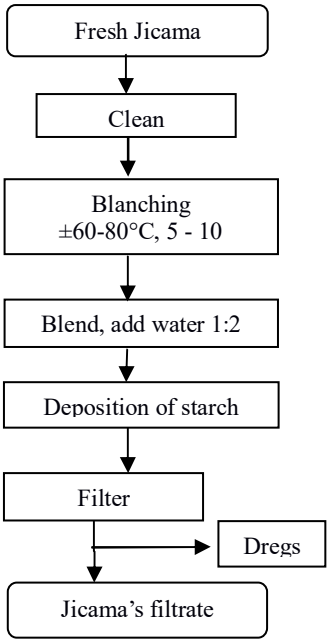

Figure 1. The Process of Making Jicama Filtrate

Making jicama yogurt probiotics are made from jicama filtrate, then added with 20% low fat milk, 10% sugar and 5% starter. The detailed production of Jicama yogurt probiotics is shown in Figure 2 (11).

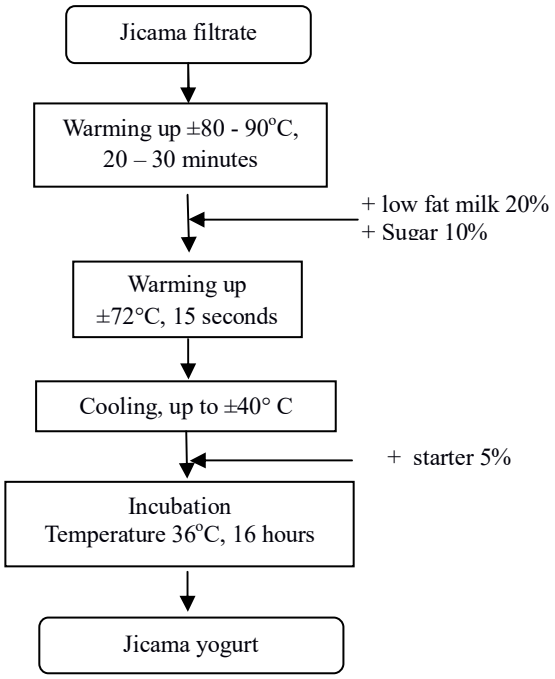

Figure.2 The Process of Making Jicama Yogurt Probiotics

Screening of respondents who have cholesterol levels> 205 mg/dL, followed by measuring the levels of the lipid profile. Measurement of lipid profile levels (total cholesterol, LDL, HDL) and triglycerides of respondents was measured one day before treatment and one day after treatment. Probiotic yoghurt jicama as much as 120 ml/day for 14 days (9,12).

The data normality test was carried out by using the Shapiro-Wilk test. Differences in lipid profile levels (total cholesterol, LDL, HDL) and triglycerides before and after intervention were tested using a dependent T-test to determine the effect of treatment on the average change in lipid profile levels (total cholesterol, LDL, HDL) and triglycerides. With a confidence level of $p<0.05$.

RESULTS AND DISCUSSION

Description of the Characteristics and Nutritional Intake of Respondents

Respondents in this study were 18 people who were employees of the Health Polytechnic of the Ministry of Health Padang. The characteristics of the respondents such as age, gender, education and nutritional status as well as nutritional intake (fat, fiber and cholesterol) of the respondents can be seen in the following table.

Table 1. Characteristics of Respondents

Characteristics	n (%)
Age of respondent	
30-39	5 (27.8)
40-49	9 (50.0)
50-59	4 (22.2)
Education	
High school	7 (38.9)
3-year diploma	6 (33.3)
S-1	2 (11.2)
S-2	3 (16.6)
Profession	
Lecturer	6 (33.3)
Administrative Clerk	6 (33.3)
Cleaning Officer	6 (33.3)
Nutritional status	
Normal	7 (38.9)
Fat	1 (5.6)
Obesity	10 (55.6)

Based on **Table 1**. it can be seen that most of the respondents aged in the range 40-49 years were 9 people (50%), high school education was 7 people (38.9%) and the nutritional status with obesity was 10 people (55.6%) and for the type of work (lecturers, administrative and cleaning staff) the number of respondents was the same, namely 33% each.

Respondents in this study were employees of the Campus I Health Polytechnic of the Ministry of Health Padang who had hypercholesterolemia who met the inclusion and exclusion criteria. The number of respondents in this study was 18 people, all of whom were women and neither of them took anti-cholesterol drugs. All respondents were given 120 ml of jicama yogurt probiotic for 15 days and can be consumed by the respondent.

Table 2. Overview of Fat, Fiber and Cholesterol Intake

Needs	Average intake Days to-			*Average*
	1	8	15	
Fat (g)	74.3	66.6	67.8	69.2
Fiber (g)	11.3	12.7	11.0	11.7
Cholesterol (mg)	149.7	172.9	188.2	170.3

Based on **Table 2**, it can be seen that the average intake of the 1st, 8th and 15th days of nutrients is fat, fiber and cholesterol. The average fat intake of respondents from day 1 to day 8 showed a decrease from 74.3 g to 65.6 g. However, the average fat intake increased again on day 15 to 67.8 g. The same was true for the respondents' average fiber intake from the first day to the last day of the study, which showed a decrease from 11.3 g to 11.0 g. Meanwhile, the average cholesterol intake of all respondents from the first day to the last day of the study showed an increase from 149.7 mg to 188.2 mg with an average of 170.3 mg.

All respondents during the study were subjected to intake control which included intake of nutrients such as fat, fiber and cholesterol. This intake control was carried out at the beginning (on day 1 of intervention), middle (day 8 of intervention) and at the end (day 15 of intervention) of the study. From the research results, it can be seen that almost all respondents have an average intake that exceeds their needs. While the intake of fiber nutrients, overall respondents have an average fiber intake less than the need. Meanwhile, for cholesterol intake only a few of the respondents whose intake exceeds the need.

Average Difference in Levels of Lipid Profile Levels (Total Cholesterol, LDL, HDL) and Initial and Late Triglycerides of Treatment Respondents

Table 3.The Difference in Average Levels of Respondents' Lipid and Triglyceride Profiles at the Poltekkes of the Ministry of Health, Padang in 2019

Lipip Profile	Measurement Value			P-*Value*
	Initial Average	Final Average	Change	
Total cholesterol	218.33	217.78	-0.56	0.909
HDL	51.11	56.67	5,56	0.001
LDL	145.11	139.56	-5.56	0.197
Triglycerides	111.39	109.22	-2.17	0.794

Table. 3 shows that the results of statistical tests found that there were significant differences in the initial and final HDL cholesterol levels in the probiotic treatment group, jicama yogurt, which was indicated by a p value <0.05. The average difference in HDL cholesterol levels in the probiotic treatment group of jicama yogurt increased with a value of 5.56 ± 5.77 mg/dL. The results of statistical tests for total cholesterol, LDL and triglycerides showed that there was no significant difference in the levels of total cholesterol, LDL and triglycerides at the beginning and at the end of the jicama yogurt probiotic treatment group as indicated by a p value>0.05. The average difference in total cholesterol, LDL and triglyceride levels in the probiotic treatment group of jicama yogurt was -0.56 ± 20.30 mg/dL, -5.56 ± 17.57 mg/dL and -2.17± 34.27 mg/dL. However, the average level of total cholesterol, LDL and triglycerides tends to decrease.

This is in line with previous studies, using white rats whose cholesterol had been raised, showing that giving 2 ml of jicama juice for 21 days can reduce total cholesterol levels by 28.25%. Meanwhile, human studies have shown that giving jicama juice as much as 250 ml/day for 21 days can reduce total

cholesterol levels by 20% (1).

Decline average levels of total cholesterol, LDL and triglycerides caused by substances that exist in the probiotic yoghurt and jicama juice. Yogurt probiotics also have a hypocholesterolemic effect. Lactic acid bacteria found in yogurt have the potential to reduce total cholesterol, LDL and triglyceride levels because they produce organic acids such as glucoronic acid, propionic acid, folic acid and lactic acid which can act as agents to lower total cholesterol, LDL, and triglycerides (7). Besides that with the addition of jicama juice containing inulin into yogurt probiotics, will increase the effectiveness of jicama yogurt in controlling the levels of lipid profiles and triglycerides of the subject. Inulin is a type of fiber and a source of carbohydrates derived from plants. Inulin is prebiotic, which means that it can provide good bacteria for the digestive process in the intestine. Inulin is also known to increase viscosity in the gastrointestinal tract and increase the thickness of the lining of the small intestine, thereby preventing cholesterol absorption and increasing its excretion through feces. This causes cholesterol catabolism and gives effects of hypocholesterolemia (9).

Inulin is fermented in the colon by LAB produce short chain fatty acids like butyric acid and propionic acid. Chain fatty acids this shortness can affect metabolism cholesterol in the liver. Propionic acid identified can lower cholesterol levels in a way inhibits the action of enzyme β hydroxy-β methyl *glutamyl CoA (HMG-CoA) reductase which plays a role* in cholesterol synthesis. Besides propionic acid can also inhibit the incorporation of acetate into plasma cholesterol by means of propionic acid compete with acetic acid transporters headed to the hepatocyte cells. This will have repercussions decreased cholesterol synthesis due to acetate is a precursor in formation cholesterol (8).

Cholesterol-lowering mechanism by LAB including through the mechanism of cholesterol assimilation and the transformation of cholesterol into coprostanol. Assimilation cholesterol occurs via a mechanism uptake of cholesterol by lactic acid bacteria which then the cholesterol will be incorporate with the bacterial cell membrane thus causing cholesterol can't absorbed. Lactic acid bacteria can also converting cholesterol into coprostanol compounds, this is caused by the presence of cholesterol enzymes *redutase produced by BAL. Coprostanol* not absorbed by the small intestine, but directly excreted with feces (8).

In addition, in the jicama juice there is a source of vitamin C, polyphenols and flavonoids, all of which function as antioxidants. From a study, it was found that the content of jicama juice (*Pachyrrhizus erosus*) per 100 grams contains polyphenolic compounds 3.063 mg/kg, flavonoids 2.669%, alkaloids 1.517%, vitamin B1 0.07 mg, vitamin C 26 mg, 13 grams of carbohydrates, iron 0.8 mg, protein 1.6 gr, energy 53 cal (3). Polyphenols and flavonoids have an effect on reducing the risk of heart and blood vessel disease. Flavonoids reduce cholesterol synthesis by inhibiting the activity of the enzyme *acyl-CoA cholesterol acyl transferase* (ACAT) on HepG2 cells which plays a role in reducing cholesterol esterification in the intestine and liver, and inhibits the activity of the enzyme *3-hydroxy-3-methyl-glutaril-CoA* which causes inhibition cholesterol synthesis.

CONCLUSION

Jicama yogurt probiotics are more effective in positively modifying the lipid profile levels. Jicama yogurt probiotic can be used as an alternative complementary therapy for hypercholesterolemic.

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