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The Effect of Porang-Processed Rice (*Amorphophallusmuelleri*) on LDL and HDL Levels in DM-Diagnosed Patients

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ABSTRACT

Diabetes mellitus (DM) was one of the deadliest diseases in the world. DM was often associated with lipid metabolism error. Porang tubers contain glucomannan which could decrease cholesterol levels. Porang tubers also could be processed into the rice. This study analyzed the effect of porang-processed rice on LDL and HDL levels of DM-diagnosed patients.This study was conducted to determine the effect of porang-processed rice on LDL and HDL levels in DM-diagnosed patients.This study was an experimental study with the Pre-Test and Post-Test Control Group Design method, which used DM-diagnosed patients as research subjects. 24 research subjects were divided into 2 groups: the treatment group was given porang-processed rice and the control group was given white rice for 5 days. Measurement of LDL and HDL levels was carried out in both groups before and after treatment.There was a significant difference in giving porang-processed rice to LDL levels in DM-diagnosed patients (p = 0.021). There was no significant difference in giving porang-processed rice to HDL levels in DM patients (p = 0.102). However, there was a significant differencein deviation between LDL and HDL levelspre-test and post-test (p = 0,002; p = 0,001).There wasa significant difference between LDL levels in DM-diagnosed patients before and after being given porang-processed rice. There was no significant difference between HDL levels in DM patients before and after being given porang-processed rice.

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INTRODUCTION

Diabetes mellitus (DM) is one of the deadliest diseases in the world.[1]in 2011, there are 366 million people with diabetes and the number will increase to 578 million in 2030.[2]Indonesia has 10,7 million people with diabetes in 2019.[3]

DM is relatedto the incidence of dyslipidemia. [4]Dyslipidemia is a condition with lipid metabolism disorder that is characterized by a rise or decline of lipid fractions.[5]Lipid fractions include total cholesterol, high-density lipoprotein(HDL), low-density lipoprotein (LDL), and triglyceride.[5]

Insulin resistance in type 2 diabetes affects lipoprotein metabolism that causesincrease lipolysis and decrease lipogenesisat adipose tissue.[6]This condition triggers LDL levels in the blood increase.[7]

HDL levels in the blood are used to transport cholesterol from peripheral tissue to the liver.[8]However, insulin resistance can lead to cholesterol in HDL being replaced with triglyceride. The replacement causes HDL levels to be lost easier, so HDL levels fall.[9]

Porang, the scientific name *Amorphophallusmuelleri*, or often referred to as *ileskuning* belongs to the Araceae family and is one of the biological richness of Indonesian tubers. Porangis a glucomannan-rich plant from Indonesia.[10]Porang is often found in the form of flour and can be processed into healthy food. One of the products from porang flour is low-calorie rice.[11]

Glucomannan can use to treat hyperglycemia, hypercholesterolemia, obesity, and inflammation. [12]Furthermore, Gonzalez-Terres et al say that lower cholesterol in rats treated with glucomannan. Glucomannan can affect the secretion of bile salts and cholesterol through the feces so that the absorption of bile salts and cholesterol is reduced.[13]

No research proves about porang-processed rice in lowering LDL levels and increasing HDL in DM patients. Therefore, researchers are interested in proving the effect of porang-processedrice on LDL and HDL levels in diabetic patients.

METHODS

This research is an experimental study with pre-test and post-test control group design. The sample was obtained by quota sampling on November 3rd-11th 2021 from diabetes patients in Diponegoro National Hospital (RSND) that were willing to become research subjects with informed consent. The inclusion criteria in this study werediabetic patients in RSND, had anti-diabetic oral, random plasma glucose (RPG) levels 200-400 mg/dl. The exclusion criteria were RSND inpatients, patients with coronary heart disease, and patients with stroke.

Research subjects are divided into 2 groups, treatment group and control group. The treatment group ate 100 grams of porang-processed rice that had been dividedinto 3x1 a day for 5 days, however the control group ate white rice for 5 days.Measurement of LDL and HDL levels was done before and after treatment in two groups. Measurement LDL and HDL levels used vein blood and was done in the Laboratory of RSND.

Data wereanalyzed using Paired T-test to compare LDL and HDL levels before and after treatment. The data was processed and analyzed using SPSS Statistics version 26 on Windows. This research has obtained ethical clearance from the Health Research Ethics Commission (KEPK) Faculty of Medicine, Diponegoro University with the number 220/EC/KEPK/FK-UNDIP/VII/2021 and a research license from RSND with the number No.2258/UN7.9/PP/2021.

RESULTS

At the beginning of research, there were 27 research subjects, divided into 2 groups, 15 people in the treatment group and 12 people in control group. After 5 days, 3 people in the treatment group dropped out because they didn't check LDL and HDL after giving the treatment.

Table 1. Characteristics of research subjects

Variable	Treatment N = 12 n (%)	Control N = 12 n (%)	p
Gender			0,418[k]
Man	4 (33%)	6 (50%)	
Woman	8 (67%)	6 (50%)	
Age			0,827[k]
21-30 y.o	0	1 (8%)	
31-40 y.o	1 (8,5%)	1 (8%)	
41-50 y.o	1 (8,5%)	0	
51-60 y.o	6 (50%)	5 (42%)	
61-70 y.o	4 (33%)	5 (42%)	
RPG Level			0,623[k]
>200 mg/dl	3 (25%)	2 (16%)	
<200 mg/dl	9 (75%)	10 (84%)	

Notes: [k]*Kruskal Wallis.*

So there were 24 research subjects of diabetic patients in RSND. Table 1. shows the characteristics of the research subjects divided into two groups, namely the treatment group

The treatment group was dominated by women (67%) while in the control group men and women were the same. The 51-60 years age group dominated the treatment group (50%) and the control group had 2 dominant age groups (42%) namely 51-60 years and 61-70 years. The majority of research subjects had RPG levels less than 200 mg/dl from both the treatment and control groups.

Based on the normality test using the Shapiro Wilk test, subjects less than 50, LDL and HDL levels before and after treatment in the treatment and control groups were normally distributed. Therefore, the different test that was carried out was a parametric test using a Paired T-Test.

Based on table 2, in the control group, the result of the different tests between pre-test and post-test was p = 0.018, which means that there was a significant difference in LDL levels between pre-test and post-test. In the treatment group, the result of the different tests between pre-test and post-test was p = 0.021, which means that there was a significant difference in LDL levels between pre-test and post-test. The difference between the pre-test and post-test values of LDL levels between groups was analyzed using the One Way ANOVA test because the data were normally distributed (p > 0.05). The results of the pre-test and post-test results showed a significant difference between the control and treatment groups (p = 0.002).

Table 2. Results of paired t-test and ANOVA levels of LDL

Group	LDL Level		p	Delta
	Pre-test	*Post-test*		
Control	130,92 ± 35,93	135,17 ± 34,16	0,018[¶]*	-4,25 ± 5,32
Treatment	130,50 ± 46,57	118,33 ± 39,39	0,021[¶]*	12,17 ± 1,78
p				0,002[a]*

Notes: [¶]*Paired T test*; [a]*One Way ANOVA*. *Significant (<0,05)

Table 3. Results of paired t-test and ANOVA levels of HDL

Group	HDL Level		p	Delta
	Pre-test	*Post-test*		
Control	38,58 ± 9,78	37,67 ± 9,11	0,020[¶]*	0,92 ± 1,16
Treatment	45,00 ± 9,14	45,92 ± 9,59	0,102[¶]	-0,92 ± 1,78
p				0,001[k]*

Notes: [¶]*Paired T test*; [k]*Kruskal Wallis*. *Significant (<0,05)

Based on table 3, in the control group, the result of the difference between the pre-test and post-test was p = 0.020, which means that there was a significant difference in HDL levels in the pre-test and post-test. In the treatment group, the result of the difference between the pre-test and post-test was p = 0.102, which means that there was a non-significant difference in HDL levels in the pre-test and post-test. The difference between the pre-test and post-test HDL levels between groups was analyzed using the Kruskal Wallis test because the data were not normally distributed (p < 0.05). The results of the pre-test and post-test results showed a significant difference between the control and treatment groups (p = 0.001).

DISCUSSION

Based on the results of the study, it was found that the significance value of LDL levels before and after being given porang-processed rice was p = 0.021. This shows that there is a significant difference between giving porang-processed rice to LDL levels in patients with diabetes mellitus. The results of this study are following the research of Chen, et al (2003) which stated that there was a significant effect between konjacglucomannan supplementation on reducing LDL levels in type 2 DM patients with a p value of less than 0.05 (p = 0.023).[14] The results of this study were strengthened with a decrease in the mean LDL level after giving porang-processed rice in the treatment group (delta = 12.17) and the difference in LDL levels between the two groups showed a significant difference (p = 0.002).

The decrease in LDL levels in the treatment group was related to the glucomannan contained in porang-processed rice. According to research by Alamsyah (2019) revealed that glucomannan can lower cholesterol levels. This can happen because glucomannan is a high-fiber compound that can absorb water and bind bile salts. These bile salts will be secreted through the feces, which should be recycled in the liver. Therefore, the liver takes cholesterol from the blood as an ingredient for the synthesis of bile salts so that blood cholesterol levels decrease.[15]

Susanti (2014) revealed that the glucomannan contained in porang tubers is water-soluble fiber.[16] The water-soluble fiber in Fairudz's (2015) study was able to lower cholesterol by forming short-chain fatty acids (SCFA). SCFA is the result of the fermentation of soluble fiber by gut microbiota. SCFA can form propionate which can inhibit the HMG-CoA reductase enzyme so that cholesterol synthesis is inhibited. Because less cholesterol is produced, LDL which is the cholesterol transporter from the liver to the periphery is reduced.[17]

In the results of the study of HDL levels in the treatment group that consumed porang-processed rice, there were no significant differences before and after treatment (p = 0.102). The results of this study are different from the research conducted by Urli (2017) that there is a significant effect of giving porang flour on HDL levels of type 2 DM Wistar rats.[18] The difference that occurs is probably because in Urli's study there were several different doses of porang flour in the treatment group. So that it can be ascertained that the dose affects HDL levels.

However, this study found an increase in the mean HDL level after giving porang-processed rice to the treatment group (delta = -0.92). The increase in HDL levels after giving porang-processed rice is by Urli's research (2017) which revealed an increase in HDL levels in Wistar DM rats after being given 20 mg of porang flour.[18] The results of this study were strengthened by the difference in HDL levels between the two groups showing a significant difference (p = 0.002).

Glucomannan is a fiber that can lower cholesterol levels if consumed in high doses. According to the American Diabetes Association (2008) consumption of high fiber (50 grams/day) can reduce glucose levels in patients with type 1 diabetes and can reduce glucose and lipid levels in patients with type 2 diabetes.[19] While in this study, consumption of porang-processed rice a day was 100 grams with a fiber content of 2 grams per 85 grams of porang-processed rice, and the diet of each research subject was not strictly controlled which could affect the results. Thus, there was no significant difference between porang-processed rice consumption and HDL levels.

The limitations of this study were that the researcher could not directly control the patient in consuming porang-processed rice and plain white rice as well as their daily diet, the researcher could not consider the dosage of anti-diabetic oral like simvastatin that can effect LDL and HDL levels, the researcher also could not perform the inclusion criteria for the RPG level of 200-400 mg/dl, the study was not conducted in a long time due to the COVID-19 pandemic.

CONCLUSION

There is a significant difference between LDL levels in DM patients before and after being given porang rice. However, there was no significant difference in HDL levels.

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