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EFFECT OF FERMENTED GLUTINOUS BLACK RICE ON LDL CHOLESTEROL LEVELS

Pengaruh Pemberian Tape Ketan Hitam Terhadap Kadar Kolesterol LDL

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ABSTRACT

Food antioxidants have been widely used as functional and bias to lower Low Density Lipoprotein (LDL) cholesterol. This study is intended to determine the effect of black sticky ribbon on the decrease of LDL cholesterol levels. This research is two groups of pre and post experiment design. The population of this study is Desa Budiharja, Kecamatan Cililin, Kabupaten Bandung Barat over the age of 35 years. Sampling using Random Sampling method by Simple Random Sampling. The sample size was 19 people in each group. The Fermented Glutinous Black Rice is given 200gr / day black sticky rice and low fat diet counseling. The control group was given low-fat diet counseling. Statistical test results using Dependent T-test showed high active LDL cholesterol levels before and after treatment in the black glutinous band group with p <0.001 (p≤0.05) and in the control group there was no significant decrease in LDL cholesterol With value p = 0,452 (p> 0,05). The result of statistic test using Mann-Whitney showed the effect of black sticky ribbon on the decrease of LDL cholesterol with p = 0,011 (p> 0.05). Need to do socialization of Fermented Glutinous Black Rice as an alternative functional ingredient to lower LDL cholesterol levels.
Keyword: Fermented Black Glutinous Rice, LDL

ABSTRAK

Antioksidan pangan telah banyak digunakan sebagai pangan fungsional dan direkomendasikan untuk menurunkan kolesterol *Low Density Lipoprotein (LDL)*. Penelitian ini bertujuan untuk mengetahui pengaruh pemberian tape ketan hitam terhadap penurunan kadar kolesterol LDL. Penelitian ini merupakan *two group pre and post eksperiment design*. Populasi penelitian ini warga Desa Budiharja, Kecamatan Cililin, Kabupaten Bandung Barat yang berusia diatas 35 tahun. Pengambilan sampel menggunakan metode *Random Sampling* dengan cara *Simple Random Sampling*. Jumlah sampel 19 orang pada masing-masing kelompok. Kelompok pemberian tape ketan hitam diberi tape ketan hitam 200gr/hari dan konseling diet rendah lemak. Kelompok kontrol diberi konseling diet rendah lemak. Hasil uji statistik menggunakan *Dependent T-test* menunjukkan terdapat penurunan kadar kolesterol LDL secara bermakna sebelum dan setelah perlakuan pada kelompok pemberian tape ketan hitam dengan nilai p<0,001(p≤0,05) dan pada kelompok kontrol terdapat penurunan kadar kolesterol LDL secara tidak bermakna dengan nilai p=0,452(p>0,05). Hasil uji statistik menggunakan *Mann-Whitney* menunjukkan terdapat pengaruh pemberian tape ketan hitam terhadap penurunan kadar kolesterol LDL dengan nilai p=0,011(p>0,05). Perlu dilakukan sosialisasi tape ketan hitam sebagai alternatif pangan fungsional untuk menurunkan kadar kolesterol LDL.

Kata kunci : Tape ketan hitam, LDL

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INTRODUCTION

Patterns and unhealthy lifestyles, such as high fat consumption and lack of physical activity are one of the factors causing heart and blood vessel disease. The most common heart and blood vessel problems are coronary heart disease, stroke, and atherosclerosis.

Data from the World Health Organization (WHO), 2011 shows coronary heart disease (CHD) is the first cause of death in the world and stroke is the second leading cause of death in the world, whereas in Indonesia Riskesdas 2007 data shows coronary heart disease (CHD) is the 8th cause of death and stroke is the death of all ages in Indonesia (15.4%).[1,2] High LDL cholesterol is one of the most responsible for this disease.

LDL (Low density lipoprotein) is the main cholesterol carrier in plasma. This lipoprotein transports cholesterol to peripheral cells for membrane synthesis and hormone production, and to the liver for bile acid production.[3] Excess LDL particles can easily penetrate damaged arteries and are most responsible for atherosclerosis.[4]

The results of Riskesdas, 2013 showed that population ≥15 years found LDL not optimal with a combined category of near optimal (100-129 mg / dl) and high borderline (130-159 mg / dl) of 60.3% and high category (160-189 mg / dl) and very high (≥190 mg / dl) of 15.9%.[5] High levels of LDL can be influenced by various factors such as age, sex, genetics, physical activity, obesity, and fat intake.[23]

Increased blood LDL cholesterol levels and decreased blood HDL cholesterol levels have an influence on the occurrence of heart disease and stroke.

A reduction in LDL cholesterol by 1 mg / dl decreases cardiovascular risk by 1% and an increase in HDL cholesterol levels decreases the risk of cardiovascular disease events by 2-3%.[6] Antioxidants in food have been widely used as functional foods and are recommended for reducing LDL cholesterol levels. Black glutinous rice is one type of food that is high in antioxidants. One of the dominant antioxidants in Fermented Glutinous Black Rice is anthocyanin.[7] Fermented Glutinous Black Rice is a very potential commodity as a source of carbohydrates, antioxidants, bioactive compounds, and fibers that are important for health.[20] Aligita, 2007 showed that the black glutinous rice isolate obtained was thought to be an anthocyanin acylated by cyanidine 3-glycoside with a substituted hydroxylation pattern at position 3.[10]

The mechanism of action of anthocyanin is by inhibiting the action of 3-Hydroxy-3- methylglutaryl coenzyme A reductase (HMG Co-A reductase) where this enzyme catalyzes the change in HMG Co-A into mevalonic acid which is the first step of cholesterol synthesis [8]. If the formation of cholesterol is inhibited then VLDL will not be hydrolyzed and will suppress LDL in the blood.[8] Qin 2009 research, proves that consumption of anthocyanin increases HDL cholesterol concentration by 13.7% and decreases LDL cholesterol concentration by 13.6% [9]. This study aims to determine the effect of Fermented Glutinous Black Rice to reduce LDL cholesterol levels.

METHOD

This research is an experimental study using two groups of pre and post test experimental designs to determine the effect of giving fermented glutinous black rice to a decrease in ldl levels. the two groups are the Fermented Glutinous

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Black Rice group and the control group. The Fermented Glutinous Black Rice group was given Fermented Glutinous Black Rice for 30 days and low fat diet counseling, while the control group was only given low fat diet counseling.

The study was conducted in Budiharja Village, Cililin District, West Bandung Regency. The study was conducted in January 2017 to February 2017.

The sample in this study was a portion of the population in the village of Budiharja. Sampling is done using the method of Random Sampling by means of Simple Random Sampling that is every member of the population has the same opportunity to be taken as a sample. Inclusion criteria, ie aged 35 years and above, LDL> 100 mg / dl without treatment, are willing to be sampled and communicative. While the exclusion criteria, namely suffering from gout, pregnant or breastfeeding, and women who are menopausal.

General sample data in the form of name, gender, age. This data collection is done using a questionnaire. Anthropometric data of body weight were measured by digital scales and height was measured using microtoise. Initial energy, fat, and fiber intake using Semiquantitative Food Frequency Questionnaire. Energy, fat, and final fiber intake using Food Recall. Serum LDL levels before and after given fermented glutinous black rice . This data collection is done by taking respondent's blood and then testing it in the laboratory.

Blood drawing is done by Health Laboratory Office staff.

The selection of respondents is carried out in a gradual manner. The first stage of the Posbindu election in the village of Budiharja, the selection was carried out randomly. From Posbindu selected samples that met the inclusion and exclusion criteria by means of laboratory examination until 38 samples were obtained as the Fermented Glutinous Black Rice and control group. Before being treated, random samples were carried out in Posbindu to randomly divide the study subjects whether they were included in the Fermented Glutinous Black Rice or control group.

Respondents who met the inclusion and exclusion criteria continued to the next stage, Respondents were given an explanation of the aims and objectives of the study. If the respondent agrees to participate in the study, he or she signs the informed consent. Respondents went through a data collection process that included interviews for food consumption using a Semiquantitative Food Frequency Questionnaire and the characteristics of respondents, as well as measurements of body weight and height. Respondents underwent blood tests at the study site and then blood samples were taken to the Health Laboratory Center. The group gave Fermented Glutinous Black Rice , given Fermented Glutinous Black Rice as much as 200gr / day for 30 days and counseling regarding low fat diets using leaflet media. The control group was given counseling regarding a low-fat diet using leaflet media. Both groups will be controlled by making Recall 1 x 24 hours every 3 days. At the end of the study, laboratory tests will be conducted on both groups to see differences in LDL cholesterol levels after 30 days. Fermented Glutinous Black Rice is given to cadres every 3 days and by cadres distributed to samples every day. As proof of having consumed Fermented Glutinous Black Rice , respondents were required to show their Fermented

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Glutinous Black Rice yesterday and filled out the observation form.

Data on age, percentage of initial and final energy intake, percentage of initial and final fat intake, and initial and final fiber intake are presented in the form of a frequency distribution table that displays the average, standard deviation, median, and minimum and maximum. Gender data is presented in the form of a frequency distribution table that displays the number of samples and the percentage of male and female samples. Differences in LDL cholesterol levels before and after, as well as changes in LDL cholesterol levels after being treated are presented in the form of a frequency distribution table presented in the form of a frequency distribution table that displays the average, standard deviation, median, and maximum minimum.

The data analyzed were LDL cholesterol levels in the Fermented Glutinous Black Rice group and the control group before and after the treatment and the normality of the data were tested first. Normality test is done by using the Sapiro Wilk statistical test because the sample is <50 people. If the value of p> 0.05 then the data is normally distributed.

Dependent T-test statistical test was used to find out the difference in the average levels of LDL cholesterol before and after being treated in both groups with a 95% confidence level. Then the data is analyzed using statistical software. If the value of p ≤ 0.05, there is a difference in LDL cholesterol before and after treatment in the Fermented Glutinous Black Rice group.

The Mann-Whitney statistical test was used to see the difference in decreasing LDL cholesterol levels between the two treatment groups with a confidence level of 95%. Then the data is analyzed using statistical software. If the value of p <0.05 then there is a difference in decreasing LDL cholesterol levels before and after treatment in the two treatment groups. This means that there is an effect of Fermented Glutinous Black Rice on reducing LDL cholesterol levels.

RESULT

Characteristics of Sample

Table 1. shows the results of statistical tests using the Mann-Whitney and Independent T-test at a 95% confidence level indicating that there were no significant differences in the characteristics of the study sample based on age between the Fermented Glutinous Black Rice and the control group with a p value = 0.121 (p> 0 , 05), there was no significant difference in the characteristics of the study sample based on the percentage of initial energy intake between the Fermented Glutinous Black Rice and the control group with a p value = 0.448 (p> 0.05), there was no significant difference in the sample study characteristics based on the percentage of energy intake Finally between the Fermented Glutinous Black Rice group and the control group with a value of p = 0.236 (p> 0.05), there was no significant difference in the characteristics of the study sample based on the percentage of initial fat intake between the Fermented Glutinous Black Rice group and the control group with a p value = 0.332 (p> 0.05), there were no significant differences in the characteristics of the research sample based on it While the percentage of final fat intake between the Fermented Glutinous Black Rice group and the control group with a value of p = 0.310 (p> 0.05), there was no significant difference in the characteristics of the study sample based on the percentage of initial fiber intake between the Fermented

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Glutinous Black Rice group and the control group with a value of p = 0.391 (p> 0.05), there was no significant difference in the characteristics of the study sample based on the percentage of final fiber intake between the Fermented Glutinous Black Rice and the control group with a value of p = 0.351 (p> 0.05).

Table 2. shows the results of statistical tests using Chi-Square at a 95% confidence level. There was no significant difference in the characteristics of the study sample by sex between the Fermented Glutinous Black Rice and the control group with a p value of 0.302 (p> 0.05).

TABEL 1.
CHARACTERISTICS OF SAMPLES BASED ON AGE AND NUTRITION INTAKE

Variable	Group	Mean	SD	Median	Min-Max	P_{value} *)
Age (year)	Intervention	42,63	7,28	42,00	36,00-70,00	0,121**)
	Control	43,42	5,03	44,00	35,00 – 51,00	
Percentage of Pre Energy Intake (%)	Intervention	107,08	10,28	109,38	80,38-119,41	0,448**)
	Control	109,17	18,80	105,68	77,07-146,75	
Percentage of Post Energy Intake (%)	Intervention	87,33	9,41	89,58	60,54-102,66	0,275**)
	Control	86,40	17,31	86,24	54,39-119,89	
Percentage of Pre Fat Intake (%)	Intervention	140,52	29,58	140,13	85,86-199,28	0,331*)
	Control	135,88	35,11	132,75	79,58-185,57	
Percentage of Post Fat Intake (%)	Intervention	106,48	16,20	109,59	68,35-127,84	0,310*)
	Control	102,93	26,23	103,08	57,29 – 163,90	
Percentage of Pre Fiber Intake (%)	Intervention	26,51	8,49	24,40	17,60-46,80	0,391**)
	Control	26,40	10,07	22,40	13,20-48,40	
Percentage of Post Fiber Intake (%)	Intervention	24,68	7,88	26,20	12,20-35,56	0,351**)
	Control	23,67	8,16	21,20	10,20-40,40	

**) Independent T-test **) Mann-Whitney*

TABLE 2.
CHARACTERISTICS OF SAMPLES BASED ON GENDER

Variable	Fermented Glutinous Black Rice (n =19)		Control (n=19)		p* Value
	n	%	N	%	
Gender					0,302
Man	1	5,30	3	15,80	
Woman	18	94,70	16	84,20	

** Chi-Square*

Differences in LDL Levels Before and After Treatment in Each Group

Analysis of the differences in the average LDL cholesterol level before and after treatment in the Fermented Glutinous Black Rice group can be seen in table 3. and table 4. Table 3. shows the mean LDL cholesterol level in the Fermented Glutinous Black Rice group before treatment 157.47 mg / dL with a standard deviation of 35.43 mg / dL and after treatment 142.32 m / dL with a standard deviation of 32.14 mg / dL. The results of statistical tests using the

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Dependent T-test at a 95% confidence level showed a significant decrease in LDL cholesterol levels before and after treatment in the Fermented Glutinous Black Rice group with a p value of <0.001 (p≤0.05).

TABLE 3.
DIFFERENCES OF LDL CHOLESTEROL BEFORE AND AFTER TREATMENT IN THE FERMENTED GLUTINOUS BLACK RICE GROUP

LDL CHOLESTEROL	FERMENTED GLUTINOUS BLACK RICE (n = 19)				p* Test
	Mean	SD	Median	Min-Max	
Pre	157,47	35,43	162,00	103,00-219,00	< 0,001
Post	142,32	32,14	137,00	92,00-199,00	

**) Dependent T-test*

TABEL 4.
DIFFERENCES IN LDL CHOLESTEROL BEFORE AND AFTER TREATMENT IN CONTROL GROUPS

LDL CHOLESTEROL	Control Group (n = 19)				p* Test
	Mean	SD	Median	Min-Max	
Pre	143,16	25,08	151,00	102,00-179,00	0,452
Post	142,74	29,21	151,00	90,00-199,00	

**) Dependent T-test*

Table 4. shows the mean LDL cholesterol levels in the control group before treatment 143.16 mg / dL with a standard deviation of 25.08 mg / dL and after treatment 142.74 m / dL with a standard deviation of 29.21 mg / dL. The analysis showed that there was no significant decrease in LDL cholesterol levels before and after treatment was given to the control group with a p value = 0.452 (p> 0.05).

Reduction of ldl cholesterol levels between fermented glutinous black rice and control groups

Analysis of changes in LDL cholesterol levels before and after successive treatments can be seen in table 5.

TABLE 5.
REDUCTION OF LDL CHOLESTEROL LEVELS BETWEEN FERMENTED GLUTINOUS BLACK RICE AND CONTROL GROUPS

Group	LDL CHOLESTEROL (n = 19)				Test p*
	Mean	SD	Median	Min-Max	
FERMENTED GLUTINOUS BLACK RICE	-15,00	-15,11	-14,00	-49,00-7,00	0,011
Control	-0,42	17,00	-5,00	-17,00-39,00	

**) Mann-Whitney*

Table 5. shows the median decrease in LDL cholesterol levels in the group of Fermented Glutinous Black Rice -14.00 mg / dL with a minimum value of -49.00 mg / dL and a maximum value of 7.00 mg / dL. Median decreased LDL cholesterol levels in the control group -5.00 with a minimum value of -17.00 mg / dL and a maximum value of 39.00 mg / dL. Statistical test results using Mann-Whitney with a 95% confidence level indicate that there is a significant difference in decreasing LDL cholesterol levels between the Fermented Glutinous Black Rice and the control group with a p value = 0.011 (p≤0.05). So there is the effect of fermented glutinous black rice to a decrease in LDL cholesterol levels.

DISCUSSION

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The results of the study showed that there were differences in LDL cholesterol levels before and after the administration of Fermented Glutinous Black Rice as much as 200 gr / day for 30 days and counseling regarding low fat diets in the Fermented Glutinous Black Rice group with p values <0.001 (p≤0.05). The mean LDL cholesterol group fermented glutinous black rice before treatment was 157.47 mg / dL with a standard deviation of 35.43 mg / dL and after the treatment of 143.32 mg / dL with a standard deviation of 32.14 mg / dL. So for the Fermented Glutinous Black Rice group there was a decrease in LDL of 15.16 mg / dL. Whereas in the control group, the results showed no difference in LDL cholesterol levels before and after counseling regarding a low-fat diet with a value of p = 0.452 (p> 0.05). The mean LDL cholesterol of the control group before treatment was 143.16 mg / dL with a standard deviation of 25.08 mg / dL and after the treatment of 142.74 mg / dL with a standard deviation of 29.21 mg / dL. So that the control group decreased LDL by 0.42 mg / dL.

The results showed that statistically there was an effect of fermented glutinous black rice to a decrease in LDL cholesterol levels in Budiharja Village, Cililin District, West Bandung Regency with a value of p = 0.011 (p≤0.05). This is because the Fermented Glutinous Black Rice contains anthocyanin which is good in reducing LDL cholesterol in the body.[21] The type of anthocyanin in Fermented Glutinous Black Rice is cyanidine 3-glycoside with a substituted hydroxylation pattern at position 3.[10] The level of anthocyanin in Fermented Glutinous Black Rice is 257 ppm or equivalent to 257 mg of anthocyanin in 1 kg of Fermented Glutinous Black Rice.[7] In this study the group fermented glutinous black rice was given Fermented Glutinous Black Rice as much as 200 gr / day. The provision of 200 gr Fermented Glutinous Black Rice / day has fulfilled 51.4% of anthocyanin needs in a day. Qin 2009 research, proves that consumption of anthocyanin increases HDL cholesterol concentration by 13.7% and decreases LDL cholesterol concentration by 13.6%.[9]

In addition to Fermented Glutinous Black Rice , food in purple, blue, to blackish red is the main food source of anthocyanin. Anthocyanin is a type of flavonoid that functions to inhibit cholesterol synthesis in the liver. Yuwafi, 2011 reported significant differences in hypercholesterolemia rats given black soyghurt at a dose of 4 ml / day on LDL levels (p <0.001), total cholesterol (p <0.001), and triglycerides (p 0.01) compared to other groups.[11] Black soyghurt is a fermented product of black soy milk by lactic acid bacteria. Black soybeans, including food ingredients that are high in anthocyanin content. Anthocyanin in black soybean has the duty to give blackish color and as an antioxidant.[11] A similar study conducted by Setyaningsih, 2013 showed a decrease in LDL cholesterol levels of 6.47% in the consumption of black soybean snack bars and in the control group an increase in LDL cholesterol levels was 2.25%.[12]

In addition, other food ingredients which contains anthocyanins are jamblang fruit skin and red dragon fruit. Agus's research, 2012 showed that the extract of jamblang peel containing anthocyanin was able to reduce LDL levels in the blood of wistar rats with hypercholesterolemia with a percentage reaching 58.93%.[13] Indriasari research, 2012 showed that in the treatment group who were given a high cholesterol diet

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and 30 mg of red dragon fruit extract and the treatment group who were given a high cholesterol diet and 60 mg of red dragon fruit extract there was a significant decrease in total cholesterol (p <0.05), a significant decrease in LDL cholesterol (p <0.05), a significant decrease in triglycerides (p <0.05), and a significant increase in HDL cholesterol (p <0.05).[14]

Anthocyanins are known to have many health benefits such as antioxidants, anti-inflammatory, antimicrobial, antiviral, inhibiting platelet aggregation, reducing the risk of cardiovascular and cancer. Anthocyanins can also improve blood lipid profiles and have a vasoprotective effect.[15]

Anthocyanins can reduce LDL cholesterol levels by inhibiting CETP (Cholesteryl ester transfer protein). By suppressing CETP activity, it can increase HDL cholesterol levels and reduce LDL cholesterol levels. As an anti-inflammatory, anthocyanin has an effect in inhibiting cytokines such as tumor necrosis factor α (TNF-α). Decreasing TNF-α will increase insulin sensitivity, increase oxidation of fatty acids in the liver, and inhibit cholesterol synthesis by liver cells.[9,22]

In addition, anthocyanin can inhibit HMG Co-A reductase in catalyzing the change of HMG Co-A to mevalonic acid which is the first step of cholesterol synthesis. If the formation of cholesterol is inhibited then VLDL will not be hydrolyzed and will suppress LDL in the blood [8]. The way anthocyanin works in inhibiting HMG Co-A reductase is the same as LDL cholesterol-lowering compounds in the body by forming van der Waals bonds with one of the active ends of HMG-CoA reductase.[16]

Anthocyanins can also increase endogenous antioxidants, including Superoxid Dismutase, Guthation Peroxidase, and Catalase. Sumardika, 2012 reported that the administration of purple sweet potato leaf water extract containing anthocyanin flavonoids was found to improve lipid profile and increase Superoxid Dismutase blood of rats given high cholesterol foods.[17] In addition, the biological activity of anthocyanins can increase the effectiveness of the work of vitamin C. The content of vitamin C can protect LDL cholesterol from oxidative damage and as an anti-inflammatory.[18] Other studies have shown that vitamin C can reduce oxidative stress. This causes vitamin C to inhibit atherogenesis by inhibiting LDL oxidation and decreasing cellular products and reducing ROS in endothelial cells.[19]

CONCLUSION

1. The mean LDL cholesterol level in the Fermented Glutinous Black Rice group before treatment 157.47 mg / dL with a standard deviation of 35.43 mg / dL and after treatment 142.32 m / dL with a standard deviation of 32.14 mg / dL. Median decreased LDL cholesterol levels in the group of Fermented Glutinous Black Rice -14.00 mg / dL with a minimum value of -49.00 mg / dL and a maximum value of 7.00 mg / dL.
2. The mean LDL cholesterol level in the control group before treatment 143.16 mg / dL with a standard deviation of 25.08 mg / dL and after treatment 142.74 m / dL with a standard deviation of 29.21 mg / dL. Median decreased LDL cholesterol levels in the control group -5.00 with a minimum value of -17.00 mg / dL and a maximum value of 39.00 mg / dL.
3. There was a significant decrease in LDL cholesterol levels before and after treatment in the Fermented Glutinous Black Rice group with a p value <0.001 (p≤0.05).

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4. There was no significant decrease in LDL cholesterol levels before and after treatment in the control group with a value of p = 0.452 (p≤0.05). the control group with a value of p = 0.452 (p≤0.05).
5. There is an effect of fermented glutinous black rice to a decrease in LDL cholesterol levels with a value of p = 0.011 (p> 0.05).

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