EFFECTS OF RED PITAYA (*Hylocereus polyrhizus*) ON LIPID PROFILE OF MALE WHITE RATS (*Rattus norvegicus*) RECEIVING HIGH FAT DIET

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ABSTRAK

Kulit buah naga merah (Hylocereus polyrhizus) mengandung antosianin, serat dan vitamin C, sehingga dapat digunakan untuk memperbaiki profil lipid pada dislipidemia. Kulit buah naga bersifat tidak tahan lama, sehingga pada penelitian ini kulit yang dipakai dalam keadaan freeze-dried. Penelitian ini bertujuan untuk membuktikan bahwa pemberian kulit buah naga merah dengan dosis 0,72 g/200 g BB tikus, 1,08 g/200 g BB tikus, dan 1,44 g/200 g BB tikus per hari selama 28 hari dapat memperbaiki profil lipid pada tikus putih jantan galur wistar yang diberi diet tinggi lemak. Profil lipid yang diteliti meliputi pemeriksaan kadar kolesterol total, kolesterol LDL, kolesterol HDL, dan trigliserida. Penelitian ini merupakan penelitian eksperimental murni dengan menggunakan rancangan randomized post test only control group design. Penelitian ini menggunakan hewan coba 30 ekor tikus putih jantan galur wistar yang dibagi menjadi lima kelompok. Pengukuran kadar kolesterol total, kolesterol LDL, dan kolesterol HDL dilakukan dengan metode CHOD-PAP, sedangkan pengukuran kadar trigliserida dengan metode GPO-PAP. Data dianalisis secara statistik dengan uji One Way Anova. Hasil penelitian ini menunjukkan bahwa pemberian kulit buah naga merah sebanyak 0,72 g dapat menurunkan kadar kolesterol total, 1,08 g dapat menurunkan kadar kolesterol total dan LDL, dan 1,44 g dapat menurunkan kadar kolesterol total, LDL, trigliserida, dan menaikkan kadar kolesterol HDL. Kulit buah naga merah dapat digunakan secara alternatif untuk memperbaiki profil lipid pada dislipidemia. ***(FMI 2018;54:16-21)***

Kata kunci*: Dislipidemia; freeze-dried kulit buah naga merah; profil lipid*

ABSTRACT

Red dragon fruit (Hylocereus polyrhizus) peel contains anthocyanin, fiber and vitamin C, so it can be used to improve lipid profile in dyslipidemia. The peel of the dragon fruit is not durable, so in this study we used freeze-dried dragon fruit peel. The aim of this study was to prove that the administration of the red dragon fruit peel in a dose of 0.72 g/200 g BW, 1.08 g/200 g BW, and 1.44 g/200 g BW of rat per day for 28 days may improve lipid profile in male wistar strain white rats with high-fat diet. Lipid profiles were studied by examining of total cholesterol, LDL cholesterol, HDL cholesterol, and triglycerides. This was a pure experimental study using randomized post test only control group design. This study used experimental animal of 30 male wistar strain white rats which were divided into five groups. Measurements of total, LDL, and HDL cholesterol levels were done by CHOD-PAP method, while triglyceride level was measured with GPO-PAP method. Data were analyzed statistically by One Way Anova test. The results of this study indicated that giving the peel of red dragon fruit as much as 0.72 g lowered total cholesterol levels, 1.08 g lowered total and LDL cholesterol levels, and 1.44 g lowered total cholesterol, LDL cholesterol, triglyceride levels, and raised HDL cholesterol level. Red dragon fruit peel can be used alternatively to improve lipid profile in dyslipidemia. ***(FMI 2018;54:16-21)***

Keywords*: Dyslipidemia; freeze-dried red dragon fruit peel; lipid profile*

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INTRODUCTION

Today, there have been many changes in lifestyle. People tend to have unhealthy eating patterns. High-calorie foods, high-fat and fast food become more popular because they are very easy to get and they have fast serving time (Yusof et al 2012). High levels of free fatty acids will stimulate triglyceride synthesis in the liver and will be secreted in the form of VLDL. The high formation of such VLDL can increase LDL cholesterol level which is the decomposition of VLDL (Sugondo 2009). This will lead to abnormalities of fat metabolism known as dyslipidemia (Sargowo & Andarini 2011).

Dyslipidemia is a lipid metabolic disorder characterized by high level of total cholesterol, LDL cholesterol and triglyceride, and low level of HDL cholesterol than normal values. Dyslipidemia has a correlation with cardiovascular disease. Improved lipid profile may prevent an increase in the prevalence of dyslipidemia (Srinivasa et al 2011).

The main principle of the management of dyslipidemia is by low-calorie diet, low cholesterol level, alcohol reduction, smoking cessation and regulated lifestyle. Red dragon fruit (*Hylocereus polyrhizus*) is one of the fruit that is currently widely consumed and cultivated by

many people in Indonesia. Fresh dragon fruit cannot be stored in a long time so it is processed in various products, such as fruit juice, syrup, crackers, jam, dodol, various cookies and others (Anonymous 2010). The by-products of these preparations are the waste of peel that has been discarded and cannot be utilized. Red dragon fruit peel contains fiber, vitamin C, minerals, and polyphenol compounds, such as tocopherol and antho-cyani, so it can be used to improve lipid profile in dyslpidemia (Wittawat 2011).

A study conducted by Lugo-Radillo et al (2012) proved that dried dragon fruit with a dose of 9.6 mg/kg BW/day for 28 days in mice can improve lipid profile in dyslipidemia. It is therefore necessary to investigate the effect of red dragon fruit peel in improving lipid profile in male white rats fed with high-fat diet. The results of this study disclosed the effect of red dragon peel in improving lipid profile in dyslipidemia.

MATERIALS AND METHODS

This was a pure experimental study using randomized post test only control group design. Thirty male wistar strain white rats were divided into five groups randomly: K0 (standard diet group), K1 (high-fat diet group), K2 (group with high fat diet and red dragon fruit peel with dose of 0.72 g/200 g BW of rat/day), K3 (group of high-fat diet and red dragon fruit peel with a dose of 1.08 g/200 g BW of rat/day) and K4 (group of high fat diet and red dragon fruit peel with a dose of 1.44 g/200 g BW of rat/day). After seven days of acclimation, the K0 group was given standard feed until day 49, and K1, K2, K3 and K4 were given high-fat diet for 14 days. In K1 group, high-fat diet was continued until the 49th day. Meanwhile, K2, K3 and K4 groups were given the peel of red dragon fruit of 0.72 g/200 g BW of rat, 1.08 g/200 g BW of rat and 1.44 g/200 g BW of rat per day by sonde orally and then continued with the administration of distilled water ad libitum. Lipid profile examination included total, LDL, and HDL cholesterols as well as triglyceride which was carried out on day 50. Measurements of total, LDL, and HDL cholesterol levels were performed by CHOD-PAP method, whereas, triglyceride level was measured by GPO-PAP method. Data were analyzed statistically by One Way Anova test.

RESULTS

Table 1. Mean and standard deviation of experimental animals' body weight

Variables	Mean ± SD (gram)				
	K0 (n=6)	K1 (n=6)	K2 (n=6)	K3 (n=6)	K4 (n=6)
BW1 (gram)	191.33±9.11	190.67±7,56	190.67±6.80	190.83±7.33	191.67±3.72
BW2 (gram)	195.50±4.18	198.33±4.46	196.00±4.79	196.17±3.52	198.10±4.91
BW3 (gram)	210.17±1.47	217.33±2.42	209.50±1.79	211.30±1.63	214.00±1.94

Table 2. Anova test of BW1, BW2 and BW3

Variables	Value	Df	Mean Square	F	p
BW1, BW2, BW3	7651.089	2	3825.544	91.183	0.017

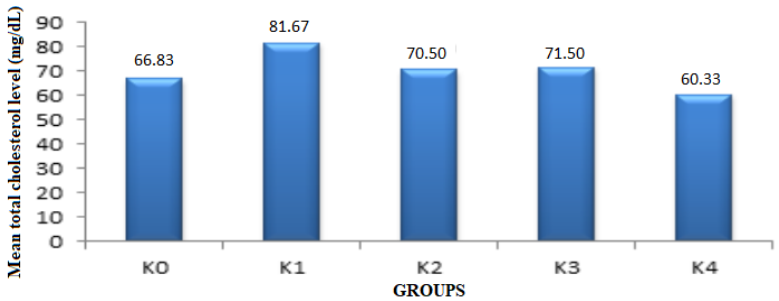

Fig. 1. Mean total cholesterol level.

Table 2 shows significant differences for samples' BW1, BW2 and BW3 of all treatment groups. Fig. 1 shows that the highest mean total of cholesterol levels is obtained in the K1 group, and it tends to decrease in the other groups. Fig. 2 shows that the highest mean of HDL cholesterol level is obtained in the K0 group and the lowest is in the K2 group. Fig. 3 shows that the highest mean of LDL cholesterol level is in the K1 group, and it tends to decrease in the other groups, and Fig. 4 shows that the highest mean of triglyceride level is found in the K1 group while the lowest is in the K0 group.

Kolmogorov Smirnov test results in Table 3 have $p>0.05$, indicating that total cholesterol, HDL cholesterol, LDL cholesterol and triglyceride in all groups have normal distribution. Homogeneity test results in Table 4 shows that total cholesterol, HDL cholesterol, LDL cholesterol and triglyceride in all groups are homogeneous since $p>a$. Anova test results in Table 5 shows $p<a$, indicating that there is significant difference of total cholesterol, HDL cholesterol, LDL cholesterol and triglyceride among 5 treatment groups.

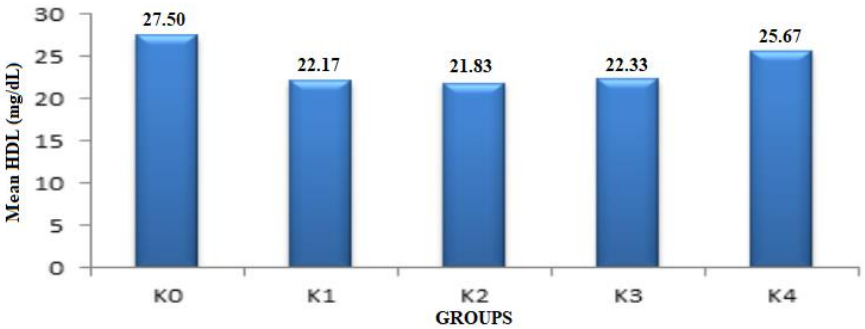

Fig. 2. Mean HDL cholesterol level.

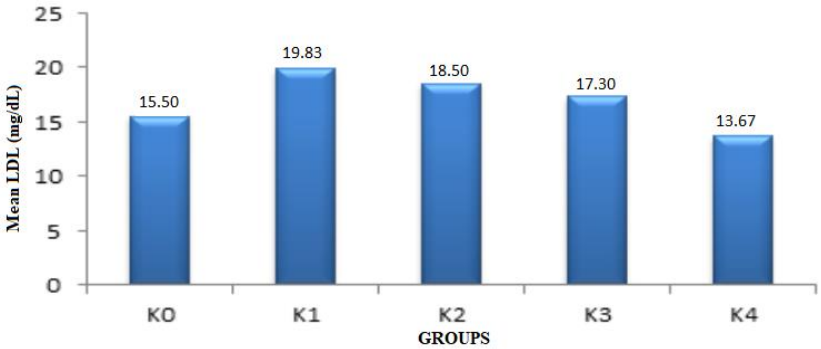

Fig. 3. Mean LDL cholesterol level.

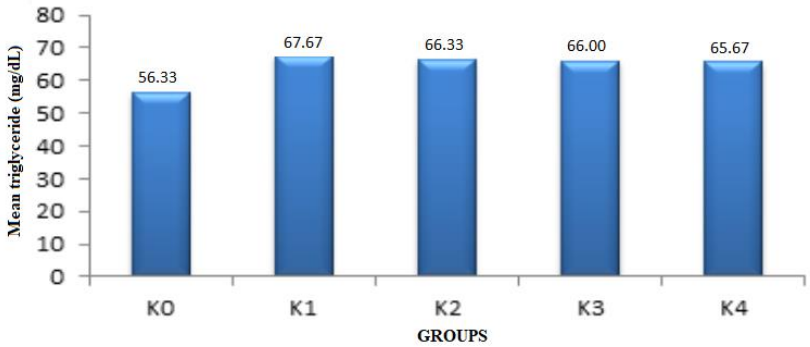

Fig. 4. Mean triglyceride level.

Table 3. Kolmogorov Smirnov test

Variables	Groups	df	p	Note
Total cholesterol	K0	6	0.200	Normal distribution
	K1	6	0.210	Normal distribution
	K2	6	0.200	Normal distribution
	K3	6	0.208	Normal distribution
	K4	6	0.212	Normal distribution
HDL cholesterol	K0	6	0.200	Normal distribution
	K1	6	0.280	Normal distribution
	K2	6	0.200	Normal distribution
	K3	6	0.150	Normal distribution
	K4	6	0.205	Normal distribution
LDL cholesterol	K0	6	0.170	Normal distribution
	K1	6	0.240	Normal distribution
	K2	6	0.201	Normal distribution
	K3	6	0.200	Normal distribution
	K4	6	0.207	Normal distribution
Triglyceride	K0	6	0.135	Normal distribution
	K1	6	0.225	Normal distribution
	K2	6	0.208	Normal distribution
	K3	6	0.206	Normal distribution
	K4	6	0.205	Normal distribution

Table 4. Levene test

Variables	df1	df2	p	Note
Total cholesterol	4	25	0.484	Homogeneous
HDL cholesterol	4	25	0.635	Homogeneous
LDL cholesterol	4	25	0.680	Homogeneous
Triglyceride	4	25	0.470	Homogeneous

Table 5. Anova test

Variables	Value	df	Mean Square	F	p	Note
Total cholesterol	1648.467	4	412.117	83.239	0.009	Significant
HDL cholesterol	154.867	4	38.717	28.608	0.019	Significant
LDL cholesterol	186.333	4	46.583	28.289	0.025	Significant
Triglyceride	501.867	4	125.467	39.538	0.032	Significant

The results of LSD test in Table 6 shows that LSD test on total cholesterol of K1 group with K2, K3, K4 groups have $p<0.05$, showing that there is significant difference, so that K2, K3 and K4 can decrease total cholesterol significantly. The results of LSD test of HDL cholesterol, K1 group with K2, K3 groups showed $p>0.05$, indicating no significant difference, so K2, K3 could not increase HDL cholesterol level significantly. However, K1 with K4 had $p<0.05$, so K4 could increase HDL cholesterol significantly.

In the LSD test of LDL cholesterol LDL, K1 group with K2 group had $p>0.05$. It means that there was no significant difference, so that K2 could not lower LDL cholesterol level significantly. However, K1 with K3 and K4 groups had $p<0.05$, indicating significant difference that K3 and K4 could significantly lower LDL cholesterol level. In the LSD test of triglyceride, the K1 group with K2 and K3 groups had $p>0.05$. It means that there was no significant difference, so K2 and K3 could not decrease triglyceride level significantly. However, K1 group with K4 group had $p<0.05$, suggesting the presence of significant difference, meaning that K4 could decrease triglyceride level significantly.

Table 6. LSD test

Groups	Groups	p			
		DHL cholesterol	Total cholesterol	LDL cholesterol	Triglyceride
K0	K1	0.035	0.000	0.045	0.025
	K2	0.000	0.048	0.000	0.000
	K3	0.001	0.001	0.506	0.030
	K4	0.025	0.025	0.001	0.000
K1	K0	0.035	0.000	0.045	0.025
	K2	0.067	0.039	0.084	0.214
	K3	0.085	0.000	0.000	0.124
	K4	0.007	0.007	0.025	0.017
K2	K0	0.000	0.042	0.000	0.000
	K1	0.067	0.039	0.084	0.214
	K3	0.000	0.000	0.002	0.753
	K4	0.025	0.025	0.035	0.000
K3	K0	0.001	0.000	0.506	0.030
	K1	0.085	0.000	0.000	0.124
	K2	0.000	0.000	0.002	0.753
	K4	0.040	0.040	0.048	0.001
K4	K0	0.025	0.025	0.001	0.000
	K1	0.007	0.007	0.025	0.017
	K2	0.000	0.000	0.035	0.000
	K3	0.040	0.040	0.048	0.001

DISCUSSION

Factors which are likely to cause decrease in total cholesterol level are levels of fiber, vitamin C and anthocyanins contained in the peel of red dragon fruit (Ide 2009). The fibers will bind the bile in the intestine which causes the excretion of bile salts out of the enterohepatic cycle and wasted with the feces, which results in a decrease of the amount of bile salts and exogenous cholesterol. This will cause the liver to use endogenous cholesterol as material to form bile salts (Murray et al 2012).

A decrease in LDL cholesterol level is suspected because anthocyanin in dragon fruit has the ability to inhibit cholesteryl ester transfer protein activity (CETP), so that there is no exchange between HDL cholesterol ester in triglyceride in LDL. Thus, HDL3 does not turn into HDL2, so HDL cholesterol will increase while LDL cholesterol will decrease. This will increase the cholesterol clearance in the periphery to be brought to the liver and will then be removed through bile acid secretion, preventing the oxidation of lipoproteins that may reduce the oxidation of LDL cholesterol (Murray et al 2012).

Whereas, the decrease in HDL cholesterol level is suspected to be due to vitamin C in dragon fruit, which may increase the enzyme cholesterol-7a hydroxylase that converts cholesterol to bile acids and bile salts in the liver which then are excreted into the intestine and disposed of in the feces. A decrease in triglyceride level is thought to be due to anthocyanins in the peel of the dragon fruit which may increase lipid hydrolysis by lipase enzymes, so that fatty acids and triglyceride are absorbed through the intestinal mucosal cells and lipids may be excreted through the feces, resulting in decreased triglyceride level (Sudheesh 2009).

CONCLUSION

Freeze-dried red dragon fruit peel lowers total cholesterol, HDL cholesterol, LDL cholesterol and triglyceride, so it can be used as an alternative therapy in dyslipidemia.

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