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The Effectiveness of Red Dragon (*Hylocereuscostaricensis*) Consumption on The Level of Blood Lipid Profile in Adult

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Abstract—The pattern of food consumption and a wrong lifestyle can spur the emergence of oxidative stress, especially in adult humans. Oxidative stress can be inhibited by consuming foods that contain high antioxidants. Red dragon fruit contains a high source of antioxidants. This study aims to analyze the effectiveness of red dragon fruit (*Hylocereuscostaricensis*) as a functional food in maintaining lipid profile levels under normal conditions (prevention of dyslipidemia) in adults. This study is a clinical experimental study with a pre and posts randomized controlled group design. This research used a quantitative analytic research type with an experimental study approach, using the RCT (Randomized Controlled Trial) method. The sample was taken by purposive sampling with a simple random sampling method. The intervention group was given red dragon fruit in 180 grams/day for 15 days. Levels of blood lipid profiles were measured before and after treatment. Data were analyzed by the Kolmogorov-Smirnov test for data normality test. Paired t-test to determine the difference in mean pretest and post-test in one group after treatment.Independent t-test to determine differences in the mean difference between pretest and post-test between groups given different treatments and nutritional intake from food due to 24 hours of food recall was analyzed using the Nutrisurvey program.

Keywords: red dragon fruit, blood lipid profile (total cholesterol, HDL cholesterol, cholesterol-LDL, and triglyceride)

INTRODUCTION

Consumption behavior has recently changed from a natural, balanced diet to an instant unhealthy diet coupled with high-stress levels and the wrong lifestyle. The wrong lifestyle, including unbalanced dietary consumption, can result in metabolic disorders in a person's body. The emergence of metabolic disorders can increase non-communicable diseases such as hypercholesterolemia, which causes coronary heart disease.

According to the 2013 Riskesdas results, it shows an increase in non-communicable diseases (PTM) and a high level of nutritional problems in the community, which are thought to be related to changes in food consumption patterns community. The results of the Individual Food Consumption Survey (SKMI) show that the consumption of vegetables and processed groups and fruits and processed by the population is still low, namely 57.1 grams per person per day and 33.5 grams/day. In the vegetable group, green vegetables were consumed the most (79.1%) compared to other vegetables. On the other hand, for the fruit and processed group, the population mostly consumed bananas (15.1%). The inadequate consumption of vegetables and processed and fruits and preparations affects the body's supply of vitamins and minerals. Dragon fruit that has a high nutrient and antioxidant content and affects health is dragon fruit.[1]

According to Prakoso et al. l (2017), red dragon fruit extract and white dragon fruit extract have a potential effect in improving hypercholesterolemic conditions.[2]Heryani's research (2016) shows that giving red dragon fruit extract to hyperlipidemic white rats shows a significant difference in total cholesterol and

triglycerides.[3] For HDL and LDL levels, there is no significant difference ($p<0.005$). According to Suryani's (2015) research, red dragon fruit juice has an antihyperlipidemic potential comparable to atorvastatin.[4]

Dragon fruit is a functional food, namely conventional food, not in capsules, tablets, or powder, which positively affects health. Dragon fruit contains high fiber, has a low GI and contains high antioxidants.

Research conducted by Rebecca et al. (2010) identified pigments in red dragon fruit (Hylocereus*polyrhizus*), closely related to the high antioxidant content in dragon fruit.[5] According to Wu et al. (2006), one of the very important dragon fruit ingredients is betacyanins, a very strong antioxidant.[6]

Research by Anand Swarup et al. (2010) gave dragon fruit extract as much as 250 mg and 500 mg for 15 days to streptozotocin-induced DM rats. The results showed an increase in endogenous superoxidase dismutase (SOD) levels. Also, there was an increase in antioxidant activity (Total Antioxidant Capacity / TAC).High levels of SOD, and increased antioxidant activity (TAC) in a person's body can reduce the risk of developing PTM, increasing in prevalence.[7]

A study conducted by Rahmawati and Mahajoeno (2009) found that super red dragon fruit (Hylocereus*costaricensis*) had the highest vitamin C content. Vitamin C can also donate electrons to intracellular and extracellular biochemical reactions.[8] Vitamin C can remove reactive oxygen compounds in neutrophil cells, monocytes, lens proteins, and retina. Outside the cell, vitamin C can remove reactive oxygen compounds, prevent oxidation of LDL, transfer electrons into oxidized tocopherols, and absorb metals in the digestive tract.[9]

This study aimed to analyze the effectiveness of consuming red dragon fruit (Hylocereus *costaricensis*) as a functional food in maintaining lipid profile levels under normal conditions (prevention of dyslipidemia).

METHOD

This research was conducted at the PoltekkesKemenkes Bandung. This research was started in February 2019 until November 2019. This research used a quantitative analytic research type with an experimental study approach, using the RCT (Randomized Controlled Trial) method. The sample was taken by purposive sampling with a simple random sampling method. The minimum number of samples used is ten people for each group, so there are 20 people. The sample calculation uses a formula to test the hypothesis on the mean of two independent populations. [10]

After going through the randomization process, all research subjects were divided into the control and intervention groups. In each group, the initial lipid profile was examined. The intervention group will be given 180 grams of dragon fruit for 15 days; then, the final lipid profile will be examined. Meanwhile, the control group examined the final lipid profile without giving dragon fruit.

This research has received approval for health research ethics from the Health Research Ethics Committee of the Bandung Health Ministry of Health with Number: 09 / KEPK / PE / X / 2019 on October 14, 2019.

RESULT

A. Characteristics of Research Subjects

The characteristic data of research subjects are as follows:

1. Gender

An overview of research subjects based on gender in this study can be seen in Table 1 below:

Table 1
Frequency distribution of research subjects based on gender

Gender	n=30		%
	Intervention Group	Control Group	
Male	8	11	53,33
Female	7	4	46,67
Total	15	15	100

(Source: Primary Data, 2019)

2. Age

The youngest subject in this study was 23 years, while the age of the oldest subject was 61 years, with an average age of 44.3 years. Data on the age characteristics of research subjects can be seen in Table 2 below:

Table 2.
Age characteristics of research subjects

Group	Youngest age (Years)	Oldest age (Years)	Mean (Years)
Intervention	29	56	42,13±11,587
Control	23	57	42,13±8,117

(Source: Primary Data, 2019)

3. The pattern of consumption of food cholesterol sources of respondents

The dietary consumption patterns of respondents from cholesterol sources were assessed using the SQFFQ and obtained the following data.

Table 3
Respondents' Cholesterol Source Consumption Patterns

Group	N	Lowest (mg %)	The highest (mg %)	Mean (mg %)
Intervention	15	80.84	612.71	304.0067±170.030
Control	15	103.10	636.49	296.6107±168.702

(Source: Primary Data, 2019)

B. Description of Research Variable Data

1. Dragon Fruit

Dragon fruit used in this study were analyzed for fiber and antioxidant content in 100 grams of whole dragon fruit pieces at the center of food and nutrition studies at Gajah Mada University, Yogyakarta.

Table 4.
Dragon Fruit Fiber and Antioxidants Content

	Antioxidants %	Insoluble Food Fiber %	Soluble Food Fiber %	Dietary fiber %
Dragon fruit (piece)	48,7025 49,1017	5,3276 5,2738	0,2849 0,2598	5,6125 5,3370

(Source: UGM Center for Food and Nutrition Studies, 2015)

Dragon fruit was prepared in pieces as much as 180 grams for each study subject per day in the treatment group for 15 consecutive days.

2. Lipid Profile of the Control Group

The lipid profile in the control group can be seen in Table 5 below.

Table 5
Lipid Profiles of the Control Group

Lipid Profile	N	Lowest (mg %)	The highest (mg %)	Mean (mg %)	Std. Deviation
CHOL_Pre	15	145	221	180.07	23.972
CHOL_Post	15	132	206	175.07	23.334
TG_ Pre	15	32	131	87.07	29.055
TG_ Post	15	23	159	84.87	33.711
HDL_ Pre	15	28	64	41.67	9.201
HDL_ Post	15	30	66	43.13	9.463
LDL_ Pre	15	84	164	121.13	23.136
LDL_ Post	15	79	154	116.87	22.418

3. Lipid Profile of the Intervention Group

The lipid profile in the treatment group can be seen in Table 6 below.

Table 6
Lipid Profiles of the Intervention Group

Lipid Profile	N	Lowest (mg %)	The highest (mg %)	Mean (mg %)	Std. Deviation
CHOL_Pre	15	127	324	206.80	48.226
CHOL_Post	15	130	335	206.07	48.996
HDL_ Pre	15	29.0	61.0	39.880	8.2921
HDL_ Post	15	28	57	41.47	9.425
LDL_ Pre	15	77	240	139.73	43.763
LDL_ Post	15	83	250	142.00	41.997
TG_ Pre	15	38	430	120.60	94.480
TG_ Post	15	38	345	108.53	71.871

C. Changes in Respondent Lipid Profiles

Changes in lipid profiles in the control group and treatment group can be seen in Table 7 below.

Table 7
Changes in Lipid Profiles in 2 Groups

Lipid Profile Changes	N	Lowest (mg %)	The highest (mg %)	Mean (mg %)	Std. Deviation
CHOL_CONTROL	15	-19	29	5.00	14.604
CHOL_INTERVENTION	15	-25	27	.73	15.392
TG_CONTROL	15	-100	80	2.20	38.634
TG_INTERVENTION	15	-33	85	14.47	33.125
HDL_ CONTROL	15	-8	5	-1.47	3.067
HDL_ INTERVENTION	15	-13	6	-1.59	5.724
LDL_ CONTROL	15	-61	25	3.39	23.652
LDL_ INTERVENTION	15	-20	25	.64	12.802

D. Respondents' food intake during the study

The research subjects' food intake data were taken using a 3X24 hour food recall, then analyzed the energy content and nutritional value with the nutrient survey program and calculated the average per day.

The average energy and nutrient intake in both the treatment and control groups can be seen in Table 8 below:

Table 8
AverageEnergy and Nutrient Intake

Nutrients	Group		Reference Daily Intakes
	Interventon (n=15)	Control (n=15)	
Energy	2080,87±308,54	2004,15±223,55	1558,27 Kal
Protein	82,18±18,48	81,61±14,18	58,43 g
Fat	76,44±21,65	70,99±17,92	34,62 g
Carbohydrate	264,65±67,80	260,63±39,71	253,22 g
Dietary fiber	29,55±5,10	21,80±4,08	25 g
Cholesterol	218,50±167,40	174,52±148,10	200 mg
Vitamin C	156,81±69,72	169,40±65,89	90 mg

(Source: Primary Data, 2019)

Table 8 shows that the average energy intake of study subjects in the treatment and control groups includes excess energy intake (>110%). The average protein and fat intake exceeded the nutritional adequacy rate that should have been in both the treatment and control groups.

DISCUSSION

In this study, cut dragon fruit consumptioncould only effectively reduce LDL cholesterol in the treatment group. The intervention in the form of dragon fruit for 15 days can significantly reduce LDL-cholesterol levels in the treatment group ($p<0.05$), while in the control group, it decreased but not significantly ($p>0.05$).

LDL cholesterol or low-density lipoprotein is a lipoprotein that comes from absorption of food in the intestine, low density, easily clots, and sticks to blood vessels' walls. Also known as 'bad' cholesterol because it can form atherosclerotic plaques, those narrow blood vessels.

Excessive oxidation processes cause oxidative damage to proteins, lipids, carbohydrates, and DNA. Lipid peroxides promote oxidative damage in the cellular and lipoprotein spheres. Oxidized LDL plays an

important role in the initiation and progression of atherosclerosis. It occurs because oxidized LDL contributes to vascular function disruption,leading to atherogenesis.[9]

The average LDL cholesterol level (mg / dL) in the treatment group after the treatment by giving sliced dragon fruit at a dose of 180 g / day decreased compared to the control group. The mean LDL cholesterol of respondents in all groups, both the treatment and control groups, decreased after the intervention compared to before the intervention. From the test results, it was found that the provision of sliced red dragon fruit reduced LDL cholesterol levels in the treatment group, which showed differences with the control group, but each group was not significantly different. This reduction in LDL cholesterol levels is likely the result of a decrease in total cholesterol levels. Given that LDL is a low-density lipoprotein containing cholesterol and cholesterol esters in high concentrations. Therefore, if the serum's total cholesterol level is low, the serum's LDL cholesterol level is also low.

The decrease in LDL levels may be due to vitamin C as an antioxidant in the red dragon fruit extract. Vitamin C is a water-soluble vitamin that can only remove free radicals in liquid media. Vitamin C can suppress free radicals that will attack lipids. Vitamin C acts as a free radical scavenger. So it can directly react with superoxides and hydroxyl anions, and various lipid hydroperoxides. Its role as a chain-breaking antioxidant, vitamin C can regenerate a reduced form of vitamin E. Vitamin C also acts as a secondary antioxidant. The provision of vitamin C significantly reduced serum total cholesterol levels in hyperlipidemic rats. Also, increasing the dose of vitamin C affects reducing the total cholesterol levels of the respondents.

Also, this fruit is rich in beta-carotene. Beta-carotene is a provitamin A which will be converted into vitamin A. Vitamin A is useful for metabolic processes. This beta carotene also functions as an antioxidant that neutralizes free radicals in the human body. The ability of beta-carotene to work as an antioxidant comes from its ability to stabilize carbon-core radicals. Since beta-carotene is effective at low oxygen concentrations, it can complement the antioxidant properties of high oxygen.

It is also in line with research by Hermawan Istiadi (2010), which states that LDL cholesterol levels can (significantly) decrease because active ingredients such as niacin (vitamin B3) can reduce VLDL production. The levels of IDL and LDL will also decrease, vitamin C, which affects hydroxylation in the formation of bile acids, thereby increasing the excretion of cholesterol.[11]

CONCLUSION

Consumption of red dragon fruit (Hylocereus*costaricensis*) has no significant effect on the lipid profile (total cholesterol, HDL-cholesterol, LDL-cholesterol, and triglycerides) in adult human blood significantly ($\alpha < 0.05$). Consumption of red dragon fruit (Hylocereus*costaricensis*) is not effective against reducing total cholesterol, increasing HDL-cholesterol, and decreasing triglycerides, but it effectively reduces LDL-cholesterol in adult human blood.

RECOMMENDATION

It is necessary to do further research regarding dragon fruit consumption by paying attention to several things. The first is to take into account and identify the phytochemical content of antioxidants in red dragon fruit. Second, the dose of red dragon fruit. Third, the duration of the intervention is longer. Fourth, confounding factors and factors that have not been studied in this study so that the results can be more accurate.

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