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EFFECTIVENESS OF PURSULA (Portulaca oleracea) FATTY ACID EXTRACTS IN REDUCE THE TRIGLYCERIDES OF OBESITY RATS

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Abstract

Hyperlipidemia is a condition of high levels of lipids in the blood. Hyperlipidemia is a major factor causing non-communicable diseases such as DMT2 and stroke. Purslane is a plant that contains PUFA which is hypolipidemic. The purpose of this study was to test the effectiveness of giving purslane plant fatty acid extracts in reducing triglyceride levels in obese rats induced by a high-fat and high-calorie diet. There were five treatments in this study, namely P1 negative control (no treatment), P2 positive control (by administering gemfibrozil), P3 (100 mg/kg BW of purslane fatty acid extract), P4 (200 mg/kg BW of purslane fatty acid extract), P5 (300 mg/kg BW of purslane fatty acid extract). The test animals used were male rats strain Ratus norvegitus, male, initial body weight ± 200 grams with final body weight ± 10% of initial weight. This research is True-Eksperimental Research using a Control Group Pretest-Posttest Design with the RAL experimental design. The data obtained were analyzed statistically using tests Quade's Rank Analysis of Covariance. The results showed that the purslane plant fatty acid extract could reduce triglyceride levels. In this study, a dose of 300 mg/kg BW was the best dose for reducing triglyceride levels in obese rats.

Keywords: *Portulaca Oleracea; Omega-3; Triglyceride Levels; Obese Rat; Hyperlipidemia*

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INTRODUCTION

Someone who is obese has a body weight above 20% of the normal limit. Obesity is a condition where there is excessive accumulation of fat in adipose tissue. Fat accumulation will cause cells in adipose tissue to experience hypertrophy and hyperplasia resulting in an increase in mass in adipose tissue. This fat accumulation can occur because the energy entering the body is higher than the energy expended. These conditions will interfere with the blood serum lipoprotein profile of obese patients. Obese people tend to have an abnormal blood serum lipoprotein profile. Serum lipoprotein levels in obese people tend to be higher when compared to people with normal weight (Winato et al., 2019). Fat that enters the body will activate its lipoprotein lipase (LPL) to hydrolyze triglycerides contained in fats into Free Fatty Acid. Adipose tissue will oxidize FFA into energy if FFA in large quantities will be converted by the liver into triglycerides. Therefore, if you eat large amounts of fat, your triglyceride levels will be high. High triglyceride levels can be a major factor in the emergence of non-infectious diseases (Non-Communicable Diseases) such as DMT2 and stroke (Putri & Anggraini, 2015).

Treatment of hypertriglyceridemia generally uses synthetic drugs, the types of synthetic drugs commonly used include fibrates, niacin, and statins. Negative side effects can arise from the use of synthetic drugs, such as skin disorders, gastrointestinal disorders, and impaired liver function (Carlos et al., 2014). Therefore, researchers are looking for alternative treatments for hypertriglyceridemia, one of which is by using traditional medicinal plants.

Compounds contained in traditional medicinal plants that have a function as hypolipidemic are PUFA compounds (Poly Unsaturated Fatty Acid). PUFA compounds contain compounds alfa linolenic acid (n-3) or omega-3, these compounds can reduce triglyceride levels by inhibiting the synthesis of triglycerides in the liver so that blood triglyceride levels can decrease (Santi & Azizah, 2018). One of the plants that contain PUFA compounds is the purslane plant (*Portulaca oleracea*) (Husein et al., 2021).

A series of studies on the use of purslane as a treatment have been carried out. Several researchers have examined the potential of purslane plants to lower triglyceride levels. Purslane plant extract

can affect the reduction of triglyceride levels in the blood. In fact, the Changizi-Ashtiyani et al., (2013) reported that purslane plant extract can to lower triglyceride levels equivalent to the use of the drug atorvastatin. However, from the many studies that have been conducted, there is still limited focus on the fatty acid content of the purslane plant, so this research focuses on the effectiveness of the purslane plant fatty acids (*Portulaca oleracea*) in reducing triglycerides in obese rats (El-newary, 2016; Azizah et al., 2018; Santi & Azizah, 2018).

RESEARCH METHODS

The research was carried out from August to October 2022. The research was carried out at the Chemistry Laboratory of the University of Muhammadiyah Malang as a place for maintenance and treatment, the Biomedical Laboratory of the University of Muhammadiyah Malang as a place for measuring triglycerides, and Materia Medika Batu City as a place for extraction.

This research is a type of research *True-Eksperimental Research* with *Control Group Pretest-Posttest Design*. The research experimental design used was RAL (Completely Randomized Design). In this design consisting of five repetitions with five treatment groups, the experiment was given treatment randomly so that all experimental groups had the same opportunity when given treatment.

The samples used in this study were 25 strained male white rats Rattus Norvegicus, male sex, initial body weight ± 200 grams with final body weight ≥ 10% of initial weight, and comes from the Chemistry Laboratory of the University of Muhammadiyah Malang. Determination of the minimum number of samples based on the Federer formula, namely (t-1) (n-1)> 15, that t is the number of treatments, while n is the number of repetitions in each treatment, so that n> 5 is obtained. This study used 5 rats in each group. The samples used in this study were 25 strained male white rats Rattus Norvegicus, male sex, initial body weight ± 200 grams with final body weight ≥ 10% of initial weight, and comes from the Chemistry Laboratory of the University of Muhammadiyah Malang. Determination of the minimum number of sa mples based on the Federer formula, namely (t-1) (n-1)> 15, that t is the number of treatments, while n is the number of repetitions in each treatment so that n> 5 is obtained. This study used 5 rats in each group.

Sample Preparation and Extraction

As much as 1.5 kg of stem and leaf simplicia of purslane was macerated using 9 L of n-hexane for three days. The resulting filtrate is collected and filtered and then concentrated using a rotary a vopator then obtained the results of purslane plant fatty acid extract are as much as 30 ml.

Acclimatization and Grouping of Experimental Animals

Before treatment, the experimental animals were acclimatized for 3 days to familiarize the rats with living in the laboratory environment, during the acclimatization period the rats were given standard feed. After that, they were grouped into five groups, each group consisting of five rats with body weight above 10% of their initial body weight. The division of the test animal groups was as follows: The negative control group (P1) was not given high-calorie feed, gemfibrozil, and doses of purslane plant fatty acid extract. The positive control group (P2) was treated with gemfibrozil (8.1 mg). Group (P3) was treated with a dose of 100 mg/kgBB. Group (P4) was treated with a dose of 200 mg/kgBB. Group (P5) was treated with a dose of 300 mg/KgBB.

Obesity Induction in Experimental Animals

Mice were given a high-calorie and high-fat diet, the high-calorie diet consisting of a mixture of BR standard feed and rice was given alternately optional for 28 days. High-fat diet using used cooking oil given orally as much as 2 mL for 14 days. Mice can be said to be obese if there is a 10% increase in body weight from the initial body weight. After the obesity condition was met, it was continued with the provision of purslane plant fatty acid extract for 14 days.

Measurement of Triglyceride Levels

Measurement of triglyceride levels was carried out before treatment (pretest) and after treatment (posttest). Rat blood sampling before treatment (pretest) via the lateral vein of the tail of the rat and blood sampling of the rats after treatment (posttest) via the orbital sinus. The blood sample is centrifuged, then the serum is separated into an empty tube that has been given a sample code. Then the blood serum samples of the rats were read for triglyceride levels using an ELISA reader.

Data Analysis Technique

Research data were analyzed using inferential statistical techniques. In the inferential statistics section, several

tests are carried out for the truth of the hypothesis, the basic test used is the Kolmogorov-Smirnov test for the normality test, Levene's test for homogeneity test, andQuade's Rank Analysis of Covariance to find out whether there is a significant effect of giving purslane plant fatty acid extract (Purslane oleracea) in reducing triglycerides in obese rats.

RESULTS AND DISCUSSION

Obesity Index Measurement Results

In this study using high-calorie and high-fat feed to induce obesity and hypertriglyceridemia. Mice that had been induced by high-calorie and high-fat feed for 14 days experienced weight gain and met obesity requirements. In the P1 group there was a weight gain of 32% of the initial body weight, in the P2 group it was 26%, in the P3 group it was 40%, and in the P5 group it was 30% of the initial body weight (Figure 1). According to Sabarinah et al., (2019) states that weight gain in mice ≥10-25% of initial body weight can be categorized as moderate obesity, if mice experience an increase of ≥40% it can be categorized as severe obesity. Sources of fat in high-fat feed can increase appetite in rats. High-fat feed can reduce the synthesis of the hormone leptin which can increase the appetite of rats (Noriko et al., 2017). In addition, the consumption of high-fat feed will increase the formation of free fatty acids. These fatty acids will be synthesized by the liver into triglycerides so that if the concentration of free fatty acids is too high a state of hypertriglyceridemia can occur (Witosari & Widyastuti, 2014). The addition of rice to high-calorie feed can increase rat weight. According to Battung *et al*., (2019) explained that glucose from rice would be stored in the form of glycogen and the rest would be stored in the form of fat, this could increase the mass of the mice.

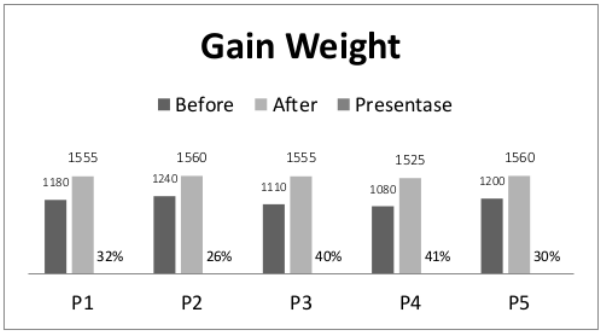

Figure 1. The Average Weight Gain of Rats

Triglyceride Level Test Results

Observation data on the average decrease in blood triglyceride levels of rats after treatment with purslane plant fatty acid extract is presented in Table 1.

Table 1. Results of Mean Decrease in Triglyceride Levels Before and After Treatment

Group	Mean of Decrease in Triglyceride Levels (mg/dL)
P1	-0.3 ± 0.447
P2	-96.1 ± 18.198
P3	-68.2 ± 11.575
P4	-68.8 ± 4.919
P5	-76.5 ± 4.953

Based on the data in Table 1, it is known that the lowest percentage decrease in rat blood triglyceride levels occurred in group P1 with an average value of 0.3 mg/dL and the highest occurred in group P2 with an average value of 96.1 mg/dL. The lowest decrease was in the P1 group because this group was not given the gemfibrozil treatment or the purslane plant fatty acid extract. While the highest reduction in triglyceride levels was in the P2 group due to the administration of gemfibrozil. Gemfibrozil is a type of drug that has the function of lowering blood triglyceride levels. The way gemfibrozil works in lowering triglyceride levels in the blood is by reducing Apo-CIII production which causes an increase in lipoprotein lipolysis activity so that by inhibiting Apo-CIII production it can reduce blood triglyceride levels (Rissa et al., 2021).

The results of the average decrease in glyceride in the purslane plant extract treatment group showed that the higher the dose of purslane plant fatty acid extract given, the higher the reduction in blood triglyceride levels of the rats. The administration of purslane plant fatty acid extract at a dose of 100 mg/KgBW had an average decrease value of 68.2 mg/dL, the administration of a dose of 200 mg/KgBW was 68.8 mg/dL, and the administration of a dose of 300 mg/KgBW was 76.5 mg/dL (Table 1). From these result it can be seen that the purslane plant fatty acid extract has hypolipidemic effectiveness. Meanwhile, if seen from the average reduction of each dose, the best hypolipidemic effect was found at a dose of 300 mg/Kg BW, namely 76.5 mg/dL, approaching the mean reduction in triglyceride levels in the

positive control group, namely 96.1 mg/dL.

The results of this study are in line with research conducted by El-newary, (2016) which stated that purslane plant extract has hypolipidemic properties. Research Azizah *et al*., (2018) state that decreased rat blood triglyceride levels in the purslane plant extract treatment because the purslane plant contains omega-3 fatty acids. According to research by Bornfeldt (2021) dan Karalis (2017) explained that omega-3 can increase fatty acid oxidation and suppress lipogenesis by the liver. Omega-3 works by reducing the production of Apolipoprotein CIII (Apo CIII) where Apo CIII can inhibit the bond between triglyceride-rich lipoproteins and Apo B/E receptors in the liver thereby inhibiting serum triglyceride clearance. Besides being able to inhibit lipoprotein binding to Apo B/E receptors, Apo CIII also has a role in activating Apo B100. Activation of Apo B100 will increase VLDL secretion by the liver. VLDL contains triglycerides, when VLDL levels in blood circulation increase, triglyceride levels in the blood also increase (Setiawan & Halim, 2022). Research conducted by Morton *et al*., (2016) showed the results that with increasing consumption of omega-3 fatty acids given to experimental rats, the results of Apo CIII levels decreased which led to a decrease in blood triglyceride levels.

Before testing *Quade's rank analysis of covariance*First, a prerequisite test is carried out which consists of a normality test and a homogeneity test. The normality test that has been carried out is presented in Table 2.

Table 2. Effectiveness Normality Test Results of Deep Purslane Plant Fatty Acid Extract Lowering Triglyceride Levels

	Shapiro-Wilk		
	Statistic	**df**	**Sig.**
Residual for TG_After	.863	.25	.003

Based on the results of the Shapiro-Wilk test, it were reported that the residual data on decreasing blood triglyceride levels in rats was not normally distributed $D(25) = .863$, $p = .003$]. After the data is tested for normality, a homogeneity test will be carried out as shown in Table 3.

Table 3. Homogeneity Test Results for Effectiveness of Purslane Plant Fatty Acid Extract in Reducing Blood Triglyceride Levels in Rats

Uji Levene's Test of Equality of Error Variances

F	df1	df2	Sig.	Keterangan
15.613	4	20	.000	Inhomogeneous

Based on the results of the Levene test which informed that the variance of the data on the decrease in triglyceride levels in rats in one treatment group and the other treatment group was not homogeneous [$F(4,20) = 15.613$ $p < .001$]. Furthermore, because the results of the prerequisite test showed that the data were not normal and not homogeneous, the data on reducing blood triglyceride levels in obese rats were tested with the *Quade's rank analysis of covariance.* Test results data *Quade's rank analysis of covariance* is presented in Table 4.

Table 4. Quade's Rank Test Results Analysis of Covariance Effectiveness of Purslane Plant Fatty Acid Extract in Reducing Triglycerides

	Sum of Squares	df	Squared Mean	F	Sig.
Between Groups	218.398	4	54.599	1.376	.278
Within Groups	793.537	20	39.677		
Total	1011.935	24			

Based on test results *Quade's rank analysis of covariance* informed that there was no significant effect on reducing rat blood triglyceride levels in each treatment [$F(4,20) = 1.376$, $p = .278$], it can be concluded that administration of purslane plant fatty acid extract can reduce rat blood triglyceride levels but has no significant effect. There was no significant effect because an error occurred when checking triglyceride levels which caused the data to be abnormal and had no significant effect. In addition, it is also likely due to the dose level of the acid extract purslane plant fat can still be tolerated by rats. The most effective dose of omega-3s for reducing triglyceride levels is 4 g (≥3g) (Skulas-Ray et al., 2019).

CONCLUSION

Based on the research that has been done, it can be concluded that purslane plant fatty acid extract can reduce triglyceride levels. In this study, a dose of 300 mg/KgBW was the best dose in reducing triglyceride levels in obese rats. However, further research is needed to determine the best dose of purslane plant fatty acid extract which has a significant effect on reducing blood triglycerides in obese rats.

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