# Effect of fucoxanthin extract from microalgae scenedesmus dimorphus on anti-obesity activity.

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## Abstract

**Obese people in Indonesia have increased every year. Obesity can lead to other diseases that are harmful to health. Scenedesmus dimorphus microalgae contain carotenoid bioactive compounds, namely fucoxanthin, which are useful as anti-obesity and anti-diabetes. This study aimed to examine the effects of Scenedesmus dimorphus microalgae fucoxanthin extract on lipid metabolism in obese mice fed a High-Fat Diet (HFD). Fucoxanthin extraction was obtained from the microalgae Scenedesmus dimorphus biomass using the ethanol soxhlet extraction method. Male mice aged 8 weeks (30 mice) were divided into 6 groups with normal control, obesity, drug, fucoxanthin extract dose 5; 10; 15 mg/20 g BW, mice induced orally and treated with HFD. Bodyweight and food intake were observed daily and lipid profiles from blood samples were tested every week. The effect of fucoxanthin extract on mice lipid metabolism is decreased levels of total cholesterol, triglycerides, Low-Density Lipoprotein (LDL) and increased levels of High--Density Lipoprotein (HDL), and weight loss of mice. The results of this study indicate the potential of fucoxanthin extract from the Scenedesmus dimorphus microalgae to control obesity as a result of the administration of HFD in vivo.**

**Keywords:** Scenedesmus dimorphus, Fucoxanthin, Lipid profile, Obesity, HFD.

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## Introduction

The lifestyle of modern humans nowadays tends to choose to consume fast food and drinks. Junk food refers to fast food that is easy to make and easy to consume. Michael Jacobson was to give the term junk food as slang for food that is not useful or has a low nutritional value. Junk food is often called HFSS (High Fat, Sugar, or Salt) which is a food that has a High composition of Fat, Sugar or Salt. The number of the adult population (aged over 18 years) in Indonesia who are obese has increased. Based on the Monitoring of the Nutrition Status of the Ministry of Health, around 25.8% of the adult population was classified as obese [1]. That number jumped more than the previous year which was only 10.6%. According to Rashmi and Baur's research, women who live in urban areas are more likely to be obese 1.26-fold compared to those who live in rural areas. This is with similar the results of the Ministry of Health survey which states that around 29.7% of women are classified as obese. While in men the number is only 11.4%. Obesity can cause various health problems such as non-alcoholic fatty liver disease, heart disease, hypertension, and type 2 diabetes. Non-Alcoholic Fatty Liver Disease (NAFLD), a disease caused by metabolic lipid syndrome, this generally occurs in obese people. Recent research shows that ectopic lipid deposition can also interfere with muscle protein replacement. Low physical activity is one reason for the imbalance of lipid metabolism in the body. Progressive reduction in physical activity can be further observed in obese people who experience joint and musculoskeletal complications, causing muscle protein and oxidative muscle replacement and decreased performance capacity [2].

Scenedesmus dimorphus microalgae contain chlorophyll a and b pigments and carotenoid pigments such as α-, β-, γ-carotene. The only antioxidant compound possessed by microalgae is a fucoxanthin compound, an orange pigment produced in carotenoid biosynthesis. fucoxanthin is interesting to study because of benefits for human health, it has anti-carcinogenic,anti-inflammatory, protective ability to protect cells against free radicals or as antioxidants. fucoxanthin also functions as anti-obesity in inhibiting fat accumulation and anti-diabetes. Also, fucoxanthin is an excellent health food supplement that has been shown to have no toxic properties. fucoxanthin pigment is one of the carotenoid bioactive pigments from algae that has the potential to be developed as a nutraceutical ingredient that has an activity of reducing body weight. Scenedesmus dimorphus as a nutraceutical is useful as an anti-anemia aplastic drug. The study focus to benefit of fucoxanthin extract from microalgae Scenedesmus dimorphus which has potential as an anti-obesity agent [3].

## Materials and Methods

### *Equipment*

The equipment used is glassware, centrifuge, autoclave, analytical balance, aquarium, spectrophotometer, injection needle for oral induction, blood tube, micro-pipette, rotary evaporator.

The materials used were culture from microalgae Scenedesmus dimorphus, white male mice (Mus musculus L.), ethanol 96%, Orlistat, Bold's Basal Medium (BBM) prepared with Pro Analysis (PA) standard substances, $NaNO_3$, $MgSO_4$. $7H_2O$, NaCl, $K_2HPO_4$, $KH_2PO_4$, $CaCl_2H_2O$, $H_3BO3$, EDTA, $FeH2SO_4$, and trace element, high-fat food (high-fat diet) and basal food for mice feed [4].

### *Research design*

Research using experimental animals, with a Completely Randomized Design (CRD). The subjects of this study were white male mice weighing 20-30 grams. The fucoxanthin extract used was the result of Scenedesmus dimorphus microalgae extraction, the extraction process was carried out referring to which had been modified using the Ethanol Soxhlet Extraction method. The treatment of test animals is divided into six groups, each containing five tails, as follows:

***Table 1.*** *Design of experimental animals.*

| No. | Groups | Treatment | Observation |
|---|---|---|---|
| 1 | Normal Control | Pellet and drinking water | 0-28 days |
| 2 | Obesity Control | Pellet, HFD and drinking water | |
| 3 | Drug Control | Pellet, HFD, Orlistat, and drinking water | |
| 4 | Low Dose | Pellet, HFD, extract fucoxanthin 10 mg/20 g BW, and drinking water | |
| 5 | Moderate Dose | Pellet, HFD, extract fucoxanthin 15 mg/20 g BW, and drinking water | |
| 6 | High Dose | Pellet, HFD, extract fucoxanthin 20 mg/20 g BW, and drinking water | |

### *Blood sampling*

Blood specimens of mice were taken from the tail for analysis every week and the final analysis was carried out on the neck section which was carried out on the 28th day under deep anesthesia, blood collected using blood tubes [5].

Centrifuge (5000 × g) for 30 minutes to separate serum and erythrocytes, then blood serum is used for lipid profile analysis.

### *Lipid profile analysis*

Lipid profile examination consists of measuring cholesterol, triglyceride, LDL, and HDL levels using a Microlab at the Pharmacology Laboratory of Andalas University.

## Results and Discussion

### *Production of biomass and fucoxanthin extract*

Scenedesmus dimorphus microalgae are ready for harvest after 24 days of cultivation in which Scenedesmus dimorphus is in a phase of phase to produce a secondary metabolite, fucoxanthin. To get the biomass concentrated by centrifuge, then dried in the oven (temperature 40-50°C and crushed with mortar to minimize the surface area. The dry biomass obtained was 11.272 g of 50 liters of cultivation (0.225 g/l). Then extraction was carried out. with 96% ethanol as a solvent in the soxhlet, the excess solvent was evaporated with a rotary evaporator and 0.5 g of thick extract was obtained, then diluted in 100 ml (0.005 g/ml) with distilled water, then measured with UV-Vis wavelength spectrophotometer 440-455 nm, a concentration of 12 ppm was obtained in 0.005 g/ml of extract. The concentration of fucoxanthin obtained was 2.4 mg/g of fucosantin extract [6].

### *Obesity evaluation*

Mice were acclimated for 7 days and weighed every day starting on the first day of treatment. The fucoxanthin extract solution prepared was induced by mice according to the dosage. Based on the measurement of body weight of mice every day for 28 days and displaying the body, the Roher value was obtained to determine Body Mass Index (BMI) ≥30 (obesity indicator) (Figure 1). Pretty good compared to mice on positive control (obesity). As for the body weight of mice given drug treatment, weight gain was still greater than the group given fucosantine extract [7].

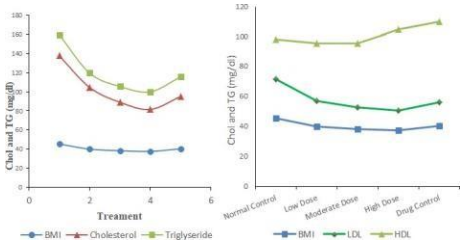


***Figure 1****. 1a: The relationship between increased BMI with (A) cholesterol and triglyceride levels; 1b: LDL and HDL at observation 28 days.*

### *Analysis of lipid profiles*

Body condition of obese mice can be investigated based on the results of analysis of lipid profiles in blood including total cholesterol, triglycerides, LDL and HDL. Blood samples are taken through the tails of mice every week and analyzed using a Microlab, for the final analysis of blood samples taken through neck cuts as well as extermination of test animals [8].

The results of testing total cholesterol levels (Figure 2), it can be seen that the mice of the obese control group showed an increase in high total cholesterol levels of 23 mg/dl compared to the normal control group of 0.5 mg/dl for 28 days of treatment. While the total cholesterol levels of drug control, low, medium and high doses decreased respectively by 19.5 mg/dl, 13 mg/dl, 27 mg/dl and 33.5 mg/dl. This shows that the medium and high dose groups had a greater decrease in total cholesterol than the drug control group [9]. The decrease in total cholesterol levels is proportional to the addition of a dose of fucoxanthin extract, the higher the dose given to test animals, the decrease in total cholesterol levels is also greater.

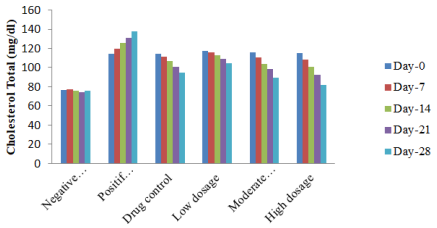


***Figure 2.*** *Cholesterol levels from the blood of mice in each treatment were observed from days 0-28.*

The results of assay triglyceride levels (Figure 3), it can be seen that mice in the obese control group showed an increase in high triglyceride levels of 23.5 mg/dl compared to the normal control group of 1 mg/dl. While the triglyceride levels of the drug control group, low, moderate and high doses decreased respectively by 17 mg/dl, 15 mg/dl, 29 mg/dl and 35.5 mg/dl. This shows that the treatment group of medium and high doses of fucosanthine extract showed a greater decrease in triglyceride levels compared to drug control. Whereas in the treatment of low doses the decrease in triglyceride levels is still smaller compared to drug control.

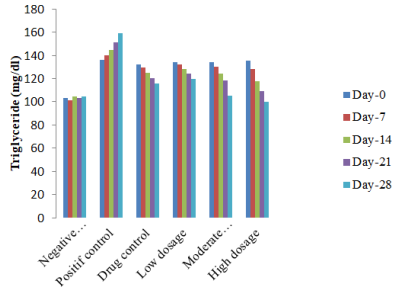


***Figure 3****. Triglyceride levels from the blood of mice in each treatment were observed from days 0-28.*

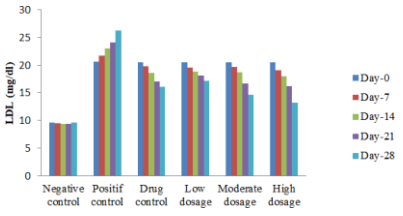


***Figure 4.*** *Low-Density Lipoprotein (LDL) from the blood of mice in each treatment were observed at days 0-28.*

The results of assay LDL levels, it can be seen that mice in the obese control group showed an increase in high LDL levels by 5.7 mg/dl compared to normal controls by 1 mg/dl. While the LDL levels of the drug control group, low, medium and high doses decreased respectively by 4.45 mg/dl, 3.25 mg/dl, 5.8 mg/dl and 7.4 mg/dl. This shows that the moderate and high dose groups had a greater decrease in LDL levels compared to the drug control group. Whereas in the low dose group the decrease in LDL levels was still low compared to drug control (Figure 4).

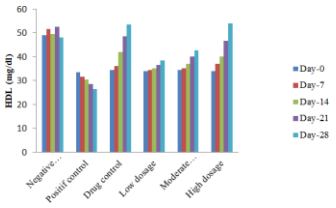


***Figure 5.*** *High-Density Lipoprotein (HDL) from the blood of mice in each treatment were observed at days 0-28.*

The results of assay LDL levels it can be seen that mice in the obese control group showed an increase in high LDL levels of 5.7 mg/dl compared to normal controls of 1 mg/dl. While the LDL levels of the drug control group, low, medium and high doses decreased respectively by 4.45 mg/dl, 3.25 mg/dl, 5.8 mg/dl and 7.4 mg/dl. This shows that the moderate and high dose groups had a greater decrease in LDL levels compared to the drug control group [10]. Whereas in the low dose group the decrease in LDL levels was still low compared to drug control (Figure 5) [11].

## Conclusion

The administration of fucoxanthin extract at a dose of 15 mg/ BW was quite effective in controlling obesity in mice compared to administering drug treatment. Fucoxanthin extract from Scenedesmus dimorphus is beneficial for treating Obesity.

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