

EFFECT OF FISH OIL ON BLOOD CHOLESTEROL LEVEL IN RATS FED WITH HYPERCHOLESTEROLEMIC DIET

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ABSTRACT

The effect of dietary fish oil on serum cholesterol level of 26 three month old male wistar rats, after feeding with hypercholesterolemic diet for 4 weeks was studied. The rats were divided into two groups. i.e. control group with hypercholesterolemic diet (10% w.w laid) and treatment group (10%) as a substitute laid, while food and water being provided freely (ad libitum). The duration of treatment was 4 weeks. After treatment was accomplished, serum total cholesterol level was measured, and the acquired data were statistically analyzed by T-test. The result of this study showed that there were significant differences in serum total cholesterol between control and treatment group. Serum total cholesterol level of treatment group was significantly lower than that in control group, and there was also no significant difference in body weights between both groups before and after treatment.

Keywords: dietary fish oil, cholesterol level, hypercholesterolemic diet

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INTRODUCTION

It has been well recognized that there is a close correlation between high serum lipid and the incidence of atherosclerotic and coronary heart disease. From all serum lipids, cholesterol is the one frequently connected with those diseases (Grundy 1990; Karyadi & Muhinal; Martin et al. 1990). Cholesterol and triglyceride in blood are bound with lipoprotein particles. It is suggested that lipoprotein, LDL, is an atherogenic lipoprotein particle, while HDL is anti-atherogenic. Atherosclerosis is a process, in which arterial lumen is slowly constricted by the presence of lipid deposition in a site, sometimes accompanied with calcification (Ernstj 1990). For individuals with high cholesterol level (hypercholesterolemic) daily diet regulation is an important step to prevent the disease (Grundy 1990; Karyadi & Muhinal; Martin et al. 1990).

The use of polyunsaturated fatty acid in diet to reduce cholesterol level has been most-intensively studied (Herold & Kinsella 1986; Lee 1989; Martin et al. 1990; Olle et al. 1991). Natural oils, such as peanut oil, cotton seed oil, soybean oil, and corn oil, are substances useful for reducing plasma cholesterol level. The cause of cholesterol reduction by polyunsaturated fatty acid remains unclear. However, several hypotheses have been suggested to elaborate such effect, including cholesterol stimulation and extraction into the intestine and the stimulation of cholesterol oxidation to become bile acid (Martin et al. 1990). Several authors have

investigated the effect of polyunsaturated fatty acid from fish oil, which is from the n-3 type, the eicosapentaenoic and docosahexaenoic acid, on serum lipid profile. The mechanism of blood cholesterol reduction remains unclear, but it is suggested to have correlation with reduced VLDL and lipoprotein formation rate in the liver (Lee 1989; Olle et al. 1991; Steinberg & Witzum 1990). Other beneficial effects of polyunsaturated fatty acid found in fish oil are plasma TG reduction, bleeding time increase, platelet count reduction, prostaglandin formation modification, and hepatic lipoprotein synthesis alteration (Isabel 1987). These can be found in community living in Eskimo, Greenland, and among Japanese fishermen, who consume fish containing n-3 polyunsaturated fatty acid or eicosapentaenoic acid (20:5 n-3) and docosahexaenoic fatty acid (20:6 n-3), so that they have a low atherosclerotic as well as coronary heart disease incidence (Isabel 1987; Share et al. 1991). This study was, therefore, intended to disclose the effect of fish oil on blood serum cholesterol level in hypercholesterolemic rats that received high lipid diet.

MATERIALS AND METHODS

As many as 26 male Wistar strain rats aged 4 weeks bought from Biochemistry Laboratory were used as experimental animals. Materials for experiment were fish oil, obtained from Brawijaya University, diethyl ether (for general anesthesia), plasma EDTA, and Total

Cholesterol Chod-Pap reagent. Diet for the experimental animals were standard diet from ITB formula (Table 1), high lipid diet (Table 2), and treatment diet. After treatment period was over, the rats were separated into isolated place without being fed for 12 hours. After being given with diethyl ether until steady respiratory rate was achieved, 8 ml blood was taken by heart puncture. Separated serum was taken and kept within sealed bottle. Laboratory examination was conducted at least 24 hours thereafter.

This study used true experimental method. Data obtained were processed statistically using t test with significance level of 5%. After being weaned at 4 weeks of age, the rats were given with standard diet (pellet) for 2 months. The bodyweight was measured and examination was conducted for total cholesterol level in 5 rats to obtain basic data. To reach hypercholesterolemic condition, 21 of those rats were given with high lipid diet for 4 weeks, and total serum cholesterol level was examined in 5 rats. Bodyweight was measured to find the increase of cholesterol level.

Furthermore, the remaining rats were divided into two groups, each was given with treatment for 4 weeks with the following criteria: Control group I was given with control diet, and control group II was given with treatment diet. After treatments were over, blood sample was taken from 12-hour fasting rats for total cholesterol level. All diets were given to each group ad libitum and to find the amount of consumed diet, the consumed diet and the remaining diets were scaled every day. Bodyweight was measured before and after treatment diets were given. Total cholesterol level examination was conducted using Chod-Pap method.

RESULTS

Table 1. Results of bodyweight measurement ($X \pm SD$)

Groups	Early BW	Final BW	Difference
Control	170.64 $\pm$ 16.002	201.5 $\pm$ 17.81	28.46 $\pm$ 8.26
Treatment I	173.07 $\pm$ 14.221	200.38 $\pm$ 23.045	27.31 $\pm$ 10.91

Table 2. Serum total cholesterol level ($X \pm SD$)

Groups	Serum Total Cholesterol Level (mg/dl)
Control	94 $\pm$ 15.354
Treatment I	77.07 $\pm$ 15.469

T test on the result of serum total cholesterol level revealed that there was significant difference ($p < 0.05$) between both experimental animals.

After treatment for 4 weeks, there was an increase of bodyweight in control group of 28.46 grams, and in treatment group I 27.31 grams. T test on the results of scaling showed no significant difference in bodyweight increase ($p > 0.05$) between both experimental groups.

DISCUSSION

Data in this study revealed that the addition of fish oil to experimental animals resulted in significant difference of total cholesterol level between control group and treatment group I. The addition of 10% fish oil resulted in 81.98% decrease of total serum cholesterol level as compared to that in control group. The results of bodyweight scaling in this study indicated that early bodyweight, final bodyweight, and bodyweight increase in each group showed no significant difference in both groups. The bodyweight measurement was intended to detect difference growth in both experimental groups, in which there was no difference of growth in both groups. Therefore, the amount of calorie was not a factor that played a role in serum total cholesterol level.

CONCLUSION

There is a significant difference in serum total cholesterol level in control and treatment groups, in which the level in treatment group is lower than that in control group. It is apparent that fish oil has hypocholesterolemic effect on serum cholesterol level. This study used 10% fish oil as the source of polyunsaturated fatty acid. This acid, the n-3 types, which is designated as eicosapentaenoic and docosahexaenoic acids, have been proved to reduce serum total cholesterol level in hypercholesterolemic rats. It is worth to conduct other studies using other types of oil (corn, soybean, etc) as the source of polyunsaturated fatty acid to find their hypocholesterolemic effects.

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