Australian Journal of Basic and Applied Sciences

2018 January; 12(1): pages 1-3
DOI: 10.22587/ajbas.2018.12.1.1

Research Article AENSI Publications

Evaluation of Omega-3 on lipid Profile and Biochemical Parameters on Wister Rats

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Received date: 22 December 2017, **Accepted date:** 22 January 2018, **Online date:** 5 February 2018

Abstract

The lipid profile (total cholesterol, HDL cholesterol, LDL cholesterol, triglycerides) is used as part of a cardiacdisease risk assessment In this research, we investigate the efficiency of Fishoil to decrease the levels of total cholesterol and proteins in Wister rats (n =60) weighing (225-250 g). Fish oil was fed for seven weeks to Wister rats. Hematological and physiological parameters were examined by automatic analyzer and the results were statistically analyzed by SPSS.12. In comparison to control rats showed highly significant decrease in values of following physiological parameters; triglycerides, total cholesterol, low density lipoprotein cholesterol, total protein. In contrast, marked increasing in the value of high density lipoprotein cholesterol. These findings indicate that diets containing Fish oil significantly improved the physiological parameters of rats. We suggest that Fish oil as part of food might improve blood parameters and increase high density lipoprotein cholesterol in rats. We further suggest that Fish oil supplementation act as antioxidant agents, and an excellent adjuvant therapy for rats.

Key words: Fish oil, lipid profile, HDL cholesterol, LDL cholesterol, triglycerides

INTRODUCTION

Fish oil is derived from the tissues of oily fish. Fish oil contain the omega-3 fatty acids eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA), precursors of certain eicosanoids that are known to decrease inflammation in the bodyand have other health benefits, such as treating hypertriglyceridemia, although claims of protecting heart from attacks or strokes have not been supported (El–demerdash, F.M., *et al*., 2005; Biswas, K., *et al*., 2002; Chattopadhyay, R.R., *et al*., 1993).

Fish oil and omega-3 fatty acids have been studied in a wide variety of other conditions, such as clinical depression, anxiety,cancer, and macular degeneration, yet benefits in these conditions have not been verified (Chattopadhyay, R.R.,*et al*., 1993; Srivastava, V., *et al*., 1993).

Omega-3 fatty acid plays an important role in prevention or treatment of cardiovascular disease, hypertension, arthrosclerosis, cancer neurological disorders and inflammatory disease. More omega-3 fatty acids intake decreases serum cholesterol which beneficially affects blood pressure, skin diseases, thrombosis atherosclerosis and diabetes, arterial compliance and hyperlipidemia response (Chattopadhyay, R.R., *et al*., 1993; "Essential Fatty Acids". 2017).

This study aimed to compare the efficiency of Fishoil to decrease the levels of total cholesterol and proteins in Wister rats.

MATERIALS AND METHODS

Materials:

Animals:

Healthy young adult male Wister rats weighing (225-252 g) were obtained from The Animal physiology Lab of Faculty of Science Hail University.

The rats were housed in well-aerated individual cages and maintained in a temperature-controlled room (24 ± 1 °C) with a 12 h light/12 h dark cycle, 55±10 % humidity. They were fed with normal commercial chow and water ad libitum. Throughout the experiments, animals were processed according to the suggested international ethical guidelines for the care of laboratory animals.

Methods:

Experimental design:

A total of 60 rats were used in the experiment.The rats were divided into 2 groups of 30 animals each as follows:

Group 1: Normal control (normal rats) received normal commercial chow and water ad libitum.

Group 2: fish oil Group received dietwere enriched with 5g/100g
dietof fish oil.

Blood collection and determination of physiological parameters:

At the end of experimental period, blood samples were collected from retro-orbital eye plexus (El–demerdash, F.M., *et al*., 2005).

Each sample was collected into both heparinized tubes to obtain the plasma and into a dry clean centrifuge glass tube without any coagulation to prepare serum.

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Blood was left for15 min at room temperature, then the tubes were centrifugation for 15 min at 3000 rpm and the clean supernatant serum was kept frozen at -20 ºC until the time of analysis for differentbiochemical analyses, prior immediate determination of triglycerides, cholesterol, high density lipoprotein HDL-cholesterol (HDL-C), low density lipoprotein LDL-cholesterol (LDL-C).

All of these parameters were measured using an automatic analyzer (Architect c8000 Clinical Chemistry System, USA).

Statistical analysis:

Statistical analyses were performed using SPSS package for Windows version 13.0. Data are expressed as mean ± SE. One-way ANOVA and two-way ANOVA were used to analyze differences among groups. Post-hoc analyses of significance were made using least-significant difference (LSD) test. Differences between groups were considered statistically significant at $p<0.05$.

RESULTS AND DISSECTION

Blood glucose:

Table 1 has showed themean values of blood glucose of both control and fish oil group.

No significant differences were observed in blood glucose level of normal rats fed on diets containing the oil of fish when compared with those rats fed on the control diet after 7 weeks of treatment.

Blood triglyceride, cholesterol, LDL-C and HDL-C:

The changes in the levels of serum lipids in control and experimental groups are illustrated in Table 1.

The rats were treated withfish oil resulted in a significant ($p<0.01$) decrease in the levels of triglycerides, cholesterol and LDL- cholesterol compared to untreated rats. While HDL- cholesterol level was significantly ($p<0.01$) increased.

The rats exposed to the diets containing the fish oil for 7 weeks had higher blood HDL- cholesterol than those of the control group ($p<0.05$).

Table 1: Effects of fish oil supplementation on blood glucose ,triglyceride, cholesterol, LDL-C and HDL-C after 7 weeks of treatment.

Treatments	Glucose (mg/dl)	Triglyceride(mg/dl)	Cholesterol (mg/dl)	HDL-C (mg/dl)	LDL-C (mg/dl)
Normal control	98.18±2.1	63.10±2.5	64.50±3.1	41.14±0.2	33.50±1.3
Fish oil	96.11±2.2***	60.90±2.1***	61.22±1.2***	43.60±0.2***	30.25±0.5***

The number of animals was 10 for each group
All values are expressed as means ± SE.
Significantly different from untreated STZ-induced diabetic rats (* $p < 0.05$, ** $p < 0.01$ and *** $p < 0.001$).
Significantly different from normal control (# $p < 0.05$, ## $p < 0.01$ and ## # $p < 0.001$).

Discussion:

In the present study, No significant differences were observed in blood glucose level of normal rats fed on diets containing the oil of fish when compared with those rats fed on the control diet after 7 weeks of treatment. Several studies demonstrated that a variety of herbal extracts effectively lowered the glucose level in STZ- induced diabetes mellitus rats (Hussein, H.K. and O.A. Abu-Zinadah, 2010; MacLean, C.H., *et al*., 2006; Chattopadhyay, R.R., *et al*., 1993; Massing, M.W., *et al*., 2001; Rajasekaran, S.K., *et al*., 2006; Pathak, R.M., *et al*, 1981).

Furthermore, several studies reported thatAzadirachtaindica alcoholic Leaf Extract significantly lowered the blood sugar level in glucose-fed and adrenaline induced hyperglycemic rats. (Chattopadhyay, R.R., *et al*., 1993; Rajasekaran, S., *et al*., 2005; Ravi, K., *et al*., 2004; Sekar, D.S., *et al*., 2005).

The effect of diabetes mellitus on lipid metabolismis well established.The association of hyperglycaemia with an alteration of lipid parameters presents a major risk for cardiovascular complications in diabetes.

Many secondary plantmetabolites have been reported to possess lipid-lowering properties (Sharma, S.B., *et al*., 2003; Srivastava, V., *et al*., 1993; Yehuda, *et al*., 2005).

The serumcholesterol and triglycerides were significantly decreased in diabetic rats supplemented with of fish oil. The oilsupplementation also result the significant attenuation inthe levels of HDL-cholesterol and LDL-cholesterol in serum toward the control level which again strengthen the hypolipidaemic influence of these oils. A variety of derangements in metabolic and regulatory mechanisms, due to insulin deficiency, is responsible for the observed accumulation of lipids (Pathak, R.M., *et al*., 1981; Sukla, R., *et al*., 1973; Xin, *et al*., 2012).

Theimpairment of insulin secretion results in enhancedmetabolism of lipids from the adipose tissue to theplasma. Further, it has been reported that diabetic rats treated with insulin show normalized lipid levels (Yoshida, M., *et al*., 2005).

We suggest that the presenteffects of theseoils-treated diabetic rats may be due to its role in normalization of insulin secretion, lowering activity oflipid biosynthesis enzymes, especially cholesterol and orlowering level of lipolysis.

Moreover, many minor components of foods, such as secondary plant metabolites, have been shown to alterbiological processes which may reduce the risk of chronic diseases in humans. Azadirachtaindica popularly known asfish is an indigenous plant widely available in Indiaand Burma. Different parts of this plant have been reported to have antiseptic, wound healing and skin disease curing activity (Zimmer, Carl., 2015; Van Dam, R.M., *et al*., 2002).

Several studies demonstrated that water soluble portion of alcoholic extract of leaves of Azadirachtaindicapossesses significant antiinflammatory, antiserotonin,antifertility and hepatoprotective activity (Ravi, K., *et al*., 2004; Sekar, D.S., *et al*., 2005; Sharma, S.B., *et al*., 2003; Srivastava, V., *et al*., 1993; Yehuda, *et al*., 2005; Sukla, R., *et al*., 1973; Xin, *et al*., 2012; Yoshida, M., *et al*., 2005; Zimmer, Carl., 2015; Van Dam, R.M., *et al*., 2002).

Significant hypolipidemic activity in rats fed on atherogenic diet and antihyperglycemic as well as hypotensive activity have also been repoted (Sukla, R., *et al*., 1973; Zimmer, Carl., 2015).

Significant blood sugar lowering effect of A. indica in alloxan and streptozotocin induceddiabetic rats have also been reported by several workers (El–demerdash, F.M., *et al*., 2005; Biswas, K., *et al*., 2002; Chattopadhyay, R.R., *et al*., 1993; Chattopadhyay, R.R., *et al*., 1993; Srivastava, V., *et al*., 1993; "Essential Fatty Acids". 2017; Hussein, H.K. and O.A. Abu-Zinadah, 2010; MacLean, C.H., *et al*., 2006; Chattopadhyay, R.R., *et al*., 1993; Massing, M.W., *et al*., 2001; Rajasekaran, S.K., *et al*., 2006; Pathak, R.M., *et al*., 1981; Rajasekaran, S., *et al*., 2005). It is well documented thatcardiovascular disease induced by hyperglycemia is associated with alterations in serum lipidprofiles (Hussein, H.K. and O.A. Abu-Zinadah, 2010; Massing, M.W., *et al*., 2001).

In conclusion, the present data suggest that using fish improve blood parameters. The responses in blood parameters in these animals are also demonstrated that oils supplementation may act as antioxidant agents and these oils could be an excellent adjuvant support in the therapy of diabetic mellitus and its complications.

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