Effect of Fish Oil on High Lipid Fed Albino Rats

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ABSTRACT

The experiment was carried out to investigate the effect of fish oil (Omega-3-fatty acid) on lipid profile of Albino rats. The rats were randomly separated into four group A, B, C and D comprises of males and females in the same group, the cholesterol was introduced by feeding the rats with margarine (butter) for eighteen days and 0.2ml of fish oil was used for the treatment for eleven days in the groups as follows, Group A fed with butter and treated with fish oil, Group B fed with butter and not treated with fish oil (control), Group C fed with normal diet and not treated with fish oil (control), Group D fed with normal diet but treated with fish oil. After the treatment the effect of fish oil on Total Cholesterol, Triglyceride, High Density Lipoprotein (HDL), Low Density Lipoprotein (LDL) and bilirubin concentrations were analyzed. The toxic effect of the fish oil was also determined using biochemical enzymes markers. Treatment with fish oil shows significant ($P<0.05$) decrease on cholesterol, Low Density Lipoprotein (LDL) and Triglyceride levels while there was significant ($P<0.05$) increase in High Density Lipoprotein (HDL). The fish oil shows no toxic effect by lowering significant ($P<0.05$) the levels of ALP, AST and ALT. There was also significant ($p < 0.05$) decrease in the level of bilirubin.

***Keywords**: Fish oil, Margarine, Hypolipidaemic, Cholesterol*

INTRODUCTION

Nutritionists call fish oil(omega-3 fatty acids) "essential" fats for good reason because the human body needs them for many functions, from building healthy cells to maintaining brain and nerve function. They are not produce by the body the only source is food. These polyunsaturated fats are also important as there is growing evidence that they help in lowering the risk of heart disease. Some studies suggest these fats may also protect against type 2 diabetes, Alzheimer's disease, and age-related brain decline [1].Omega-3s come primarily from fatty fish such as salmon, mackerel, and tuna, as well as from walnuts and flaxseed in lesser amounts. Scientists are still debating the optimal amount of fat in a healthy diet, as well as the best proportion of omega-6s and omega-3s. For now, there are several simple changes most of us could make to take advantage of their substantial health benefits [2]. Omega-3 fatty acids correct imbalances in modern diets that lead to health problems. Eating foods rich in omega-3 fatty acids can help lower the risk of chronic diseases such as heart disease, stroke, and cancer, as well as lower Low Density Lipoprotein or "bad" cholesterol. A diet high in Alpha Linolenic acid(ALA) helps reduce heart disease and stroke by reducing cholesterol and triglyceride levels, enhancing the elasticity of blood vessels, and preventing the build-up of harmful fat deposits in the arteries. In fact, the National Institutes of Health (NIH)has reported the majority of U.S. diets no longer contain the amount of omega-3 fatty acids needed by our bodies for overall health and wellness[3].

Diets high in Eicosapentaenoic acid (EPA) and Docosahexaenoic acid (DHA) help with brain and eye development, prevents cardiovascular disease, and can help to prevent Alzheimer's disease. For example, diets notably high in Docosahexaenoic acid (DHA) have been known to protect against degenerative processes within the retina of the eye to increasing the problem solving skills in nine month old infants. A 10-year study correlated increased intakes of Docosahexaenoic acid or Eicosapentaenoic acid as consumed by various population sectors with relative risk of heart related deaths. Those who increased consumption of Docosahexaenoic acid or Eicosapentaenoic acid up to 664 mg/day were associated with an approximate 40% reduction in cardiovascular disease and a significant reduction in all-cause mortality and all infant formula is now supplemented with Docosahexaenoic acid[4].

MATERIALS AND METHODS

Animals Used

Twenty adult male albino rats weighing approximately 110g – 250g were obtained from animal house unit of university of Jos. The rats acclimatized to the laboratory conditions for four weeks before any experimental work was undertaken; they were fed with standard feed.

Experimental Design

Twenty adult male rats were randomly divided into two groups of ten rats each; one group wasted with margarine (butter) in their diet (group 1) while the other group was fed with normal diet (group 2) for the period of eighteen days. Group 1

& 2 were further divided into two i.e. A & B and C & D respectively. Each made up of five (5) rats.

- Group A fed with margarine and treated with fish oil.
- Group B fed with margarine and not treated with fish oil (control).
- Group C fed with normal diet and not treated with fish oil (control).
- Group D fed with normal diet and treated with fish oil.

Treatment of Rats
They were treated with0.2ml of fish oil given orally using syringe of 1ml for the period of eleven (11) days, after which the blood samples was collected.

Collection of Blood Sample
At the end of the treatment, the blood sample were collected from the jugular vein using EDTA bottles to prevent clothing and hemolysis the samples were taken to lab and centrifuge for ten (10) minutes at a speed of 300rpm and the serum was collected and used for the analysis.

Determination of Serum Total Cholesterol
Total cholesterol was determined by the method of [5].

Determination of Serum Triglycerides
The serum triglyceride level was determined by the method of [5].

Determination of High Density Lipoprotein
The serum HDL was determined enzymatically according to [6].

Determination of Low Density Lipoprotein
LDL concentration was calculated from the total cholesterol concentration HDL, and triglyceride concentration using [7].

Statistical Analysis
The statistical analysis of the result was carried out by one way analysis of variance (ANOVA) to obtain significant difference of the result at 0.05 level of confidence ($p<0.05$).

RESULTS

Table I: Effect of Fish Oil on Lipid Profile in Albino Rats Fed with High Lipid Diet.

Group	Total Cholesterol (mmol/l)	HDL (mmol/l)	Triglyceride (mmol/l)	LDL (mmol/l)
Group $A_{\text{cholesterol treated}}$	1.85 ± 0.05	1.25± 0.05	1.00 ± 0.10	0.15 ± 0.05
Group $B_{\text{cholesterol control}}$	2.10 ± 0.10	1.25± 0.05	1.05 ± 0.05	0.35 ± 0.15
Group $C_{\text{normal control}}$	1.80 ± 0.10	1.00 ± 0.10	0.90 ± 0.10	0.40 ± 0.10
Group $D_{\text{normal treated}}$	1.75 ± 0.05	1.15 ± 0.15	1.05 ± 0.05	0.10 ± 0.10

Value are expressed as ± S.D, for four determination n = 4

Table II: Effect of Fish Oil on Enzymes in Albino Rats Fed with High Lipid Diet.

Group	AST (U/L)	ALT/(U/L)	ALP (U/L)
Group $A_{\text{cholesterol treated}}$	65.43 ± 1.304	27.36 ± 0.045	141.26± 6.353
Group $B_{\text{cholesterol control}}$	140.2 ± 1.278	62.11 ± 2.28	393.13 ± 4.21
Group $C_{\text{normal control}}$	54.30 ± 0.315	25.21 ± 0.496	96.10 ± 0.194
Group $D_{\text{normal treated}}$	52.14 ± 1.254	24.73 ± 0.547	93.42 ± 4.354

Value are expressed as ± S.D, for four determination n = 4

Table III: Effect of Fish Oil on Bilirubin in Albino Rats Fed with High Lipid Diet.

Group	Total Bilirubin (mg/100ml)	Direct Billirubin (mg/100ml)
Group $A_{\text{cholesterol treated}}$	0.95 ± 0.01	0.36 ± 0.05
Group $B_{\text{cholesterol control}}$	2.16 ± 0.0225	0.69 ± 0.023
Group $C_{\text{normal control}}$	0.88 ± 0.008	0.25 ± 0.004
Group $D_{\text{norma ltreated}}$	0.87 ± 0.346	0.21 ± 0.048

Value are expressed as ± S.D, for four determination n = 4

DISCUSSION

The result from Table I showed the effect of fish oil on total cholesterol, low density lipoprotein, triglycerides and high density lipoprotein. There was a significant ($P<0.05$) decrease on the levels of total cholesterol, Low density lipoprotein and triglycerides while there was a significant ($P<0.05$) increase on high density lipoprotein. From Table II omega-3- fatty acid reduces serum liver enzymes (ALP, AST and ALT) significantly (P<0.05). Omega-3 fatty acid helps to maintain cholesterol level within normal range. The introduction of cholesterol in the diet increases the enzymes activities for more than 100% and the treatment fish oil drastically reduces the enzymes activities, alsoin Table III the introduction of cholesterol also increases bilirubin level significantly (P<0.05), but after treatment with fish oil there was significant (P<0.05) decrease.Omega-3 fatty acids from fish oil can help lower triglycerides and Apo proteins (marker of diabetes), and raise level of High Density Lipoprotein, people with diabetes may benefit from eating food or taking supplements that contain Docosahexaenoic acid and Eicosapentaenoic acid. Alpha LinolenicAcid (from flaxseed for example) may not have the same benefit as Docosahexaenoic acid and Eicosapentaenoic acid because some people with diabetes lack the ability to efficiently convert Alpha Linolenic Acid to a form of omega-3 fatty acids that the body can use readily [8].Long chain Omega 3 fatty acids have been proven to decrease the low density lipoprotein (LDL), serum triglycerides, platelet agreeability, blood viscosity, hypertension, glycolipid synthesis, and reduce the fatty droplet deposit to the liver[9].

These fatty acids have also been shown to improve the insulin resistance, liver function, and enhance red cell deformability. In addition, they alter the cellular membrane phospholipids Omega 3 fatty acid concentration, which increases the cellular metabolic rate as well as cellular functions. Therefore, directly and indirectly Omega 3 long chain polyunsaturated fatty acids (Seal Oil) improves the general condition of the liver and can effectively treat or even prevent the occurrence of fatty liver. Fatty liver is a malfunction of the liver which results in disturbance of metabolism of fat, protein and carbohydrates thereby overeating and overindulgence of alcohol should be eliminated[3].Omega-3 fatty acid is useful to the liver; its predisposition to oxidative stress counters the cholesterol observed in liver toxicity presumably by amplifying the capacity of free radical[10].

CONCLUSION

In conclusion, the ability of fish oil (Omega-3 fatty acid) to significantly decrease the raised in concentration of total cholesterol, low density lipoprotein, triglycerides, bilirubin in high lipid fed rats proves that the fish oil (omega-3 fatty acid) has hypocholesteronaemic, hypolipidaemic effect. It also possesses no serious toxic effect as shown by the lowered AST, ALT and ALP levels.

REFERENCES

Toth Peter P. (2009): High Density Lipoprotein Cardiovascular Risk Circulation 109: 18 09-1812

Kris-Etherton, P.M., Harris, W.S., Appel, L.J. (2002). AHA scientific statement: fish consumption, fish oil, omega-3 fatty acid and cardiovascular diseases. 106: 2747-2757.

Martin, J.M., Stapleton, R.D. (1996). Omega-3 Fatty acid in Critical Illness on US National Library of Medicine National Institute of Health Sept. 68(9): 531-541

Okuyama, H., Ichikawa, Y., Sun, Y., Hamazaki, T. L., William E.M. (2007). World Review of Nutritional Dietetics 96 (Prevention of Coronary Heart Disease): 83-103

Allain, C.C., Poon, L.S., Chan, C.S., Richmond, W. P. (1974). Enzymatic determination of total serum cholesterol. Clin. Chem. 20: 470- 475.

Finley, P.R., Schifman, R.B., Williams, R.J., Lichhti, D.A. (1978). Cholesterolin high- density lipoprotein: use of Mg 2+/dextran sulphate in its enzymatic measurement. Clin. Chem. 24: 931-933.

Friedewald, W.T., Levy, R.I., Fredrickson, D.S. (1972). Estimation of the concentration of low-density lipoprotein cholesterol in plasma, without use of the preparative ultracentrifuge. Clin. Chem. 18: 499-502.

Mcpherson, R. and Spiller, G.A. (1996): Effect of Dietary Fatty Acids and Cholesterol on Cardiovascular Disease Risk Factors in Man. In: Handbook of Lipids in Human Nutrition. Spiller G.A ed CRC Press P. 41.

Alder, A.J. and Holib, B.J. (1997). Effect of Garlic and Fish oil Supplementation American Journal of Clinical Nutrition; 65 (2): 445 -450.

Beynen, A.C and D. Krichevsky, (1986): Dietary Fats and Serum Cholesterol In

Nutritional Effects on Cholesterol Metabolism (Beynen A. C. Ed). Translational Voorthuizen, pp: 1-10.

Reference to this paper should be made as follows: Luka, C.D and Mohammed, A. (2013), Effect of Fish Oil on High Lipid Fed Albino Rats, *J. of Medical and Applied Biosciences, Vol.5, No.1, Pp. 1-7.*

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