The Effect of Fish Oil and Omega-3 Fatty Acid on Some Physiological and Biochemical Criteria in Male Rabbits

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Abstract

Fish oil and omega-3 have many benefits and effects on human and animals health, such heart diseases, lipids, liver and many other diseases, so the aim of the this study was to investigate the effect of fish oil and omega-3 on complete blood picture test (CBC), Lipid profile, some liver enzymes and kidney parameters in male rabbits. Twelve adult male rabbits were used in this study that divided into two groups: (Six rabbits for each group) and treated daily for 4 weeks.
Group 1: 0.2 ml/Kg B.W fish oil dose orally.
Group 2: 0.2 ml/Kg B.W omega-3 dose orally.

Blood samples were collected and divided from both two groups at the end of the experiment and then parameters were measured. Results explained that fish oil and omega-3 had the same effect in male rabbits. The level of complete blood picture (CBC) showed a significant decrease ($p<0.05$), but did not go beyond the normal reference value. The study explained that there were significant reduction in total cholesterol, serum triacylglycerol (TAG), serum low density lipoprotein (LDL) and very low density lipoprotein (VLDL) while the high density lipoprotein (HDL) was elevated significantly as compared with control. Significant increase in serum level of glutamic oxalic transaminase (GOT) and glutamic pyruvic transferees (GPT) in fish oil and omega-3 treated animals as compared with the control. While the effect of fish oil and omega-3 on kidney parameters (Uric acid, Creatinine) showed non-significant changes or a slight increase significant in kidney parameters as compared with the control. [DOI: 10.22401/JNUS.20.1.15]

Keywords: Fish oil, Omega-3, Liver enzymes, Kidney parameters, Lipid profile.

Introduction

Fish oils are unique fats because they are rich sources of n-3 fatty acids (FAS) and they are polyunsaturated fat that contain many compounds that including omega-3 fatty acids [1]. These compounds are not only in fish but also in many organisms like plants, the major omega-3 in fish oil that are eciosapentaenoic acid (EPA, (20:5)) and decosahexaenoic acid (DHA(22:6))[2].

Fish oil and omega-3 have many important benefits like they entered in a good feeding and treated for many diseases as they decrease rheumatoid arthritis [3].They have benefits in preventing cardiovascular disease, and the protection of heart from risk as Heart attack and sudden cardiac death[2]. Besides, omega-3 has important as anti-thrombotic, anti-inflammatory effects and it reduces in platelets and endothelial cells[4].

Recent modern studies showed that omega-3 could down regulate the activity of the nuclear factor (NF-kß) [5] that plays a key role in the regulation of gene expression in inflammatory responses and has been implicated in the pathogenesis of CVD[6]. In addition, the importance of omega-3 , fish oil also contains omega-6 that plays role in a healthy body provided that the ratio between these compounds are balanced, it means a higheromega-6 and a lower omega-3 intake there was a balance between them. Their balance is an important determination for brain and in decreasing the risk for coronary heart disease (CHD), Hypertension, cancer and Diabetes [7]. Both EPA and DHA complete with arachidonic acid (omega-6) in cyclooxygenase and lipoxygenesis synthesis, resulting in net anti-inflammatory effects. Both reduce blood viscosity without a significant positive effects on blood lipids, most consistently a reduction in triglyceride concentration[8]. Both fish oil and omega-3 have hypolipidemic effect [9].

The purpose of the this study is to investigate the effect of fish oil and omega-3 on the complete blood picture(CBC), lipid

profile, some liver enzymes and kidney function parameters in male rabbits.

Subjects and Methods

1- Experimental animals

Twenty healthy adult male rabbits (1200-1800g) were kept in the animal house of Department of Biology at the College of Science for Women, University of Baghdad provided with food and water. Twelve adult male rabbits were randomly divided into two groups kept for 2 weeks for adaptation, (12 rabbits/group) and handled as follows for 30 days: *Before they divided, animals in this group before starting the experiment blood was collected part was used for hematological study with EDTA anticoagulants and part for biochemical study and considered as control group (Before treated).Treated group was divided into groups (n=6) as follows:

A- Group 1: 6 Rabbits were administered with 0.2 ml fish oil orally by gavages needle.

B- Group 2: 6 Rabbits were administered with 0.2 ml omega-3 orally by gavages needle.

2- Preparation of fish oil and omega-3

Fish oil was prepared from *Valamugil seheli* known as mullet fish, where fish cleaned and removed the scales then it was put in oven at less than 60c° to get oils. Oils was collected in test tubes, while omega-3 plus was purchased from local pharmacy of Vitex Pharmaceuticals in Australia(1000mg natural fish oil).

Blood sampling

Blood samples were collected from fasting animals at Zero time (Before supplementation) and at the end of experiment (after 30 days), Blood was drawn by heart puncture technique from rabbit. Each blood sample was divided into two parts:

1- Aliquot of 0.2 ml of blood was kept in heparin tube for complete blood picture (CBC). It is measured in Mindray BC-2800(Korea, Japan, China).

2- Another part of blood was kept in gel and clot activator tube not more than 4 hours, followed by centrifugation for 15 minutes at 4000rpm. Serum was isolated and kept in eppendorf tubes frozen at -20C° until analysis to study some biochemical and parameters like:

A- Lipid profile measured by enzymatic method with commercially available kit (HUMAN Germany) [10], [11],[12],[13], [14] sequentially:

1- Total cholesterol (TC) concentration (mg/dl).

2- Triacylglycerol (TG) concentration (mg/dl).

3- High density lipoprotein-cholesterol (HDH-C) concentration (mg/dl).

4- Low density lipoprotein-cholesterol (HDH-C) concentration (mg/dl).

5- Very low density lipoprotein-cholesterol (HDH-C) concentration (mg/dl).

B- 1-Liver enzymes :A- Aspartic or Glutamic oxaloacetic Transaminase AST or GOT activity (IU/l), B- Glutamic pyruvic Transaminase GPT activity (IU/l) [15]. C- Alkaline Phosphatase ALP activity (IU/l))[16].

2-Kidney parameters:

A- Uric acid concentration (mg/dl)(16).

B- Creatinine concentration (mg/dl)[17].

Statistical Analysis

The Statistical Analysis System- SAS (2012)[18] program was used to find out the effect of difference factors on studyed parameters. Least significant difference–was used to compare between means.

Results and Discussion

Tables (1) and (2) showed that male rabbits intubated omega-3 and fish oil, exhibited significant decrease in RBCs, Hb, HCT%, WBCs and Plt as compared with control (Before treatment). These results agree with Abbas (2013)[19], Harris (2003) [20] and Daak, etal (2013)[21]. The decrease in RBC, Hb, HCT may due to a decrease in erythropioesis and thus haemolysis [22]. While the decrease in Plt due to antithrombo effect of omega3 and fish oil that is rich with omega3 that have a vasodilatation effect on blood flow [23]. Fish oil increased WBCs, which may due to fish oil that enhanced the function of B cells [24].

Table (1)
The effect of Omega3 on blood picture in male rabbits.

Parameters	Mean ± SE	
	Control (Before treatment)	Omega treatment (After treatment(30 days))
R.B.C x 10^{12}	6.49 ± 0.11	5.17 ± 0.04*
Hb (g/dl)	13.83 ± 0.13	11.00 ± 0.15*
HCT (%)	42.58 ± 0.54	34.61 ± 0.52*
W.B.C x 10^{9}	7.16 ± 0.18	9.15 ± 0.43*
PLT x 10^{9}	257.33 ± 5.57	165.13 ± 3.75*
* (P<0.05) Significant.		

Values expressed as mean ±SE n=6.

Table (2)
The effect of fish oil on blood picture in male rabbits.

Parameters	Mean ± SE	
	Control (Before treatment)	Fish oil treatment (After treatment (30 days))
R.B.C x 10^{12}	6.30 ± 0.12	5.22 ± 0.16*
Hb (g/dl)	13.63 ± 0.32	10.83 ± 0.20*
HCT (%)	41.25 ± 0.76	34.76 ± 0.71*
W.B.C x 10^{9}	9.05 ± 0.48	8.67 ± 0.08NS
PLT x 10^{9}	318.75 ± 30.62	251.42 ± 16.63NS
* (P<0.05), NS: Non-significant.		

Values expressed as mean ±SE n=6.

Tables (3) and (4) showed that animals treated that omega-3 and fish oil, exhibited a significant decrease in TAG, TC, LDL-C, VLDL-C. The hypolipidimic effect of omega3 and fish oil may due to suppression of hepatic lipogensis [25] and also omega3 have an important role by regulating genes that are controlling lipid homeostasis resulting in lower triacylglycerol concentration [26]. These results agreed with Simopoulos (1991) [27] and Abbas (2013)[19] found that omega-3 reduced plasma cholesterol and TAG concentration by inhibiting biosynthesis of very low-density lipoproteins (VLDL) and triglycerides in the liver. Also, they reported decrease in cholesterol and LDL level, a marked a decrease in TG and no change in HDL level or increases [9]. As well as, [28] found that omega-3 fatty acids decreased in serum triacylglycerol, LDL and VLDL of all treated diabetic rats with omega-3 for 8 weeks suffered from increasing lipid profile level in diabetic rats without omega 3 treatment.

Table (3)
The effect of Omega 3 on Lipid profile in male rabbits.

Parameters	Mean ± SE	
	Control (Before treatment)	Omega treatment (After treatment (30 days))
Cholesterol Total(mg/dl)	89.83 ± 0.40	78.83 ± 0.74*
Triglyceride (TAG) (mg/dl)	58.83 ± 2.77	45.16±1.70*
HDL(mg/dl)	39.30 ± 0.52	39.65 ± 0.82*
LDL(mg/dl)	44.52 ± 0.20	30.42 ± 1.83*
VLDL(mg/dl)	11.76 ± 0.55	9.02±0.31*
* (P<0.05) Significant.		

Values expressed as mean ±SE n=6.

Table (4)
The effect of fish oil on Lipid profile in male rabbits.

Parameters	Mean ± SE	
	Control (Before treatment)	Fish oil treatment (After treatment (30 days))
Cholesterol(mg/dl) Total	101.58 ± 2.11	83.00 ± 3.00*
Triglyceride(TAG) (mg/dl)	64.16 ± 3.21	45.50±1.25*
HDL(mg/dl)	36.11 ± 0.67	39.45 ± 0.51*
LDL(mg/dl)	51.80 ± 1.65	38.13 ± 3.91*
VLDL(mg/dl)	12.83±0.64	9.10±0.25*
* (P<0.05) Significant.		

Values expressed as mean ±SE n=6.

The results of the present study explained that the effect of omega3 and fish oil on liver enzyme (GOT, GPT, ALP) and kidney parameters (Uric acid, Creatinine) as shown in Tables (5) and (6) increased GOT, GPT with in Uric acid concentration in omega3 treated male rabbits as compared with control, while in fish oil intubated male rabbits there was significant increase in GOT, GPT and creatinin. Some results agree with Mohammed, etal [29] and Assad, etal [30].

Table (5)
The effect of Omega3 on Liver enzymes and Kidney parameters in male rabbits.

Para. / Group	GOT (U/ml)	GPT(U/ml)	ALP (U/ml)	Creatinine (mg/dl)	Uric acid (mg/dl)
Control (Before treatment)	23.67 ± 1.05	42.00 ± 1.59	121.00 ± 2.36	0.423 ± 0.01	47.66 ± 0.67
Treated (After treatment (30 days))	28.67 ± 1.78*	49.33 ± 2.60*	117.00± 4.27NS	0.478 ± 0.03NS	36.67 ± 2.23*
* (P<0.05), NS: Non-significant.					

Values expressed as mean ±SE n=6.

Table (6)
The effect of Omega3 on Liver enzymes and Kidney parameters in male rabbits.

Para. / Group	GOT (U/ml)	GPT(U/ml)	ALP (U/ml)	Creatinine (mg/dl)	Uric acid (mg/dl)
Control (Before treatment)	20.16 ± 0.47	41.17 ± 1.49	115.67 ± 2.57	0.470 ± 0.02	42.67 ± 1.33
Treated (After treatment (30 days))	25.83 ± 1.49*	49.83 ± 1.17*	120.67 ± 2.20NS	0.606 ± 0.03*	39.00 ± 2.08NS
* (P<0.05), NS: Non-significant.					

Values expressed as mean ±SE n=6.

Conclusion

The conclusion of this study explained that the omega-3 and fish oil have a hypolipidimic effects, an immunenhancer by increasing the number of white blood cells, significant decrease in platelet count and significant decrease in uric acid in omega3 treated rabbits as compared with control.

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