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Favorable impact of sea fish gel supplementation on serum adiponectin levels and some metabolic risk factors in Patients with Diabetes Mellitus

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Abstract:
Type 2 diabetes mellitus is responsible for significant burden (health and financial) to individuals and health care system. Omega 3 fatty acid consists anti lipidemic and anti inflammatory properties which is helpful for management of T2DM and its complications. To observe the effects of omega-3 fatty acid on serum adiponectin level and C-reactive protein level in type-2 diabetic patient. The prospective interventional study was carried on with middle aged diabetic patient on the year 2017.Amid them, one group(27) were given fish oil capsule orally (omega 3 fatty acid 2g/day) for consecutive 12 weeks and another group consists 25 subjects (with placebo supplementation) were nominated as control. Serum adiponectin by ELISA method and CRP were estimated by EIA method at laboratory. For statistical analysis, Paired Student's 't' test and Unpaired Student's 't' test were administrated. In this study serum adiponectin level significantly rises and post prandial blood sugar decreases after 12 weeks of study period in study group with fish oil capsule supplementation, with comparison to control group. It can be concluded that omega-3 fatty acid supplementation was effective to rise adiponectin levels and decreases post prandial blood sugar levels in T2DM.

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Introduction

Type 2 diabetes mellitus is manifestation of inflammation, due to dysfunction of pancreatic beta cell insulin cannot produced and insulin resistance occurs. Adiponectin is a serum protein produced from adipose tissue which is involved in maintaining homeostatic control in circulating blood glucose and lipid level. In T2DM circulating serum adiponectin level decreases(Suxena and Modi,2014).Insulin is the potent anabolic hormone which prompts glucose uptake by stimulating translocation of GLUT-4 to plasma membrane(Pessin and Saltiel,2000). Insulin resistance occurs when the insulin sensitive tissue loses response to insulin. The basic effect of insulin resistance on glucose metabolism is to prevent the uptake and utilization of glucose by most cells of the body. As a result blood glucose concentration increases, cell utilization of glucose falls, utilization of fat increases and free fatty acid level increases in blood(Delarue and Magnun,2014) .

Consumption of fish oil can decreases free fatty acid level, improve insulin sensitivity as well as reduce the incidence of type 2 DM (Albert et al,2014) . Omega-3 fatty acid act directly on insulin sensitive tissues, increases number of insulin receptors thus reducing insulin resistance(Laila and Lanza,2016).Intake of diet rich in polyunsaturated fatty acid, particularly n-3 and n-6, promts the action of insulin through various metabolic pathways, which are suppression of hepatic lipogenesis, reduction of the release of triglycerols from liver, improvement in ketogenesis, and oxidation of fatty acids in liver(Flachs et al,2013)

Omega- 3 fatty acid prevents this change by increasing peroxisome proliferator receptor gamma, increasing hepatic uptake and oxidation of free fatty acid in skeletal muscle .it has been hypothesized that sustained concentration of high post prandial blood sugar eventually leading to develop diabetes(Thota et al, 2018) Serum C-reactive protein level is increases in patient with type-2 diabetes mellitus (Ford ES 1999) Supplementation of omega 3 fatty acid may increases serum adiponectin level(Song et al, 2017) Fish oil supplements lowers c-reactive protein level (Bowden et al 2009).

Methods

This prospective, interventional study was administrated at Department of Physiology, Dhaka Medical College, Dhaka from January 2017 to December 2017.The study has updated on 2019. Total 60 patients were nominated from Endocrinology outdoor, Dhaka medical college and personal contact from Dhaka city. At the onset of study 60 diagnosed type-2 diabetic patients were recruited randomly on the basis of inclusion and exclusion criteria. There were 30 patients of control group and 30 patients of study groups recruited for completion of study, After 6 weeks of study period, 3 patients were dropped out from study group and 5 patients were dropped out from control group. Ultimately total 52 type diabetic patient of both sexes with the age ranging from 40-50 years with FBG 7.0 mmol/l or 126 mg/dl, HbA1c 6.5%, serum total cholesterol >200 mg/dl, serum triglyceride >150 mg/dl, LDL>130 mg/dl, BMI≤30 Kg/m^2 and patients with oral hypoglycemic drug were included in this study. Subjects having history of heart, liver, endocrine disorder, insulin therapy, pregnant and lactating women were excluded from this study. For this study 27 diagnosed type-2 diabetic patients with omega-3 fatty acid supplementation were recruited as study group and 25 type-2 diabetic patients with placebo supplementation were nominated as control group. The study group again sub-divided into pre-supplementation group and after 12 weeks of supplementation as post supplementation group. The control group was sub-divided as pre and post follow-up group. After recruitement, the sum and substances, motive and gain of the study were explained to each subject and informed written consent was taken from participants. Before taking blood detailed family and medical history were taken. Anthropometric measurement

of the subjects was recorded and blood pressure was measured. All the information were recorded in a prefixed questionnaire. With aseptic precaution, 5 ml of venous blood was collected from ante-cubital vein by a disposable plastic syringe from each subject after overnight fasting for biochemical tests. Serum adiponectin level were measured by ELISA method in Immunology department, BIRDEM hospital Dhaka and C reactive protein level was measured by enzyme linked immune sorbent assey at laboratory medicine department, Dhaka medical college. . Omega-3 fatty acid (2gm) was supplied to study group and placebo were supplied to control group then they were asked to intake twice daily for 12 weeks with proper guidance . Subjects were instructed not to alter their diet and physical activities during the course of the study. A regular telephonic contact and periodic visit was made to subjects . For statistical analysis, Paired Student's't' test and Unpaired Student's 't' test were performed as applicable using SPSS for windows version 16.0.Data were expressed as mean ± SE. The *p* value of < 0.05 was accepted as level of significance.

Results

In this study there are no significant difference were observed in age, sex, systolic and diastolic blood pressure between study and control group (Table 1). Table 1 showing some significant difference at body mass index between study and control group. In table- 2 at the onset of study serum adiponectin and C-rp level were almost same In study group, the mean adiponectin ($p<.0.001$) was found higher and mean c-rp ($p<.0001$) level were found significantly lower in post supplementation group, than pre-supplementation group. Again the mean serum adiponectin ($p<.0001$) levels were found significantly higher and mean serum c-rp ($p<.0001$) levels were found significantly lower and in study group compared to control group. There was no statistical difference were observed in mean serum adiponectin and serum c-reactive protein in between pre-follow-up and post follow-up group.

Discussion

In this ongoing study, the mean serum adiponectin were lower and c-reactive protein levels were higher in patients of T2DM at the beginning of the study. Fish oil supplementation rises serum adiponectin level significantly($p \leq .001$)for 12 weeks acid in comparison to that of their baseline value. Consumption of fish oil capsule also lowrs c-reactive protein significantly in comparison to baseline value (.001) after 12 weeks of intervention. On the other hand significant change was observed in between study and control group where serum adiponectin level rises and c-reactive protein decreases.

Adiponectin is an adipocyte secreted protein that circulates in high concentration in circulating blood and helps to increases insuin sensitivity(Gavrila et al,2003).Higher levels of adiponectin is associated with lower incidene of diabetes(Duncun et al,2004).Serum adiponectin is produces from adipose tissue ,omega-3 fatty acid supplement increases serum adiponectin by stimulating the adipoq (adiponectin gene)in adipose tissue by acting as ligands of PPAR-ɣ (Flachs et al,2006). C-reactive is a marker of systematic inflammation that can be elevated in diabetes mellitus(Ford ES 1999) .Fish oil capsule has favourable effects on c-reactive protein, it can reduce serum c-reactive protein level(Rasic et al.2007). When serum triglyceride level rises, it decreases the binding of insulin with its receptor through releasing some inflammatory mediators from liver, that decreases insulin receptor signaling activity. Fish oil has a role on reducing serum triglyceride level. Peroxisome proliferating receptor –α present in liver increases hepatic uptake of free fatty acid. It also increases free fatty acid oxidation on skeletal muscle. When free fatty acid decreases in blood that decreases serum triglyceride which decreases BMI level(Shidfar et al.2008).In the present study adiponectin

level rises and c-reactive protein decreases in patients with T2DM after supplementation of omega-3 fatty acid in comparison to their baseline value and control group.

Table 1: General characteristics of the patients in both groups (N=52)

Parameters	Study group (n=27)		Control group (n=25)	
Age (years)[a]	45.90 ± 3.80		44.92 ± 3.75	
Sex (%)[b]				
Male	18 (66.7%)		11 (44 %)	
Female	9 (33.3%)		14 (56%)	
BMI (kg/m^2)	At base line 25.03 ± 2.27	After 3 month with fatty acid supplementation 21.03 ±1.04	At base line 25.87 ± 1.75	After 3 months with fatty acid supplementation 24.67± 1.09
Systolic BP (mmHg)	119.07 ± 7.08		121.79 ± 4.47	
Diastolic BP [a] (mmHg)	79.63 ± 6.26		80.00 ± 0.00	
Duration of disease [a] (years)	5.43 ± 1.50		5.35 ± 1.57	

Source:Field study

Table 2. serum adiponectin and C-reactive protein levels in different groups (N=52)

Parameters	Study group (n=27)		Control group (n=25)	
	Pre-supplemenation group	Post supplementation group	Pre-follow-up group	Post follow-up group
Serum adiponectin(ng/ml)	3.7 ± 1.2	5.1±1,4**	4.1 ± 1.2	4.3 ± 1.43##
C-reactive protein(mg/dl)	7.5± 3.8	4.5± 2.6*	6.68 ± 1.68	6.2 ± 1.2##

Results are expressed as mean ± SD. a= Paired student's t test was performed for comparison within groups and b=unpaired t test was performed to compare between groups. *p* value < 0.05 was accepted as level of significance. N= total number of subjects, n = number of subjects in each group, (*= study group baseline vs study group after 12 weeks of supplementation; # = study group after 12 weeks vs control group after 12 weeks); (* *p*<.01, ***p*<.001;# *p*<.01,## *p*<.001).

Conclusions

The result of study can be concluded that consumption of omega-3 fatty acid can improve serum adiponectin and c-ractive protein levels in patients of type-2 diabetes mellitus. Supplementation of fish oil capsule increases serum adiponectin level and decreases c-reactive protein level that might play a beneficial role on diabetic person Therefore, omega-3 fatty acid containing food may be helpful to minimize the complications in type-2 diabetes mellitus.

Conflict of Interest: None

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