

Effect of Hilsha Fish Oil on Hyperlipidemia in Human Subject

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Introduction

Hypercholesterolemia is one of the causal factors of atherosclerotic heart disease. Blood cholesterol level depends on cholesterol metabolism in the body. There are various external factors which influence cholesterol metabolism. Dietary cholesterol and saturated fat increase blood cholesterol level and unsaturated fat decrease it.^{1,2,3,4} Unsaturated fatty acids are the fatty acids those contain one or more double bonds⁵. They have both plant and animal origin. Sources of unsaturated fatty acid of animal origin are mainly fishes. The marine fish contained unsaturated fatty acids (PUFA). This unsaturated fatty acid decreased serum total cholesterol (TC), serum triglyceride (TG) and low density lipoprotein cholesterol (LDL-Chol) whereas it increase high density lipoprotein (HDL-Chol).^{6,7,8,9}

Hilsha fish is a migratory fish. This fish migrate from sea to river for breeding and from river to marine water for feeding. Marine planktons are the major food sources for Hilsha fish. This plankton contain omega⁻³ fatty acid. As the hilsha fish lives on marine plankton's. So this fish also contain omega⁻³ fatty acid. The Hilsha fish fat has been analyzed in the Institute of Food Science and Technology (IFST), Bangladesh Council of Scientific and Industrial Research (BCSIR) Dhaka in 1988 and 1993 and also in Institute of Nutrition and Food Science (INFS), University of Dhaka in 1990. It has been shown that Hilsha fish contain 50-60% unsaturated fat with considerable amount of polyunsaturated fatty acid (PUFA).^{10,11,12} In Bangladesh Hilsha is a popular fish and about one-fourth of total catch of fish is contributed by Hilsha fish

alone (SYB 1992)¹³. Previous findings have shown that Hilsha fish fat could reduce serum cholesterol (TC), serum (TG) and LDL-cholesterol with corresponding increase in serum HDL-cholesterol.^{14,15} Objective of present study is to observe the effect of hilsha fish fat on hyperlipidemic and normolipidemic subjects as well as to compare the effect on both groups.

Materials and Methods

Fourteen human subjects, age between thirty to forty five year old of both sexes were selected from different area of Dhaka City. Out of them seven were normolipidemic, their serum lipid level were within normal range i.e. serum cholesterol <280 mg/dl; serum TG<160mg/dl, LDL-chol. 180mg/dl and HDL-chol>40 mg/dl and for hyperlipidemic subjects the serum lipid level was above the normal. For exclusion of other diseases measuring of blood pressure (BP), blood sugar, renal, liver and thyroid function tests were performed. Hilsha oil was administered to the subjects at a dose of 15gm per day in divided dose as done as done by others¹⁶. Blood Sample was collected just before and at the end of Hilsha fish oil administration. All the subjects were briefed about the objectives of the study and their

consent was taken in the written form.

Extraction of Hilsha fish oil was done by Bleigh and Dayer method and the chemical analysis were performed in the Laboratory of IFST, BCSIR Dhaka, Serum TC, Serum TG, HDL-chol were determined by using Human kits. LDL-chol was determined by using fried wald formula¹⁷. Statistical significant of difference were evaluated by using paired 't' test.

Result

Serum triglyceride decreased from 133.43 to 113.66 in normolipidemic ($P\leq 0.05$) and 211.14 to 165.79 in hyperlipidemic subjects ($P\leq 0.01$). Serum total cholesterol decreased from 264.29 to 159.86 in normolipidemic ($P\leq 0.01$) and 215.71 to 144.71 in hyperlipidemic subjects ($P\leq 0.01$) and serum LDL- chol decreased from 106.60 to 90.80 in normolipidemic ($P\leq 0.05$) but the decrease was more marked in hyperlipidemic subjects i.e. from 145.26 to 94.60($P\leq 0.01$). HDL-chol increased both in normolipidemic from 30.28 to 45.00($P\leq 0.01$) as well as in hyperlipidemic from 35.40 to 43.07($P\leq 0.05$).

Discussion

The initial level of serum lipids in hyperlipidemic subjects were high

Table 1. Mean Serum Lipid Level In Normolipidemic Subjects (Group I) Before and at the Fish oil Administration

Parameters	Before feeding trial (mg/dl)	After feeding trial (mg/dl)
Triglyceride	133.43±07.04	113.66±13.17*
Total cholesterol	164.29±08.11	159.86±09.01**
DHL-cholesterol	30.28±02.32	45.00±05.28*
LDL-cholesterol	106.60±07.07	90.08±06.31*

* P ≤ 0.05 ** P ≤ 0.01

Table 2. Mean Serum Lipid Level in Hyperlipidemic Subjects (Group II) Berore and at The End of Fish Oil Administration

Prameters	Before feeding trial (mg/dl)	After feeding trial (mg/dl)
Triglyecride	211.14±25.52	165.79±13.19**
Total cholesterol	215.71±17.81	144.71±15.83**
HDL-cholesterol	35.40±04.65	43.07±04.71*
LDL-cholesterol	145.26±01.70	94.60±01.84**

* P ≤ 0.05 ** P ≤ 0.01

compared to those found in normolipidemic subjects. After Hilsha fish oil administration the serum triglyceride level decreased both in normolipidemic and in hyperlipidemic subjects. Similar change was found by other workers with experimental animals by Hilsha fish oil¹⁸ and in human being by Marine fish oil^{19,20}. The possible mechanism of decreasing the level of TG in blood are of several ones. Most of the workers were on the opinion that fall in plasma TG was due to decreased hepatic synthesis of VLDL lipoprotein. Other possible mechanism was due to increased

catabolism of VLDL either in the peripheral tissue or by the liver.

Serum total cholesterol decreased in both groups which is similar to that of Marine fish oil. Most of the scientists observed that decreased serum total cholesterol was due to increased biliary and fecal excretion of cholesterol and its catabolites. Serum HDL-cholesterol increased both in normolipidemic and hyperlipidemic subjects which coincide with the findings of some experiment done on animal model. The possible mechanism of increased HDL-cholesterol was due to increased biosynthesis of discoid

HDL-cholesterol. Serum LDL-cholesterol decreased in both groups. The possible cause of decreased LDL-cholesterol was due to decreased LDL-cholesterol synthesis.

Summary

Effect of Hilsha fish oil was determined in human subjects. The subjects were divided into two groups. One group was normolipidemic and other group was hyperlipidemic. Both the groups took Hilsha fish oil with normal diet. Blood lipid level was determined enzymatically both before and at the end of fish oil administration. It was found that serum T. G., T.C. and LDL-Chol decreased in both groups. But it was more marked in hyperlipidemic subject than normolipidemic ones. On the other hand serum HDL-chol level increased both in normolipidemic and in hyperlipidemic subjects. Thus it is concluded that Hisha fish oil is beneficial for human being in relation to atherosclerosis

References

1. Wood PDS, Shioda R, Kinsell: Dietary regulation of cholesterol metabolism. *Lancet* 1966, Sept. 17:604-7.
2. Gruger EH. Fatty acid composition of fish oil, their chemistry, technology, stability, nutritional properties and uses. AVI publishing company 1967:3-30.
3. Baynen AC, Katan ; Why polyunsaturated fatty acid lower serum cholesterol. *Am. J. clin. Nutr.* 1985, 42: 560-563.
4. Connor WE, wrtiak DT, stone DB. Cholesterol balance and fecal neutral steroid and bile acid excretion in normal men fed dietary fat of different fatty acid composition. *J. clin Invest.* 1969; 48: 1363-1375.
5. Mayer PA: *Harper's Biochemistry*. 23rd ed. 1993: Printice Hall International Inc.
6. Connor WE, Harris Ws, Rager D: Reduction of Pasma lipids by dietary fish oils in patients with hypertriglyceridemia. *N. Engl J. Med.* 1985; 48: 1210-1254.
7. Grundy M. S. the effect of polyunsaturated fats on lipid metabolism. *J. clin. Invest.* 1975; 55: 269-82.
8. Lossonezy To, Ruiter A, Bronsgee S, Vongent CM, Hermus R JJ : the effect of a fish diet on serum lipids in healthy human subjects. *Am. J. clin Nutr.* 1978; 31: 1340-46.
9. Mensink RP, katar MB; Effect of a diet enrich with monounsaturated or polyunsaturated fatty acids on level of low density and high density lipoprotein cholesterol in healthy women. *N. Eng. J. Med.* 1989;321 : 436-41.
10. Jahan SS, MS, Muslemuddin M, Rubbi SF. The study of physical and chemical characteristics of Hilsa fish oil. *Dhaka University studies.* 1988;3 : 103-8.
11. Jahan SS. Investigation of the change of biochemical components of Hilsha fish under different storage conditions Ph. D. thesis, Department of Biochenmistry. University of Dhaka, June, 1993.

12. Quazi S, Hossain A, Mohiduzzaman M, Naha B. Effect of Hilsha fish oil and other fats and oil on cholesterol metabolism of rats. *Bangladesh J. Sci. Res.* 1989; 7 : 233-40.
13. BBS. Statistical year book of Bangladesh 13th ed. Bangladesh Bureau of statistics 1992.
14. Ghosh. Pk, Effect of fish oil and calcium channel blocker on experimental induced atherosclerosis in rabbits. M. Phil thesis department of pathology. Institute of post graduate medicine and research. Dhaka. 1990.
15. Siddique LN, Ali Ms. begum SN, Moslesuddin S, Jahan SS. Effect of Hilsha fish oil on lipid profile in normotensive subjects. *Bangladesh Journal of physiology and pharmacology* 1995;1: 24-26.
16. Knapp HR, FitzGerald. A Controlled Study of Polyunsaturated Fatty Acid Supplements in Essential hypertension. *N. Eng. J. Med* 1989;210: 1312-47
17. Verley H. *Practical Biochemistry*. eds. Gowen lock AH, Me Muray JR and MC, Launchian DM. 6th edition Heineman Medical books, London 1988.
18. Assmann G. *Lipid metabolism and atherosclerosis*. Germany, 1982; 14: 53.
19. Nestel PJ, Connor WE, Recardon MF, Connor wengs. Suppression by diet rich in fish oil of very low density lipoprotein in man. *J. clin. Invest* 1984; 74: 82-9.
20. Philipson BE, Rotherack DW, conner WE, Harris WS, Illing worth. Reduction of plasma lipids and lipoproteins and apoproteins by dietary fish oil in patients with hypertriglyceridemia. *N. Eng. J. Med.* 1988; 312: 1210-16.
21. Bleigh EB, Dayer WJ, A rapid method of total lipid extraction and purification *Can. J. Biochem. physiol.* 1963; 37: 911-917.
22. Albrink MJ, Man EB, Conn NH. Serum triglyceride in coronary heart disease. *Ann. Intern. Med.* 1959; 103: 4-8
23. Albrink MJ, Meigs JW, Man EB. Serum lipids, hypertension and coronary artery disease *Am. J. Med.* 1961; 31: 4-22.