

Determination of Omega-3 Fatty Acid Composition in Fresh Water Fish

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ABSTRACT

The term 'Fish' generally refers to aquatic animals. While the fish oils are not only very useful food, is a great source of calories but these are rich in different types of polyunsaturated fatty acids including essential fatty acids. These fish oils are responsible to keep the cholesterol level in blood low so help in controlling the cardiovascular diseases. The present study was conducted to evaluate three different fish oils for their oil contents and presence of omega-3 essential fatty acids. It was observed that all the three varieties of fish oil had high contents of polyunsaturated fatty acids and can be successfully used for the prevention of cardiovascular diseases.

Key Words: Oil contents; Fatty acids; Cardiovascular disease; Fish

INTRODUCTION

Fats and oils are composed of different fatty acids and triesters of glycerol called triglycerides. The major sources of fats and oils are plants and animals. Metabolism of these fatty acids produces energy. These fatty acids are obtained from dietary intake (Seidelin *et al.*, 1992). In addition to the energy purpose, every living cell needs essential fatty acids like omega-3 and omega-6. It has been observed that omega-3 essential fatty acids (EFAs) reduce the risk of atherosclerosis by lowering plasma triglyceride levels (Goodnight *et al.*, 1982; Philipson *et al.*, 1985).

Atherosclerosis is characterized by deposition of cholesterol, triglyceride fats, fibrous tissue and red blood cells. It restricts blood flow through artery. When coronary artery is involved it leads to IHD and finally to MCI. Unsaturated omega-3 (EFAs) help in reducing the cholesterol level (Potter & Kiss, 1995). Omega-3 EFAs also help in stopping blood platelets from clinging to one another (Trubo & Carroll, 1997). It has been observed that fish oils are the good source of omega-3 EFAs (Bays & Lansing, 1994). Fish oils containing omega-3 EFAs eicosapentacenoic acid (EPA) and docasahexaenoic acid (DHA) show positive effect in prevention and therapy of cardiovascular diseases (Korstanje *et al.*, 1991).

This project was conducted to study the fatty acids composition with special emphasis on omega-3 essential

fatty acid due to its importance from medical point of view, in oils extracted from different varieties of fish (*Mastacembelus armatus*, *Mystus singhala* and *Labeo calbasuo*). This research work provided a very useful data about fatty acid composition (omega-3 essential fatty acids) and opened new doors for further research in this field for the benefits of human beings.

MATERIALS AND METHODS

Three varieties of fish, *Mastacembelus armatus*, *Mystus singhala* and *Labeo calbasuo* were bought from the market. These varieties of fresh water fish were chopped separately and the oil was extracted by using solvent chloroform and n-hexane in the ratio of 50:50 (Shahid, 1987). The oils were analyzed for fatty acid profile by using gas liquid chromatography on a Perkin Elmer (3920) with a flame ionization detector (FID) and attached to an integrator (Shimadzu Japan Intersmat ICR-IB). The sample injected was 3 microlitre with the condition of carrier gas N₂ 25 ml/min, hydrogen 40 ml/min, air 500 ml/min, column temperature 190°C injection port temperature 200°C and detection port temperature 250°C.

RESULTS AND DISCUSSION

The fatty acid composition of different varieties of fish is shown in Table I.

Table I. Fatty acid composition of fresh water fish

Variety of fish	14:0	16:0	16:1	18:0	18:1n9	18:1n7	18:2n6	20:1n9	22:1n9	22:5n3	22:6n3	Total
Mastacembelus armatus	0.8	22.08	-	-	-	28.02	10.56	21.68	1.18	9.13	1.99	95.45
Mystus singhala	9.05	14.71	19.37	4.91	21.28	13.47	-	-	-	-	-	82.79
Labeo calbasuo	14.7	-	39.08	43.86	-	-	-	-	-	-	0.89	98.62

The results show that all the selected varieties of fish are good source of polyunsaturated fatty acids. But the *Mastacembelus armatus* is the best source of omega-3 essential fatty acids compared to other two varieties of fish. These variations in fatty acids composition may be due to different kinds and origin of these fish species. But on the basis of above results, it is concluded that these varieties of fish can be successfully used for the cure/prevention of cardiovascular diseases. These results correlate with the results reported by Blonk *et al.* (1990) and Singer (1995).

Omega-3 EFAs also play an important role in decreasing blood pressure and plasma rigidity. It also slows the progress of breast cancer and other types of cancer, after a 5-week administration of 4-8 capsules of fish oil (containing omega-3 EFAs) corresponding to 1.26 to 2.5g daily (Bach *et al.*, 1989).

REFERENCES

- Ackman, R.G., C.A. Eaton and B.A. Linke, 1975. Differentiation of fresh water characteristics of fatty acids in marine specimens of the Atlantic Stergeon, *Acipenser Oxyrhynchus*. *Fishery Bull.*, 73: 838-45.
- Ackman, R.G., C.A. Eaton, E.C. Bligh and A.W. Lantz, 1967. Fresh water fish oils; yield and composition of oils from reduction of Sheeps head, Tullibee, Mana and Alewife. *J. Fish Res. Bd., Canada*, 24: 1291-7.
- Bach, R.U. Schmdt, F. Jung, H. Kiesewetter, B. Hennen, E. Wenzel, H. Schieffer, L. Bette and S. Heyden, 1989. Effect of fish oil capsules in two dosages on blood pressure, platelet functions haemorheological and clinical chemistry parameters in apparently healthy subjects. *Ann. Nutr. Metabol.*, 33: 359-67.
- Bays, H. and A.M. Lansing, 1994. Fish oil omega-3 fatty acids in treatment of hypertriglyceridemia. A Practical Approach for the Primary Care Physician. *J. Ky. Med. Assoc.*, IV8 92: 105-8.
- Blonk, M.C., H.J.G. Bilo, J.J.P. Nauta, C. Snijderspopp and C. Mulder, 1990. Dose response effects of fish oil supplementation in healthy volunteers. *American J. Clin. Nutr.*, 52: 120-27.
- Goodnight, J., W.S. Harris, W.E. Cannor and D.R. Illingworth, 1982. PUFA, hyperlipidemia and thrombosis. *Atherosclerosis*, 21: 87-113.
- Khan, A.R., 1981. Isolation and characterization of lipids in different species of fresh water fishes. *M.Phil Thesis*, Department of Biological Sciences, Quaid-i-Azam University, Islamabad.
- Korstanje, M.J., H.J.G. Bilo, H.G. Peltenburg and T.G. Stoof, 1991. Fish oil from food of medicine. *Nederland Trijdschriftvoor Geneeskunda*, 135: 828-33.
- Kotb, A.R., A.F. Abu-Hadeed and A.Al Baker, 1991. Omega-3 polyunsaturated fatty acid contents of some popular species of Arabian Gulf fish. *Food Chem.*, 40: 185-90.
- Philipson, B.E., D.W. Rothrock, W.E. Harris and D.R. Illingworth, 1985. Reduction of plasma lipids, lipoproteins and apoproteins by dietary fish oils in patients with hyperglyceridemia. *New England J. Med.*, 312: 12106.
- Potter, N.N. and H. Kiss, 1995. *Food Sciences*. 5th Ed., Chapman and Hall N.Y., USA, p. 65-6.
- Seidelin, K.N., B. Myrup and H.B. Fisher, 1992. Omega-3 fatty acids in adipose tissue and coronary artery disease are inversely related. *American J. Clin. Nutr.*, 55: 1117-9.
- Shahid, M., 1987. Lipid composition of three species of fresh water fish. *M.Sc. Thesis*, Department of Food Technology, University of Agriculture, Faisalabad.
- Singer, P., 1995. Mechanism involved in the blood pressure lowering effect of omega-3 fatty acids. *Muench Med. Wochenschr.*, 137: 331-33.
- Trubo, R. and M. Carroll, 1997. *Cholesterol Cures*. Rodale Press Pennsylvania, U.S.A.

(Received 25 November 1999; Accepted 08 August 2000)