Agents and Actions, vol. 22, 3/4 (1987)

0065-4299/87/040369-02 $ 1.50+0.20/0

Coronary heart disease and dietary fish consumption

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The observation of the Danish workers showing that Greenland Eskimoes with a very low incidence of acute myocardial infarction had a high intake of *n*-3 polyunsaturated fatty acids, initiated an intensive research in order to establish possible protective effects of these fatty acids also in other populations [1]. Until then, a high intake of saturated fatty acids and a low intake of polyunsaturated fatty acids (PUFA) of the *n*-6 family had been two main factors associated with a high incidence of coronary heart disease. The beneficial effect of the *n*-3 PUFA, and particularly eicosapentaenoic acid (20:5, *n*-3) (EPA), has been associated both with changes in prostaglandin synthesis with subsequent favourable effects on the platelet/endothelial cell interaction and with effects on lipoprotein metabolism. Experimental studies in rats, many years ago, showed that α-linolenic acid (18:3, *n*-3) was able to counteract the thrombogenic effects of a high dietary intake of saturated fatty acids [2]. In rats α-linolenic acid is transformed to EPA. Recent long term studies in swine and other species have confirmed that supplement of dietary EPA is able to inhibit both atherosclerosis and thrombosis [3].

In man, the Japanese studies confirmed that the incidence of coronary heart disease (CHD) was low in subjects with a high intake of fish (250 g/capita/per day) [4]. This was, however, far less fish than that reported from the Eskimoes with an average intake of about 400 g of seal/fish per day. Other epidemiological data that support the recent observations in Eskimoes and Japanese were collected in Norway during the Second World War [2]. During these years significant reductions in mortality from CHD and in the frequency of post-surgical venous thrombosis were associated with a dramatic reduction in the intake of saturated fats and also with a marked increase in the intake of fish and fish products.

Recent studies from Zutphen, The Netherlands, indicate that the mortality from coronary heart disease was about 2.5 times lower among men who consumed at least 30 g of fish per day compared to non-users [5]. A dose-response relation was observed between intake of 0 and 30 g fish per day. A similar inverse relation between fish consumption and mortality from CHD was reported from the Western Electric study [6]. In two other cohort studies from Hawaii and Norway with a much higher fish consumption than in the Dutch and American studies, no relation was found between fish intake and mortality from coronary heart disease [7, 8].

We have recently carried out studies comparing populations with a high (132 g/capita/per day) and a low (55 g/capita/per day) fish intake. We were unable to establish an inverse correlation between fish consumption and the mortality of coronary heart disease. Furthermore, this study showed that this high fish intake was not sufficient to significantly change the content of EPA and arachidonic acid in platelet phospholipids. Also platelet function and serum lipids were mainly unaffected by this high fish consumption.

Since the first epidemiological report on the positive effects of marine oils in the prevention of coronary heart disease, a continuous discussion has been maintained on which concentrations of EPA should be recommended particularly in relation to consumption of other dietary lipids. Accumulated evidence from epidemiological studies are confusing. These studies indicate that there may exist at least two different mechanisms involved in a possible protective effect. The one may be related to only traces of *n*-3 fatty acids daily. The studies of Lagarde et al. support such a mechanism [9]. They added 50 mg daily to an ordinary diet and observed significant changes in platelet function and prostaglandin synthesis. The other mechanism is related to very high intake of fish as observed in Greenland and Japan. These effects are related to a daily EPA-intake of 1 g to many grams per day and is associated with significant changes both in fatty acid composition and platelet behaviour. This mechanism may also be operating in a series of studies reported during the last few year where dietary supplement of various concentrations of marine lipids has been given in addition to an ordinary diet [10]. In these studies it has regularly been possible to induce changes approaching those in the epidemiological studies. The lack of preventive effects of a high fish intake in recent studies may indicate that other, at present unknown, risk factors are involved. Obviously, these risk factors may demand higher concentrations of the dietary *n*-3 fatty acids to be neutralized, than what can be achieved by a high daily intake of mainly lean fish.

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