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Intake of fish and long-chain *n*-3 fatty acids and the risk of coronary heart mortality in men and women

Ritva Järvinen[1], Paul Knekt[2,3]*, Harri Rissanen[2] and Antti Reunanen[2]

[1]*Department of Clinical Nutrition, University of Kuopio, PL 1627,70211 Kuopio, Finland*
[2]*National Public Health Institute, Mannerheimintie 166, 00300 Helsinki, Finland*
[3]*The Social Insurance Institution, PL 450,00101 Helsinki, Finland*

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This prospective study investigated the relationship between the consumption of fish and intake of long-chain *n*-3 fatty acids and the risk of coronary heart mortality in 2775 men and 2445 women aged from 30 to 79 years who were free of CHD and had participated in a health examination survey from 1967 to 1972. In total, 335 men and 163 women died of CHD during a follow-up until the end of 1992. A dietary history interview method provided data on habitual consumption of fish and other foods over the preceding year at baseline. The intakes of long-chain *n*-3 fatty acids were calculated on the basis of food composition values of Finnish foods. Higher consumption of fish was associated with a decreased risk of CHD among women, whereas no significant association was seen among men. The relative risk between the highest and the lowest quintile for fish consumption was 1·00 (95 % CI 0·70, 1·43; *P* for trend 0·83) for men and 0·59 (95 % CI 0·36, 0·99; *P* for trend 0·02) for women in analysis adjusting for age, energy intake, geographical area, BMI, serum cholesterol, blood pressure, smoking, occupation and diabetes; however, after adjustment for dietary confounders this association was no longer significant. The intake of *n*-3 fatty acids was not significantly associated with the risk of CHD in either men or women. In conclusion, our results for women are in line with the suggested protective effect of fish consumption against CHD but a similar association was not, however, found in men.

Fish intake;; *n*-3 Fatty acids;; Coronary heart disease

Fish consumption is suggested to be beneficial against CHD due to the *n*-3 fatty acids that are specific to fish lipids. Fish-specific *n*-3 fatty acids have been shown to be effective in reducing the recurrence of cardiac attacks in clinical trials (Kris-Etherton *et al.* 2002). These fatty acids may modify risk factors for CVD through different mechanisms, including anti-arrythmic, anti-thrombotic and anti-atherosclerotic properties (Mori & Beilin, 2001), or through their anti-inflammatory effects (Lopez-Garcia *et al.* 2004). Several prospective studies (Kromhout *et al.* 1985; Daviglus *et al.* 1997; Albert *et al.* 1998; Hu *et al.* 2002) have found that the risk of CHD is significantly decreased with higher consumption of fish and/or intake of *n*-3 fatty acids. However, beneficial effects of fish or fish oils have not been reported in all studies (Marckmann & Gronbaek, 1999; Gillum *et al.* 2000; Burr *et al.* 2003; Osler *et al.* 2003; Folsom & Demissie, 2004; Nakamura *et al.* 2005).

Findings from two recent meta-analyses on fish consumption and CHD risk, one on fourteen cohort and five case–control studies (Whelton *et al.* 2004) and the other that included eleven prospective studies (He *et al.* 2004), suggested an inverse relationship between fish consumption and the occurrence of CHD, especially fatal CHD. Evidence on the association between fish consumption and CHD risk continues to be controversial, however. The beneficial effect of fish consumption has been demonstrated more often among high-risk populations (Marckmann & Gronbaek, 1999; Osler *et al.* 2003). There is potentially a threshold level for the intake of fish that is thought to be effective against CHD. The association between fish consumption and CHD risk has been difficult to demonstrate among populations with a high average intake of fish (Vollset *et al.* 1985; Ascherio *et al.* 1995; Nakamura *et al.* 2005). The majority of studies have been carried out among men. Since the protective effect of fish against CHD is apparently due to their specific fatty acids, then the type of fish consumed, whether lean or fatty, is also important in relation to CHD risk (Oomen *et al.* 2000; Mozaffarian *et al.* 2003). As a major source of Hg, fish may also increase the risk of CHD (Salonen *et al.* 1995; Chan & Egeland, 2004).

In the present study, the relationships between the consumption of fish and fish-specific fatty acids and the risk of CHD were investigated among men and women drawn from a population-based cohort in Finland.

Population and methods

The Finnish Mobile Clinic carried out a large health examination survey in Finland from 1966 to 1972. Total populations, or random samples of them, altogether 62 440 individuals aged 15 years or older, were invited to take part in the

* **Corresponding author:** Dr Paul Knekt, National Public Health Institute, fax +358 9 4744 8760, email Paul.Knekt@ktl.fi

study in thirty rural, semi-urban and industrial communities in six different regions. The overall participation rate was 82·5 % (Aromaa, 1981). Approximately one in five of the participants was randomly selected for an interview on their dietary habits. In total, there were 2775 men and 2445 women aged between 30 and 79 years and without any previous diagnosis of heart disease who participated in the examination, which included a dietary interview (Knekt *et al.* 1994). During the follow-up, which lasted until the end of 1992, 335 men and 163 women died of CHD. The mean duration of the follow-up was 21·5 years. Data on the causes of death were received from Statistics Finland for all the people who died during the follow-up. The coverage of the register is complete and it also includes the death certificates of emigrants who died abroad. Coronary death was defined as codes 410–414 of the International Classification of Disease, Ninth Revision.

At baseline, data on total habitual food consumption during the preceding year were collected using a dietary history interview method (Järvinen *et al.* 1993). A preformed questionnaire listing more than 100 different foods and food groups was used to guide structured interviews. The type of fish and method of preparation was specified during the interview. A total of twenty-six different fish items were recorded in the interviews. Artificial food models or samples of real food were used to assist respondents in their estimation of the amounts of food consumed. Nutrient intakes from all food items were computed using a food composition database mainly compiled from Finnish food composition tables (Rastas *et al.* 1989). The estimation of dietary fatty acids was based on the analysed values of Finnish foods as presented in a previous study (Knekt *et al.* 1990). The intraclass correlation coefficient for fish consumption repeated at intervals of 4–8 months was 0·72. For measurements repeated within an interval of 4–7 years the coefficient was 0·39 (Järvinen *et al.* 1993). The short-term reproducibility of *n*-3 fatty acids was 0·72 and the long-term reproducibility was 0·44.

Data on demographic characteristics, smoking, diseases and medicines were provided by a self-administered questionnaire. Smoking habits were categorized as follows: non-smokers; ex-smokers; pipe or cigar smokers; those who smoked less than fifteen cigarettes per d those who smoked fifteen or more cigarettes per d. Height and weight were measured and BMI (kg/m^2) was calculated. Blood pressure was measured with the auscultatory method with the subject in a sitting position (Aromaa, 1981). Four hypertension categories were formed on the basis of systolic and diastolic blood pressure and antihypertensive medication (Knekt *et al.* 1994). Blood samples were collected and total cholesterol concentration in serum samples was determined by an autoanalyser modification of the Liebermann-Burchard reaction (Huang *et al.* 1961).

The general linear model was used to estimate the adjusted means of the selected characteristics of the study subjects in the quintiles of fish intake. The relative risks of mortality in the quintiles of fish and other dietary components using the lowest quintiles as the referent category were computed based on Cox's model (Cox, 1972). For these analyses the intakes of fatty acids were first adjusted by the residual method (Willett & Stampfer, 1986). Age and energy intake were included in the model as continuous variables. In further analysis, potential non-dietary confounders were added to the model: BMI and serum cholesterol were included as continuous variables and geographical area (six regions), smoking (five categories), hypertension (four categories), occupation (agricultural, industrial, blue-collar workers, white-collar workers, housewives) and diabetes (no, yes) were added as categorical variables. In additional analyses of several dietary factors (dietary fibre, vitamin E, vitamin C, β-carotene, flavonoids, vitamin B_6 and folic acid) were also taken into account by adding them as continuous variables in the model. Testing for the trend for association between the intake of fish and *n*-3 fatty acids and CHD risk was carried out by including the variables as continuous in the model.

Results

Tables 1 and 2 demonstrate the relationships between general CHD risk factors and several dietary variables and fish consumption among men and women. Fish consumption was closely associated with the intake of the fish-specific fatty acids, EPA and DHA. Fish consumption was also related to a higher intake of several dietary vitamins and antioxidants as well as to a better composition of dietary fatty acids, but also with a higher dietary cholesterol intake. However, several general risk factors of CHD, e.g. smoking, serum cholesterol and BMI, tended to be higher at higher levels of fish consumption and more so in men.

Total fish consumption was not significantly associated with CHD risk in men (Table 3). However, consumption of freshwater fish but not seawater fish tended to be associated with a higher risk of CHD; the age- and energy-adjusted relative risk in the highest quintile of freshwater fish was 1·43 (95 % CI 1·02, 1·99). However, no significant trends were seen, and adjustment for potential confounders diminished the associations.

In contrast to men, CHD risk decreased among women with higher fish consumption (Table 4). In analyses including energy intake and the general risk factors of CHD, the relative risk in the highest *v*. lowest quintile was 0·59 (95 % CI 0·36, 0·99; *P* for trend 0·02). Consumption of lake fish or seawater fish was not found to be associated with CHD risk in women when studied separately.

The intake of fish-specific *n*-3 fatty acids was not significantly associated with the risk of CHD in either men or women (Tables 3 and 4). The relative risks between the highest *v*. lowest quintile of the individual fatty acids EPA and DHA were, respectively, 0·95 (95 % CI 0·66, 1·35) and 1·02 (95 % CI 0·71, 1·47) among men, and 0·83 (95 % CI 0·51, 1·36) and 0·69 (95 % CI 0·42, 1·13) among women.

Since fish consumption was clearly associated with better dietary habits, we also carried out analyses including additional adjustments for several dietary factors (dietary fibre, vitamin E, vitamin C, β-carotene, flavonoids, vitamin B_6 and folic acid), which may appear as potential confounders in the analysis of CHD risk. In general, further adjustments did not materially affect the results. However, the inverse relationship between total fish consumption and CHD risk decreased after these adjustments were made; the relative risk between the highest *v*. lowest quintile was 0·67 (95 % CI 0·39, 1·15; *P* for trend 0·08).

Table 1. Mean levels of characteristics of men adjusted for age and energy intake in quintiles of fish intake

	Quintile of fish intake					
Variable	≤11	12–21	22–35	36–62	≥63	*P* value for difference
Age (years)*	44·22	44·83	44·15	46·02	46·73	<0·001
BMI (kg/m^2)†	25·01	25·49	25·57	25·75	25·82	0·001
Serum cholesterol (mmol/l)†	6·48	6·74	6·79	6·79	7·12	<0·001
High blood pressure (%)†	6·7	6·5	5·3	9·4	8·5	0·14
Diabetes (%)†	1·5	1·1	0·6	1·7	2·5	<0·001
Smoking (%)†	47·9	46·4	49·4	52·1	57·7	<0·001
Dietary intake/d						
Energy (MJ)†	11·97	12·10	12·60	13·25	14·31	<0·001
Saturated fatty acids (g)‡	74·2	72·1	72·2	71·2	71·5	0·004
PUFA (g)‡	7·86	8·24	8·59	9·31	9·76	<0·001
EPA + DHA (g)‡	0·15	0·24	0·34	0·48	0·93	<0·001
Dietary cholesterol (mg)‡	524·4	530·4	553·5	553·3	605·9	<0·001
Fibre (g)‡	30·9	32·4	32·2	32·4	31·1	0·97
Vitamin E (mg)‡	7·54	7·84	8·11	8·68	9·39	<0·001
Vitamin C (mg)‡	67·4	71·1	77·7	82·5	83·2	<0·001
Flavonoids (μg)‡	3286	3412	3756	4028	3953	0·003
β-Carotene (μg)‡	1434	1439	1830	1617	1839	<0·001
Vitamin B_6 (mg)‡	1·80	1·89	1·95	2·03	2·19	<0·001
Folic acid (μg)‡	238·7	245·1	250·9	253·5	254·6	<0·001

* Unadjusted.
† Age-adjusted.
‡ Age- and energy-adjusted.

Discussion

The present findings among women are in line with the suggested beneficial effect that fish consumption has against developing CHD. Only a few previous prospective studies on fish consumption and CHD risk have been reported on women. In the Nurses' Health Study, a significant inverse relationship was demonstrated between the intake of fish and fish-specific *n*-3 fatty acids and incidence of death due to CHD (Hu *et al.* 2002). On the other hand, no protective effect of regular fish consumption against CHD mortality was observed among women in the NHANES I Follow-up Study (Gillum *et al.* 2000), and fish consumption was not found to be related to CHD death in sub-analysis on women from a Danish cohort (Osler *et al.* 2003). Recent findings from a study on postmenopausal women suggested a slight inverse trend between fish consumption and CHD death, although adjusting for several potential confounders

Table 2. Mean levels of characteristics of women adjusted for age and energy intake in quintiles of fish intake

	Quintile of fish intake					
Variable	≤8	9–15	16–24	25–40	≥41	*P* value for difference
Age (years)*	46·92	45·07	45·79	45·73	46·97	0·01
BMI (kg/m^2)†	25·73	25·89	26·24	26·69	26·82	<0·001
Serum cholesterol (mmol/l)†	6·72	6·78	6·89	6·90	6·99	0·005
High blood pressure (%)†	13·9	16·6	15·8	15·1	13·7	0·36
Diabetes (%)†	0·9	3·0	1·7	2·5	1·1	0·77
Smoking (%)†	13·3	13·7	12·6	14·0	18·7	<0·001
Dietary intake/d						
Energy (MJ)†	8·64	8·77	9·40	9·93	10·61	<0·001
Saturated fatty acids (g)‡	51·2	50·4	50·4	48·8	48·6	0·004
PUFA (g)‡	5·79	6·12	6·13	6·40	7·04	<0·001
EPA + DHA (g)‡	0·11	0·16	0·22	0·30	0·55	<0·001
Dietary cholesterol (mg)‡	385·6	399·1	402·5	408·7	435·1	<0·001
Fibre (g)‡	24·5	25·1	24·9	25·1	24·7	0·14
Vitamin E (mg)‡	5·98	6·42	6·40	6·68	7·38	<0·001
Vitamin C (mg)‡	73·7	79·3	84·1	88·3	88·2	<0·001
Flavonoids (μg)‡	3784	4101	4221	4554	4691	<0·001
β-Carotene (μg)‡	2054	2106	2347	2295	2442	0·13
Vitamin B_6 (mg)‡	1·34	1·42	1·44	1·49	1·58	<0·001
Folic acid (μg)‡	192·8	201·7	205·7	212·5	211·6	<0·001

* Unadjusted.
† Age-adjusted.
‡ Age- and energy-adjusted.

Table 3. Adjusted relative risks (RR) of CHD in quintiles of fish consumption and intakes of long-chain *n*-3 fatty acids in men

	Quintile of dietary variable					
	1	2	3	4	5	*P* for trend
Fish, total						
Range of quintile (g/d)	≤11	12–21	22–35	36–62	≥63	
Mean of quintile (g/d)	5·8	16·5	28·1	47·0	112·4	
No. of cases	63	66	64	68	74	
Age- and energy-adjusted RR (95 % CI)	1·0	1·11 (0·78, 1·57)	1·15 (0·81, 1·63)	1·16 (0·82, 1·64)	1·24 (0·88, 1·75)	0·23
Multivariate adjusted RR* (95 % CI)	1·0	1·07 (0·75, 1·52)	1·09 (0·77, 1·56)	0·98 (0·69, 1·39)	1·00 (0·70, 1·43)	0·83
Fish, seawater						
Range of quintile (g/d)	≤1	2–5	6–11	12–22	≥23	
Mean of quintile (g/d)	0·2	3·3	8·2	16·2	47·3	
No. of cases	68	65	64	58	80	
Age- and energy-adjusted RR (95 % CI)	1·0	1·02 (0·73, 1·44)	1·05 (0·74, 1·48)	0·89 (0·62, 1·26)	1·29 (0·93, 1·79)	0·30
Multivariate adjusted RR* (95 % CI)	1·0	0·98 (0·70, 1·39)	1·00 (0·71, 1·41)	0·83 (0·58, 1·19)	1·09 (0·77, 1·54)	0·93
Fish, lake						
Range of quintile (g/d)	≤3	4–9	10–19	20–41	≥42	
Mean of quintile (g/d)	0·9	6·4	14·1	28·8	88·7	
No. of cases	66	76	69	47	77	
Age- and energy-adjusted RR (95 % CI)	1·0	1·52 (1·09, 2·11)	1·20 (0·85, 1·68)	0·90 (0·62, 1·31)	1·43 (1·02, 1·99)	0·46
Multivariate adjusted RR* (95 % CI)	1·0	1·56 (1·11, 2·18)	1·24 (0·88, 1·74)	0·81 (0·55, 1·19)	1·21 (0·85, 1·73)	0·70
Long-chain *n*-3 fatty acids						
Range of quintile (g/d)	≤0·17	0·18–0·27	0·28–0·39	0·40–0·59	≥0·60	
Mean of quintile (g/d)	0·13	0·23	0·33	0·48	0·99	
No. of cases	64	57	69	70	75	
Age- and energy-adjusted RR (95 % CI)	1·0	1·03 (0·72, 1·47)	1·19 (0·85, 1·68)	1·23 (0·87, 1·73)	1·21 (0·87, 1·69)	0·16
Multivariate adjusted RR* (95 % CI)	1·0	1·00 (0·70, 1·44)	1·11 (0·78, 1·57)	1·10 (0·77, 1·56)	0·96 (0·68, 1·38)	1·00

* Adjusted for age, energy intake, area, BMI, serum cholesterol, blood pressure, smoking, occupation and diabetes.

attenuated the association (Folsom & Demissie, 2004). In the present study, higher fish consumption was associated with a lower risk of CHD in analyses including energy intake and non-dietary confounders, but after further adjustment for several potential dietary confounders the association was less significant. Although the potential implementation of over-adjustment cannot be excluded, the present findings may indicate that the suggested beneficial association of fish consumption is due to other dietary factors shown to be associated with fish consumption. The fact that the intake of

Table 4. Adjusted relative risks (RR) of CHD in quintiles of fish consumption and intakes of long-chain *n*-3 fatty acids in women

	Quintile of dietary variable					
	1	2	3	4	5	*P* for trend
Fish, total						
Range of quintile (g/d)	≤8	9–15	16–24	25–40	≥41	
Mean of quintile (g/d)	4·2	12·0	19·8	31·7	70·0	
No. of cases	48	30	31	27	27	
Age- and energy-adjusted RR (95 % CI)	1·0	0·86 (0·54, 1·35)	0·79 (0·50, 1·25)	0·70 (0·44, 1·13)	0·63 (0·39, 1·02)	0·04
Multivariate adjusted RR* (95 % CI)	1·0	0·91 (0·57, 1·47)	0·77 (0·48, 1·23)	0·68 (0·42, 1·12)	0·59 (0·36, 0·99)	0·02
Fish, seawater						
Range of quintile (g/d)	≤1	2–4	5–9	10–18	≥19	
Mean of quintile (g/d)	0·3	2·9	6·9	13·5	36·6	
No. of cases	70	26	39	29	29	
Age- and energy-adjusted RR (95 % CI)	1·0	0·63 (0·39, 1·04)	1·17 (0·75, 1·82)	0·86 (0·53, 1·40)	0·73 (0·44, 1·18)	0·52
Multivariate adjusted RR* (95 % CI)	1·0	0·66 (0·39, 1·09)	1·14 (0·72, 1·81)	0·80 (0·49, 1·31)	0·70 (0·41, 1·18)	0·39
Fish, lake						
Range of quintile (g/d)	≤1	2–5	6–11	12–22	≥23	
Mean of quintile (g/d)	0·2	3·5	8·4	16·1	46·3	
No. of cases	38	36	34	25	30	
Age- and energy-adjusted RR (95 % CI)	1·0	0·98 (0·62, 1·55)	1·13 (0·71, 1·80)	0·81 (0·49, 1·36)	0·80 (0·49, 1·30)	0·28
Multivariate adjusted RR* (95 % CI)	1·0	0·85 (0·52, 1·37)	1·09 (0·67, 1·78)	0·87 (0·51, 1·48)	0·75 (0·45, 1·26)	0·37
Long-chain *n*-3 fatty acids						
Range of quintile (g/d)	≤0·11	0·12–0·17	0·18–0·24	0·25–0·36	≥0·37	
Mean of quintile (g/d)	0·09	0·15	0·22	0·30	0·59	
No. of cases	42	23	38	28	32	
Age- and energy-adjusted RR (95 % CI)	1·0	0·62 (0·37, 1·03)	1·10 (0·71, 1·72)	0·77 (0·47, 1·24)	0·83 (0·52, 1·31)	0·63
Multivariate adjusted RR* (95 % CI)	1·0	0·67 (0·40, 1·13)	1·14 (0·72, 1·79)	0·75 (0·46, 1·23)	0·73 (0·44, 1·19)	0·31

* Adjusted for age, energy intake, area, BMI, serum cholesterol, blood pressure, smoking, occupation and diabetes.

fish-specific fatty acids was not found to be associated with the disease risk gives further support for this notion.

An inverse association between fish consumption and CHD risk among men was not demonstrated, which is in line with the results of previous studies on fish consumption and CHD in Finnish men. Fish consumption was not associated with CHD mortality among the Finnish participants of the Seven Countries Study (Oomen *et al.* 2000), and fish consumption among middle-aged Finnish men who smoked was not found to be related with CHD death either (Pietinen *et al.* 1997). In their study on middle-aged men from eastern Finland, Salonen *et al.* (1995) found an increased risk of coronary events among those with a higher hair Hg content, which corresponded to higher fish consumption, especially the consumption of white low-fat fish. In recent further analysis of the data, the notion concerning the potential interference of Hg in the development of CVD was given further support (Virtanen *et al.* 2005).

Among other population cohorts including both men and women, the findings on fish consumption and CHD risk have mostly been consistent in sub-analyses of men and women (Gillum *et al.* 2000; Osler *et al.* 2003). Two recent meta-analyses of studies on fish consumption and CHD risk did not report significant interaction of gender, although the possibility that the association is stronger among women cannot be totally excluded (He *et al.* 2004; Whelton *et al.* 2004). In the present study, men with high levels of fish consumption also had an overall higher level of general CHD risk factors than women. It is possible that the effects of diet are difficult to distinguish from the higher burden of major CHD risk factors. Furthermore, it has been shown that fish consumption among this population is associated with a conservative dietary pattern characterized by a higher consumption of butter, potatoes and whole milk and that this pattern is more closely related with men (Montonen *et al.* 2005). An interference of dietary recommendation on fish consumption is hardly possible, since there was no general awareness of suggested beneficial effect of fish consumption against CHD when the baseline data of the study were collected.

It is unlikely that there is any methodological reason for the suggested difference between men and women. Both the estimation of exposure and the measurement of outcome were carried out on men and women at the same time, by the same investigators and by the same methods. On the one hand, women may be more aware of their dietary habits and more able to describe their food intake more precisely than men. On the other hand, women may also be more likely to change their reporting on dietary habits deliberately. It is, however, difficult to conclude whether these differences between men and women have been reflected in the reliability of the collected dietary data. Since the number of female cases was rather limited in the present study, the possibility remains that their result was a chance finding.

We did not find any significant association between intake of long-chain *n*-3 fatty acids and CHD risk in either men or women. The fish that is habitually consumed in Finland has been mainly white fish, which is low in fat, so the amount of fish fat consumed may have only had a minor effect on CHD risk. Previous studies have reported less association between fish consumption and CHD risk when analyses are restricted to fish types characterized with a low fat content (Oomen *et al.* 2000; Mozaffarian *et al.* 2003). Furthermore, the association between the intake of fish oil and CHD risk may be attenuated by the simultaneous intake of Hg mainly through fish (Rissanen *et al.* 2000; Guallar *et al.* 2002; Virtanen *et al.* 2005). A higher consumption of long-chain *n*-3 fatty acids was associated with a higher risk of CHD among middle-aged Finnish men who smoked after adjustment for *trans*-saturated fatty acids and *cis*-MUFA (Pietinen *et al.* 1997).

The prospective study design was an advantage of the present study because it diminished the potential recall bias and bias due to disease status, since dietary data were collected before the incident outcome point. However, dietary habits may have changed during the long follow-up period, and it is questionable how well the measurement made at baseline can represent the dietary habits over a follow-up period of decades. Nevertheless, in a previous study, fish consumption measured at baseline predicted the 30-year risk of myocardial infarction (Daviglus *et al.* 1997). In their recent meta-analysis, He *et al.* (2004) found that the inverse association between fish intake and CHD mortality was more evident in those studies with a longer follow-up. This may indicate that consumption of fish or other habits associated with fish consumption may be rather stable.

Due to the comprehensive dietary data collected at baseline, potential dietary confounders could be extensively allowed for in the analysis. Several non-dietary risk factors of CHD were available and adjusted in the analysis. However, any missing information on alcohol consumption and physical activity may have caused residual confounding. Adjusting for occupation may have partly compensated the lack of data on physical activity because it roughly takes into account physical activity at work. Since consumption of dietary supplements was uncommon in Finland at the time of the baseline study (Klaukka *et al.* 1990), we suggest that lack of data on this did not significantly confound our results.

In conclusion, our present results support the suggested beneficial effect of fish consumption against CHD in women; however, potential confounding due to better dietary habits associated with fish consumption cannot be excluded. However, in line with previous studies on middle-aged Finnish men, fish consumption was not found to offer protection against the development of CHD in men, who were characterized by a high level of general CHD risk factors. Further studies on the issue of fish consumption and CHD risk are needed among different populations in order to elucidate whether there might be a difference in the responses of men and women, and if the relationship between fish consumption and CHD risk depends on other dietary or lifestyle factors.

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