

SELF REPORTED INCIDENCE OF OSTEOPOROTIC FRACTURES AND EXPOSURE TO PERSISTENT ORGANOCHLORINE COMPOUNDS THROUGH FISH CONSUMPTION

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Introduction

The high, and increasing, incidence of osteoporotic fractures is an important public health problem¹⁻³. Changes in environmental factors might be of importance^{4,5}.

Dioxins and dioxin-like PCBs have in animal experiments impaired bone metabolism⁶⁻⁸. The mechanisms are not well known, but it might be that these pollutants act as endocrine disruptors and modulate the homeostasis of estrogens or other steroid hormone systems. A pertinent question is whether exposure to persistent organochlorines (POC) through diet might be harmful for the human skeleton. In Sweden, a major source of human exposure to POC is consumption of fatty fish from the Baltic Sea. The Swedish fishermen's populations have high intakes of locally caught fish and constitute suitable study bases. We have recently shown that Swedish fishermen's wives at the east coast (at the Baltic Sea) had a significantly increased incidence of hospitalized vertebral fractures, as compared with west coast fishermen's wives, and we observed a similar, but non-significant, such tendency among the fishermen⁹.

The aim of the present study was to assess the association between self-reported fracture incidence and consumption of POC contaminated fatty fish from the Baltic Sea.

Methods and Materials

A questionnaire was sent to 6950 fishermen and 5819 fishermen's wives from the Swedish east (exposed) and west (unexposed) coasts that were born 1920 or later, living in Sweden and alive at 31 December 1999. The response rates varied between 50 and 59 %. Calendar year and localization of skeletal fractures were asked for, together with specified current fish consumption and information about potential confounders. The non-responders had almost identical age distributions as the responders. The fracture incidence rates for specific skeletal localizations were based on allocated fractures and person-years under risk from age 25 until time of fracture or end of follow-up (Table 1). Hip, vertebral, and wrist fractures were classified as osteoporotic fractures.

When calculating incidence rates for osteoporotic fractures, the follow-up stopped at time of first fracture within this category or end of follow-up period. The impact of cohort affiliation (east versus west coast) and consumption of fatty fish from the Baltic Sea was assessed by Poisson regression models, with age taken into account. We also considered the following variables as potential confounders: physical exercise, body mass index, heredity for fractures, cortisone drugs, consumption of dairy products, smoking habits, and alcohol consumption. If these variables tended to be associated with the risk of developing fracture ($p < 0.15$) we included them in the models one at a time. If the age-adjusted Incidence Rate Ratio (IRR) changed by at least 15% the confounder was kept in the model.

Table 1. Number of fractures, individuals and person-years under risk in the cohorts of Swedish fishermen and their wives from the west and east coasts, respectively.

	Fishermen		Fishermen's wives	
	West Coast	East Coast	West Coast	East Coast
Wrist fractures	92	40	198	64
Hip fractures	33	14	48	9
Spine fractures	32	13	25	14
All osteoporotic fractures ^a	148	64	248	84
Number of person-years under risk ^b	73 265	31 256	77 166	29 216
Number of persons ^c	2 432	1 080	2 426	952

^aAn individual with more than one of the above mentioned fractures contributes with only one fracture.

^bIn the analyses of all osteoporotic fractures.

^cIncluded in the analyses of all osteoporotic fractures.

Results

There was no effect of cohort affiliation for all osteoporotic fractures among the fishermen (IRR 1.02, 95% CI 0.76-1.37) or among the fishermen's wives (IRR 0.95, 95% CI 0.74-1.22). Among the east coast fishermen's wives, there was, however, a positive association between consumption of fatty fish from the Baltic Sea and the incidence for osteoporotic fractures (Table 2). Those who consumed at least four such meals per month had an increased incidence as compared with those that ate at most one such meal per month (IRR 1.75, 95% CI 0.97-3.15). None of the potential confounders changed this estimate more than marginally. No such association was seen for the fishermen (Table 3).

Table 2. Crude and confounder-adjusted Incidence Rate Ratios (IRR) for osteoporotic fractures within the cohort of East Coast fishermen's wives with respect to consumption of fatty fish from the Baltic Sea.

Fatty fish from the Baltic Sea (meals/month)	N	Crude		Age adjusted*	
		IRR	95 % CI	IRR	95 % CI
0-1	364	1.0		1.0	
>1 - <4	368	1.76	1.00-3.09	1.63	0.93-2.87
≥4	220	2.18	1.22-3.91	1.75	0.97-3.15

*25-50, 51-60, 61-70, and 71-80 years, respectively

Table 3. Crude and confounder-adjusted Incidence Rate Ratios (IRR) for osteoporotic fractures within the East Coast fishermen's cohorts with respect to consumption of fatty fish from the Baltic Sea.

Fatty fish from the Baltic Sea (meals/month)	N	Crude		Age-adjusted*	
		IRR	95 % CI	IRR	95 % CI
0-2	419	1.0		1.0	
>2-6	410	0.61	0.34-1.07	0.60	0.34-1.07
>6	251	0.64	0.3-1.2	0.63	0.34-1.18

* 25-70 and 71-80 years, respectively

Discussion

The present finding of exposure-response associations in women between dietary intake of fatty fish from the Baltic Sea and increased IRR for fractures are supported by the previous finding of an increased IRR for hospitalized vertebral fractures among east coast fishermen's wives^{9,10}. On the other hand, it is puzzling why there was no effect of cohort affiliation in the present study. A hypothetical explanation could be that also consumption of other fish than fatty fish from the Baltic Sea would constitute a risk factor for fractures. There was, however, no indication of increasing IRR with fish consumption among West Coast fishermen's wives.

We have, thus, found some support for an association between POC exposure through contaminated fish and increased risk for osteoporotic fractures. This conclusion is, however, not without caveats. A nested case-referent study of osteoporotic fractures within the fishermen's cohort, using biomarkers of POC exposure as a complement to dietary interviews, could contribute to a better understanding. Moreover, ongoing bone density studies in the same population may also be beneficial for assessing the possible impact of POC exposure on human bone metabolism.

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