EXPOSURE TO PERFLUORINATED ACIDS IN 108 SWEDISH WOMEN IN RELATION TO METHYLMERCURY AND FISH CONSUMPTION

Katrin Holmström[1], Marika Berglund[2] and Ulf Järnberg[1]

[1] Stockholm University
Department of Applied Environmental Science, Stockholm, Sweden
katrin.holmstrom@itm.su.se

[2] Karolinska Institutet
Institute of Environmental Medicine, Stockholm, Sweden

Aim

To investigate if fish is an exposure source to perfluorooctane sulfonic acid (PFOS) and perfluoro octanioc acid (PFOA) in humans.

Introduction

To reduce human exposure to potentially hazardous chemicals it is important to identify the main sources of exposure. Perfluorinated acids have been found in human blood samples worldwide. They have a long half-life in humans, and have shown a potential for reproductive interference and carcinogenity in animal experiments.

Despite their ubiquitous presence, little is known about exposure of the general population to perfluorinated acids. In wildlife the highest concentrations can be found in piscivouros animals. Fish consumption is thus a possible source for human exposure to perfluorinated acids.

People eating fish are also exposed to methyl mercury (MeHg), a well-known neurotoxic environmental contaminant. The highest concentrations of MeHg are found in predatory fish. Since fish is the only exposure source of MeHg in the general population, MeHg n blood can serve as a biomarker of fish intake, and especially of predatory fish species.

Materials & Methods

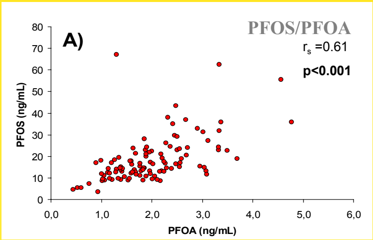
Women with a moderate to high proportion of fish in their diet were recruited. The volunteers answered a detailed questionnaire regarding their diet, in particular their fish intake, and provided blood samples for analysis (n=108).

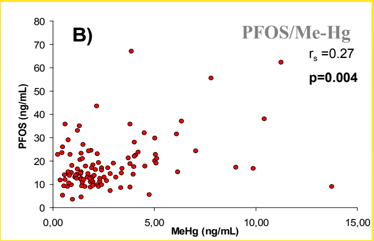
Perfluorinated acids: The samples were analyzed for PFOS and PFOA using HPLC coupled to ESI-MS/MS monitoring the transitions 499-99 for PFOS and 413-369 for PFOA.

Methyl mercury: The samples were analysed for methyl mercury (MeHg), using an automated multiple injection analysis system and CV-AFS.

Associations between blood concentrations and fish consumption data were explored using Spearman's rank correlation test (r_s). The threshold of significance was set to $p<0.05$.

Figure 1.





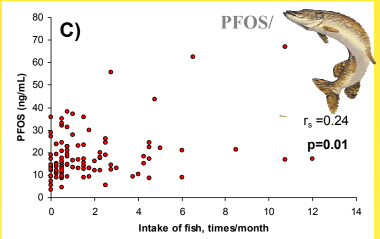


Figure 1.

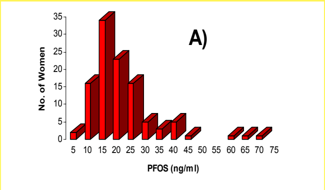
Scatterplots of associations between measured blood concentrations of PFOS and

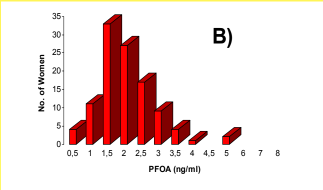
(A) Measured concentrations of PFOA

(B) Measured concentrations of Methyl-Hg

(C) Intake of predatory fish species generally containing high levels of MeHg (pike, perch, pikeperch, burbot, and eel)

Figure 2.





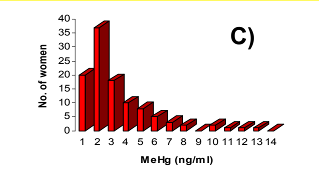


Figure 2.

Frequency distributions of measured blood concentrations in 108 Swedish women for

(A)PFOS,

(B) PFOA and

(C) MeHg

Results

There was a significant correlation between PFOS and PFOA levels in blood (Fig 1A), indicating some common source of exposure. No correlation between concentrations of PFOS or PFOA in blood and total stated fish intake was found. However PFOS and PFOA (r_s=0.22; p=0.02) were significantly positively correlated to MeHg in blood (Fig 1B), and PFOS (not PFOA) to increasing intake of predatory fish species (Fig 1C), and to intake of shellfish. Concentrations of PFOS and PFOA were not correlated to intake of fatty fish. No correlation was found to other types of food contained in the survey.

The mean values of PFOS, PFOA and MeHg are shown in Table 1. Their frequency distributions are shown in Figure 2. The statistics of the correlations are shown in Table 2.

Conclusions

- The results indicate that predatory fish species can be a source of exposure to perfluorinated acids.
- The weak correlations, however, suggest that there are other sources also of importance for human exposure.
- The lack of correlation between PFOS or PFOA and the intake of fat fish, which generally contain high concentrations of organic contaminants, such as dioxins and PCBs, also implies that available risk models developed for organic contaminants may not apply to perfluorinated acids.

Tables

Table 1.	**Mean (range)** ng/mL	S.D.
PFOS	18 (3.0-67)	11
PFOA	2.0 (0.4-4.8)	0.8
MeHg	2.8 (0.4-14)	2.4

◄ ***Table 1 .*** *Mean concentrations of PFOS, PFOA and MeHg in blood, (ng/mL)*

Table 2.	**PFOS**	**PFOA**	**MeHg**
Total fish consumption (times/month)	r_s=0.12 p=0.2	r_s=0.02 p=0.8	r_s=0.41 **p<0.001**
Consumption of pike, pikeperch, perch, burbot and eel	r_s=0.24 **p=0.01**	r_s=-0.02 p=0.8	r_s=0.38 **p<0.001**
Consumption of shellfish	r_s=0.25 **p=0.01**	r_s=0.13 p=0.2	r_s=0.32 **p<0.001**
Consumption of salmon and herring	r_s=0.12 p=0.2	r_s=0.06 p=0.5	r_s=0.17 p=0.07

◄ ***Table 2.*** *Correlation coefficients* (r_s) *for PFOS, PFOA and MeHg in blood, and intake of different kinds of fish*