Human Exposure to Organohalogen Compounds in the Faroe Islands

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Abstract

The Faroe Islands in the North Atlantic are part of the sub-Arctic region, a remote region far from industrial activity. In spite of this remoteness, the Islands are not a sanctuary; exposures and effects of environmental pollutants mar its natural beauty and wildlife. In the Arctic regions, fish, sea mammals and seabirds have shown to contain elevated levels of the classical persistent organic pollutants (POPs) such as polychlorinated biphenyls (PCBs), as well as more recent POPs such as the polybrominated diphenyl ethers (PBDEs). Human populations living in the Arctic regions are usually highly dependent on seafood and seabirds as food sources, and diet becomes their major source of exposures to POPs. As reported in the 1980's, residents of the Faroe Islands were shown to have high concentrations of organohalogen substances (OHS) in their breast milk. Long-finned pilot whales (*Globicephala melas*) blubber and meat have been shown to be a major source of OHS exposure for some of the Faroe Islanders.

The main objective of this thesis is to investigate the sources and concentrations of some POPs and their metabolites for the Faroese population. First, human milk and serum from pregnant women (mothers) and children were analyzed for PBDEs, PCBs, and polychlorinated biphenylols (OH-PCB), the major PCB metabolites. Second, POPs were measured in seabirds, i.e. PCBs in fulmars (*Fulmarus glacialis)* and guillemots (*Uria algae*), and PBDEs in fulmars to search for other potential sources of POPs exposure.

The results reinforce previous findings that part of the Faroe Island population is highly exposed to OHS. Median concentrations (430 ng/g lipid weight (l.w.) of CB-153) in maternal serum (1994-95) are among the highest in the world. Serum concentrations of CB-153 in children (age 7, samples collected in the early 2000's) were approximately 90% of those in the mothers, sampled 1994-95. Similarly high CB-153 concentrations (380 ng/g l.w.) were measured in samples of mother's milk, collected in 1999. The OH-PCB concentrations were also high in segments of the population, with 2.9 ng/g fresh weight as the sum of five OH-PCBs. Except for 4-OH-CB107, concentrations of OH-PCBs were generally lower in children than in mothers.

The ΣPBDE median concentrations in maternal serum and human milk (1999) are at the higher end of those reported in Europe, with levels of 9.5 and 8.2 ng/g l.w. respectively. ΣPBDE levels increase in human milk samples collected at three different time points (1987-1999), mainly due to increasing BDE-153 concentrations. The range of serum ΣPBDE concentrations in mothers and children are similar, although the congener patterns show differences. BDE-47 is the dominant congener in maternal serum, while BDE-153 is the major congener in children. The differences seen in PBDE congener patterns may arise differences in dates of sampling (7 years) for the two populations, maternal serum sampled in 1994-95 and children serum sampled in 2000-01, rather than from differences in uptake/metabolism or in contemporary exposures.

PCB concentrations in fulmars and pilot whales show similar ranges. In contrast, PBDE concentrations are 100 times higher in pilot whales than in fulmars. Consequently, Hence, Faroese may be especially exposed to PCBs via consumption of fulmars and fulmar eggs, while the exposure to PBDEs is less pronounced.

Results from this thesis highlight the high exposures to PCBs, OH-PCBs, and PBDEs among residents of the Faroe Islands, a remote region in the Northern Atlantic far away from industrial and urban sources of pollution.

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