PERSISTENT ORGANIC POLLUTANTS AND HEAVY METALS CONTROL IN ESTONIA

Ott Roots[1] and Mart Simm[2]

Ministry of the Environment of Estonia, Mustamäe tee 33, 10616, Tallinn, Estonia[1] Estonian Marine Institute, Marja 4D, 10617, Tallinn, Estonia[2]

Introduction

According to Article 53 of the Constitution of the Republic of Estonia, every person is obliged to preserve the human and natural environment and to compensate for damages they cause to the environment. Since fish generally contain higher levels of toxicants than any other food categorie, diets containing higher amounts of fish may be expected to lead to higher toxicants intake. The breast cancer incidents were higher than expected in women from the Baltic coast and an increase risk for low birth weights in humans (especially boys) has been associated with a high consumption of fish from the Baltic Sea[1].

Methods and Materials

Samples of fish were collected along the Estonian coast at three sampling sites: Tallinn and Kunda at the Gulf of Finland and Pärnu at the Gulf of Riga. The fish were frosen promptly following examination and selection. Lateral muscle tissue or liver (approx. 10 g) from fish were taken for analyses. Description of sampling techniques as well as the analytical procedures can be found in our earlier works[2,3,4]. All solvents used were of the highest quality commercially available. The samples were analyzed by scientists from Estonian Environment Research Centre which is the internationally accredited laboratory.

Results and Discussion

By the World Health Organization (WHO), monitoring of persistent organic pollutants (POPs) and heavy metals in animals – derived food, especially fish, should be carried out in all countries to determine possible sources of this contaminant in the diet. Since 1994, the analysis of hazardous substances from Baltic fish is a part of the national environmental monitoring program – which concentrates on the hazardous organic substances and heavy metals – is based on the analysis of toxic compounds from the muscle tissue and liver of the 2 – 3 years old female Baltic herring [5].
The figure and tables 1 and 2 shows the results of our analysis in years 1994 - 1998.
For each level of sea food consumption the health risk from marine pollutants varies according to their concentration. The joint FAO/WHO Expert Committee on Food Additives (JECFA) generally sets at ADI - the acceptable daily intake of food additive on the basis of the highest "no-observed-effect" (NOEL) level in animal studies. When considering the possible effects of consuming sea food, it is necessary to characterise communities and individuals according to the amounts they consume, since communities in different parts of the world are likely to show the differences in their consumption of sea food. For example, based on FAO food balance data, the European region average consumption of sea food (fish and shellfish) is 60 g per person day and in East-Asia 79 g per person day.

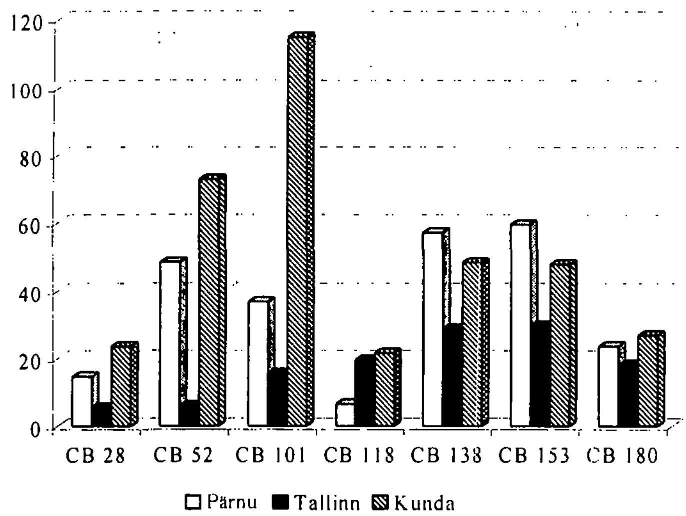

Figure. Mean concentrations (µg kg^{-1} lipid weight) of polychlorinated biphenyls isomers (IUPAC No) in muscle tissue of 2- and 3- year old female herring samples from the Gulf of Riga (Pärnu) and the Gulf of Finland (Tallinn, Kunda).

Table 1. Mean concentrations (µg kg^{-1} lipid weight) of summary DDT in muscle tissue of 2- and 3-year old female herring samples from the Gulf of Riga (Pärnu) and Gulf of Finland (Tallinn, Kunda).

Area	Year		
	1996	1997	1998
Kunda	163	236	164
Tallinn	152	198	93
Pärnu	249	190	90

Table 2. Mean concentrations (mg kg^{-1} wet weight) of heavy metals in 2- and 3-year old female herring from the Gulf of Riga (Pärnu) and Gulf of Finland (Tallinn, Kunda).

Area	Organ/Tissue	Copper	Cadmium	Zinc	Mercury
Kunda	Muscle	0.5±0.2	0.02±0.01	12±4	0.04
Tallinn	Muscle	0.4±0.1	0.01±0.01	11±3	0.02
Pärnu	Muscle	0.4±0.1	0.01±0.01	11±3	0.01
Kunda	Liver	3.0±1.7	0.38±0.16	33±10	0.03
Tallinn	Liver	4.5±3.1	0.49±0.33	25±5	-
Pärnu	Liver	2.5±0.7	0.36±0.22	31±13	0.01

If we look at the amounts of toxicants obtained with food (fish), we can see that even the maximum levels of organochlorines found in the organism of Baltic fish (at the coastal areas of Estonia) do not represent any human health risk, as they are lower than the standartds set by the WHO. Besides, our calculations were made on the ground of 150 g of edible fish per day, compared with the European average of 60 g per day. However, it is known that marine food is not the only route of human exposure and any overall risk assessment must take this into account.
Authors recommends that besides biological parameters of fish (age, length, weight, sex, fat percentage, degree of maturity) in future the feeding conditions of fish (percentage of empty stomachs and the content of different food in stomach) should also be considered as an additional parameter[6]. The interpretation of chemical and biological monitoring provides more comprehensive information on quality assessment and ecological functioning of aquatic ecosystem.

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