SURVEILLANCE OF THE SELECTED FISH AND SHELLFISH FOR DIOXINS

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Introduction

Since fish and shellfish spend their entire lives in the aquatic environment, they incorporate chemicals from this environment into their body tissues. These chemicals, in turn, have bioaccumulated and biomagnified into the tissue of population of fish-eating predators[1,2]. Therefore, fish and shellfish are the primary source of environmental exposure to dioxins. Analyzing fish and shellfish tissues can be served as an important indicator of environmental contaminants to human health [3-4]. However, relatively limited data are available on the levels of dioxins for fish and shellfish in Korea. The results presented here refer to the levels in the edible portion of fish and shellfish species that are the significant contributors to dietary intake. The selected fish and shellfish have been monitored to evaluate PCDDs (polychlorinated dibenzo-p-dioxins), PCDFs (polychlorinated dibenzofurans) and PCBs (polychlorinated biphenyls) contamination from five major cities across Korea; Seoul, Chunchon, Daejon, Kwangju and Busan. The saltwater fish and shellfish of the high amounts consumed that were analyzed included mackerel (Scomber japonica), hair tail (Trichiurus lepturus), yellow croaker (Pseudosciaena polyactis), oyster (Crassostrea gigas), little neck clam (Rudiatapes philippinarum), granular ark shell (Tegillarca granosa) and hard shell mussel (Mytilus coruscus).

Methods and Materials

The seventeen 2,3,7,8-substituted PCDDs and PCDFs, and four co-planar PCBs (#77, #81, #126 and #169) were determined by the US EPA method 1613 with a modification to include co-planar PCBs published previously[5]. The clean up was performed with the automatic system (Power-Prep/P, Fluid Management Systems Inc., USA) and HRMS analysis was done by Finnigan MAT95XL (Thermofinnigan GmbH, Germany). The results were expressed in pg WHO-TEQ/g on a whole weight basis and non-detects (nds) were assigned to zero[6].

Results and Discussion

The data on per capita consumption of foods in Korea (1,290g/day) is summarized in Table 1[7]. The selected fish and shellfish consumption (17.4g/day) accounts for about 7% on Korean food consumption rate of animal origin (247.5g/day). The percent lipid determined during PCDD/F and PCB analyses for samples is ranged from 1.7% to 13.7% and also presented in Table 1. The results for PCDD/Fs and PCBs in fish and shellfish samples are listed in Table 2. Total PCDD/Fs in fish and shellfish varies from 0.001 to 2.939 pgTEQ/g wet weight. The mean concentration of PCDD/Fs (pgTEQ/g ww) of fish and shellfish samples were 0.858 for mackerel, 1.452 for hair tail, 0.043 for croaker, 0.147 for oyster, 0.008 for little neck clam 0.028 for granular ark shell and 0.374 for hard shell mussel, respectively. In addition, the levels of four non-ortho co-planar PCBs in fish are ranged from 0.001 to 6.704 pgTEQ/g wet weight. The average levels of co-planar PCBs (pgTEQ/g ww) of fish and shellfish samples were 1.498 for mackerel, 3.760 for hair tail, 0.208 for

croaker, 0.183 for oyster, 0.027 for little neck clam, 0.032 granular ark shell and 0.554 for hard shell mussel, respectively. Among fish and shellfish analyzed, little neck clam showed the lowest levels of PCDD/Fs and PCBs. Regarding the congener pattern, 2,3,7,8-TCDF and PCB 77 are the most frequently detected congeners, whereas considering WHO-TEFs, 2,3,4,7,8-PeCDF and 3,3'4,4',5-penta PCB (#126) are found at the highest concentration (data are not shown). As presented in Fig. 1 and Fig. 2, co-planar PCBs were contributed a significant fraction to the total TEQ levels as well as to the total levels of PCDD/Fs and co-planar PCBs in the selected Korean fish and shellfish.

The data generated in this study can serve as a general indicator of the contamination levels for fish and shellfish in Korea. Moreover, it can provide a data set for the risk assessment proposed by these environmental contaminants to human exposure, even if further studies should be employed in the future to more adequately characterize PCDD/F and PCB contamination of food in Korea.

References

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Table 1. The per capita consumption of food in Korea

Food group	Consumption (g/day)	Species	Consumption (g/day)	Lipid content (%)
Total	1290.0			
Plant origin	1042.5	Mackerel	6.1	10.2
Animal origin	247.5	Hair tail	2.6	13.7
Meat	69.0	Yellow croaker	4.3	12.6
Egg	22.5	Oyster	1.0	3.0
Milk	87.5	Little neck clam		2.1
Others	3.2	Granular ark shell	3.4	1.7
Fish & shellfish	66.3	Hard shell mussel		7.1

Table 2. Survey results for Dioxins in the selected Korean fish and shellfish

(pgTEQ/g ww)

Food item (n=10)	PCDD/Fs		Co-PCBs	
	Range	Mean	Range	Mean
Mackerel	0.250~1.388	0.858	0.705~2.646	1.498
Hair tail	0.022~2.939	1.452	0.418~6.704	3.760
Yellow croaker	0.011~0.083	0.043	0.003~0.476	0.208
Oyster	0.002~0.196	0.147	0.004~0.259	0.183
Little neck clam	0.001~0.019	0.008	0.001~0.045	0.027
Granular ark shell	0.001~0.123	0.028	0.001~0.056	0.032
Hard shell mussel	0.001~1.226	0.374	0.079~1.188	0.554

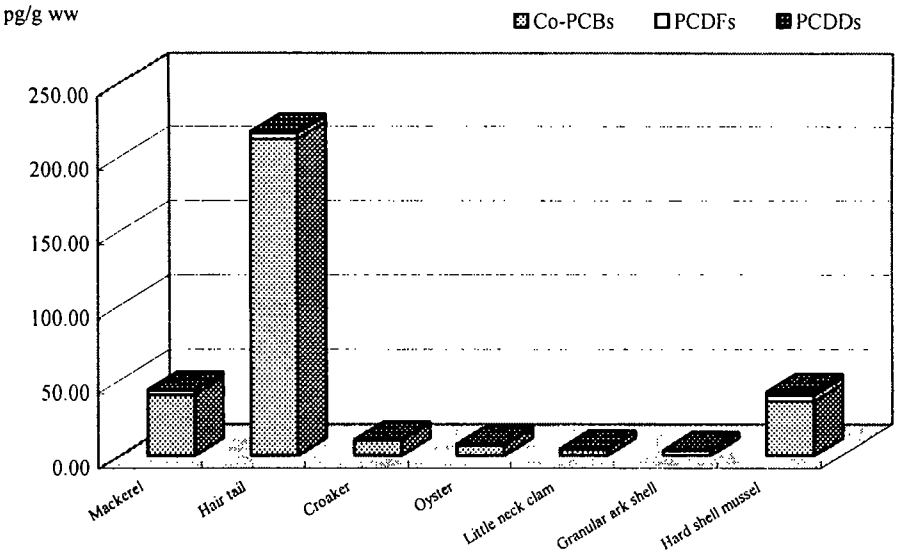

Fig. 1. Stack histogram of dioxin levels in fish and shellfish (pg/g ww)

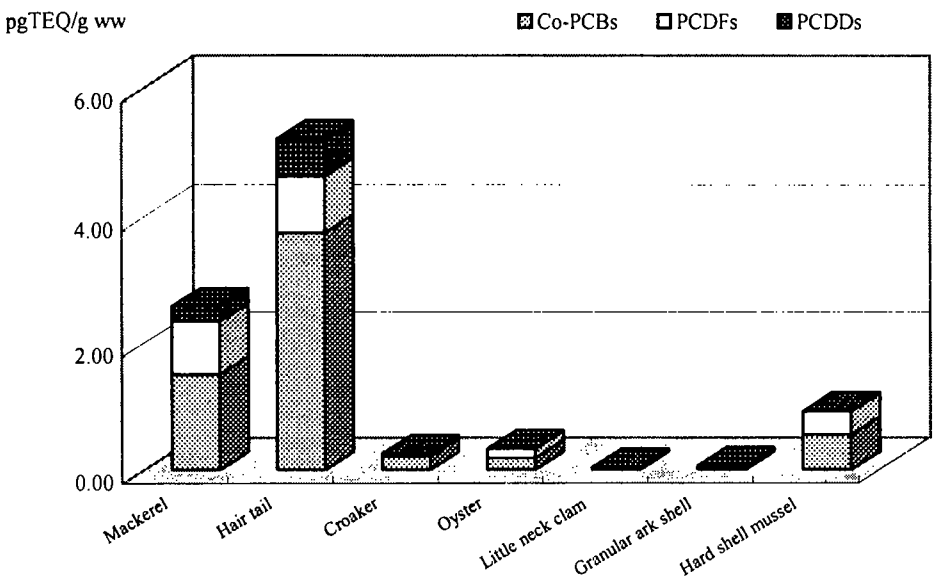

Fig. 2. Stack histogram of dioxin levels in fish and shellfish (pgTEQ/g ww)