LEVELS OF DIOXIN-LIKE COMPOUNDS IN KOREAN FOOD

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Introduction

The Belgium crisis happened in the last year raised a great concern about contaminating food by dioxin-like compounds in Korea. Generally the food consumption is the main route of human exposure to the toxicants so that Korea Food & Drug Administration (KFDA) has been tried to investigating such compounds in Korean-intaking food[1]. Because of toxicity, wide spread presence and persistence in the environment, 2378 substituted polychlorinated dibenzo-p-dioxins (PCDDs) and polychlorinated dibenzofurans (PCDFs), and co-planar polychlorinated biphenyls (PCBs) are regards as dioxin-like compounds[2]. Moreover, the re-evaluated TDI for dioxins recommend by WHO-ECEH/IPCS in 1998 is based on PCDDs, PCDFs as well as on certain PCB congeners[3]. The present study reports the levels of PCDDs, PCDFs (17 congeners) and non-ortho PCBs (#77, #126, and #169) in Korean food. The food samples (pork, mackerel, cheese, and milk) mostly of animal origin were obtained from the markets at 3 different sites in Seoul and analyzed for dioxin-like compounds using an US EPA Method 1613 with a modification to include non-ortho PCBs[4-6].

Methods and Materials

The samples (pork, mackerel and cheese) were ground and homogenized three times. About 20g of each sample were taken, transferred to a pre-extracted cellulose thimble and mixed with 80g of sodium sulfate, anhydrous. The samples were then fortified with the ^{13}C-labeled standards and extracted with Soxhlet extractor using a mixture of hexane/methylene chloride (1:3) for 18 hrs. After extraction, the solvent was removed and the lipid content was determined gravimetrically. The extract was cleaned up using sulfuric acid impregnated silica gel and purified on a series of silica gel, alumina and carbon column prior to analysis by HRGC/HRMS. In case of milk, about 150g was taken, homogenized and worked up as identical as above. For each run, samples were prepared including a method blank and a QC sample. HRGC separation was accomplished using HP6890 with a DB-5MS column (30m, 0.25mmid, 0.1μm film thickness). The oven temperature program was 140°C (held for 1 min), increased at 15°C/min to 220°C and increased at 3°C/min to 270°C (held for 3 min). Helium at a flow rate 0.8ml/min was used as a carrier gas. Injector and transfer line temperature were 260°C each. The samples were splitlessly injected (1μl). HRMS analysis was performed with a Finnigan MAT95XL in MID mode operating positive EI ionization at a resolving power of >10,000 at m/z 314 of PFTBA. The ion source temperature was 250 °C.

Results and Discussion

Table 1 provides the results for the simultaneous determination of PCDDs, PCDFs and non-ortho PCBs in pork, mackerel, cheese, and milk samples. The contaminating levels were calculated as the TEQ values by multiplying with the corresponding WHO-TEFs for each congener. For generating results, non-detects (nds) were assigned to zero. As might be expected, contamination levels appear to differ among species. Pork contains the lowest levels of PCDD/Fs (0.001pgTEQ/g ww) as well as the lowest levels of non-ortho PCBs (0.004pgTEQ/g ww). While mackerel has the highest levels of those compounds (PCDD/Fs; 0.866pgTEQ/g ww, non-ortho PCBs; 1.578pgTEQ/g ww). In case of cheese samples, the levels of dioxin-like compounds range from 0.0001 to 0.0327 and in milk samples range 0.032 to 0.111 pgTEQ/g ww. On the whole, the overall TEQ level of PCDD/Fs was as much as lower than that of non-ortho PCBs in food samples studied. In other words, PCB contribution is greater than that of PCDD/Fs, although the industrial

use of PCBs has been severely restricted in Korea from year 1984. It can be seen in the figure 1, the congener pattern is quite different in food samples studied. Among 20 toxic congeners in Korean-intaking food, PCB #77 is the highest contributing congener as shown at the left side of figure 1 and regarding WHO-TEQ values, PCB #126 is the highest contributing congener as shown at the right side of figure 1. However, in case of PCDD/Fs only, the congener pattern is strongly dependent on the food samples that vary in species, fat content and living circumstances. In conclusion, contamination levels determined give no indication of particular health risk associating with consumption of food samples. Further studies need to be done to fully characterize the levels of dioxin-like compounds in Korean food, but this study could be useful as a reference to evaluate dietary based exposure assessment.

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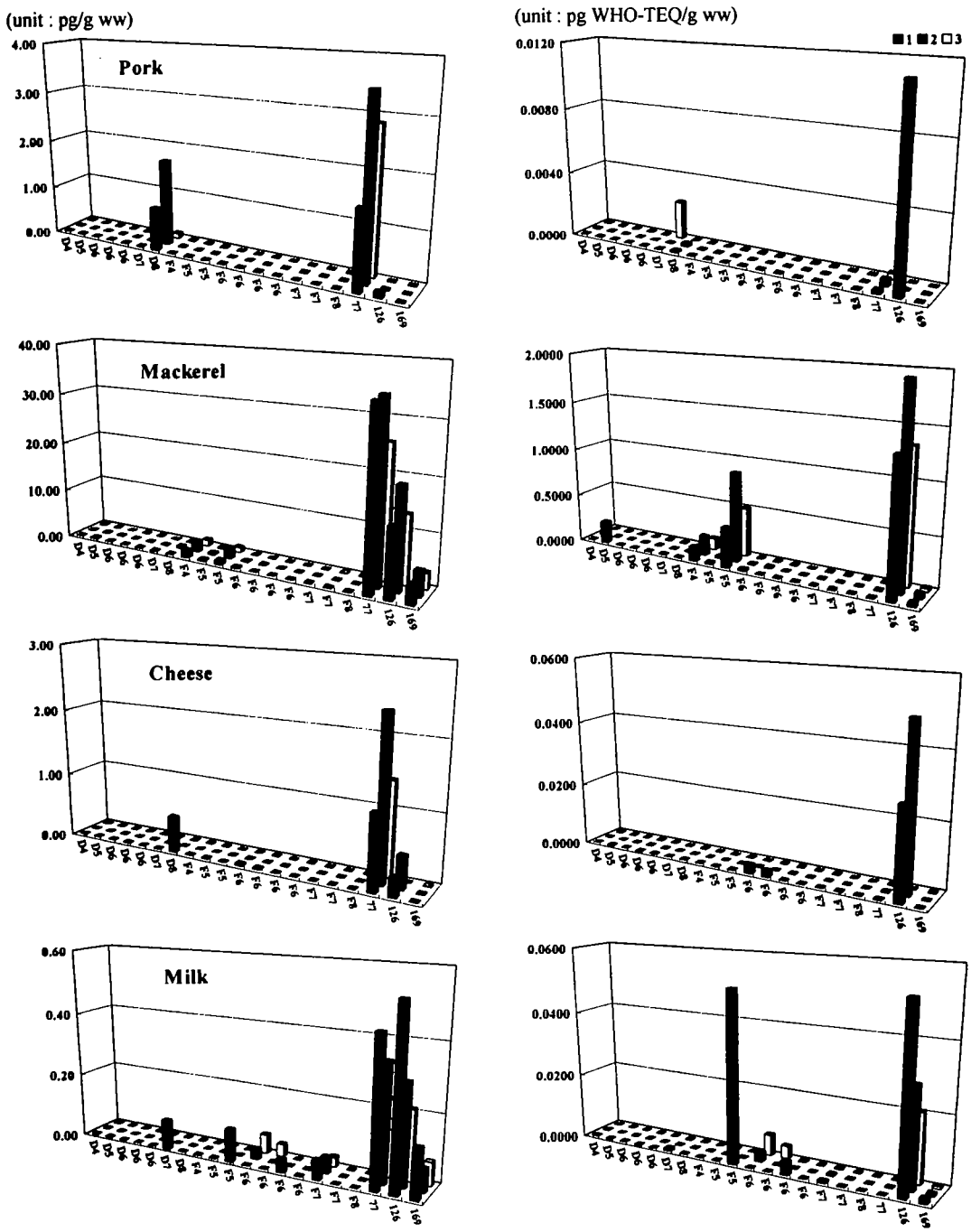

Figure 1. Congener Profiles in pg/g ww(left) and in pg WHO-TEQ/g ww(right).