POPs in US Humans and Food

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Introduction

This paper reports on a series of POPs in U.S. food studies. We first reported PBDE contamination of human milk in all samples and found these were the highest levels reported in humans (Schecter et al. 2003). The levels were orders of magnitude higher than European levels and much higher than Vietnamese levels. Next we began a series of PBDE market basket studies of commonly consumed food from U.S. supermarkets, first in Dallas, Texas, then in Albany, New York and Los Angeles, California. Initially, individual samples were collected and analyzed (Schecter et al. 2004, Schecter et al. 2006). After comparing similar foods from Texas, New York and California and noting no differences by geographical region in food purchased from large chain stores in PBDE levels, we proceeded to a study of pooled food from Texas and analyzed 31 samples of meat, fish or dairy products from 310 individual samples which had been pooled by food type (Schecter et al. 2009a;b, Schecter et al 2010). In this study, PBDEs, HBCD, non-dioxin like PCBs, PFCs and pesticides were analyzed. We report, for the first time to the best of our knowledge, HBCD congeners and also PFCs in U.S. food and estimate daily consumption for these and the other measured POPs.

Materials and Methods

Food was sampled beginning in the early 2000s with individual samples collected first from supermarkets in Dallas, Texas, then Texas, New York and California. Samples were purchased and then quickly frozen at -80° C and shipped to Eurofins laboratory in Hamburg Germany or to the Wadsworth Laboratory in Albany, NY for analysis. In the most recent study, 10 individual samples were purchased from five large supermarket chains in Dallas, Texas on two occasions for each for 31 types of food. Sampling was done over a two month period in 2008-2009. The 310 samples were shipped to Eurofins laboratory for pooling with 10 samples per pool and analyzed for the compounds listed above. Methods have been described elsewhere (Päpke et al. 2004, Schecter et al. 2004, Schecter et al. 2009b, Schecter et. al. 2010). Chemicals analyzed were **PBDEs**: BDE-17, 28, 47, 49, 66, 85, 99, 100, 119, 138, 153, 154, 183, 196, 197, 206, 207, 209; **HBCDs**: Sum of alpha, beta and gamma stereoisomers; **PFCs:** PFOS, PFOA, PFBS, PFXxS, PFHxA, PFHpA, PFNA, PFDA, PFOSA, PFDes, PFDoA; **PCBs:** Congeners 28, 52, 101, 118, 138, 153, 180; **Pesticides:** alpha, beta, gamma, delta and epsilon HCH, DDT and DDT metabolites, Aldrein, dieldrin, endrin, isodrin, alpha and beta endosulfan, endosulfan sulfate, toxaphene 26, 50 and 62, heptachlor, mirex, chlordane, oxychlordane, transnonochlor, cis- and trans-heptachlorepoxide, octachlorostyrene.

Results and Discussion

PBDEs in human milk, the first food consumed, were present in all samples (N=91). Levels were the highest detected worldwide with a range from 6-600 ppb, lipid, and skewed distribution with few samples in the higher levels. HBCD was found in low levels (mean of 0.5 ng/g) similar to levels reported in Europe and with only the alpha isomer detected, the opposite of what is found in commercial mixtures where the gamma predominates (Ryan et al. 2006). For U.S. food from the market basket surveys, fish usually contained higher levels of PBDEs than meat or dairy products on a whole weight (ww) basis, although meat was higher for one survey. For PBDEs, meat was responsible for more dietary intake than fish or dairy based on levels as well as dietary patterns in the US where fish is not as popular a diet item as it is in many countries. Measurable levels of PFOA and HBCD are reported in US food for the first time. A number of long banned chemicals such as PCBs, DDT and metabolites and other pesticides are found in some food.

Figure 1 shows our estimated daily intake for the average American of PBDEs and HBCD from a variety of sources, meat, fish, dairy and eggs, and vegetables in pg/day. Total PBDE levels, including BDE 209, exceed levels of HBCD. Figure 2 shows estimated dietary intake of various pesticides as well as PCBs and PFOA from meat, fish, dairy and eggs, and vegetables in ng/day for an average American. “DDT” includes metabolites of DDT.

The finding of many POPs in U.S. food including some which have long been banned suggests the need for improved supervision of food to prevent contamination of food with persistent toxic pollutants from reaching consumers. The findings that many of the POPs found are associated with animal (and fish) fat suggests some approaches in cooking and in diet to decrease intake. The combination of many chemicals may result in further health risk than the presence of each chemical alone.

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Figure 1: Dietary Intake of PBDE and HBCD (pg/day)

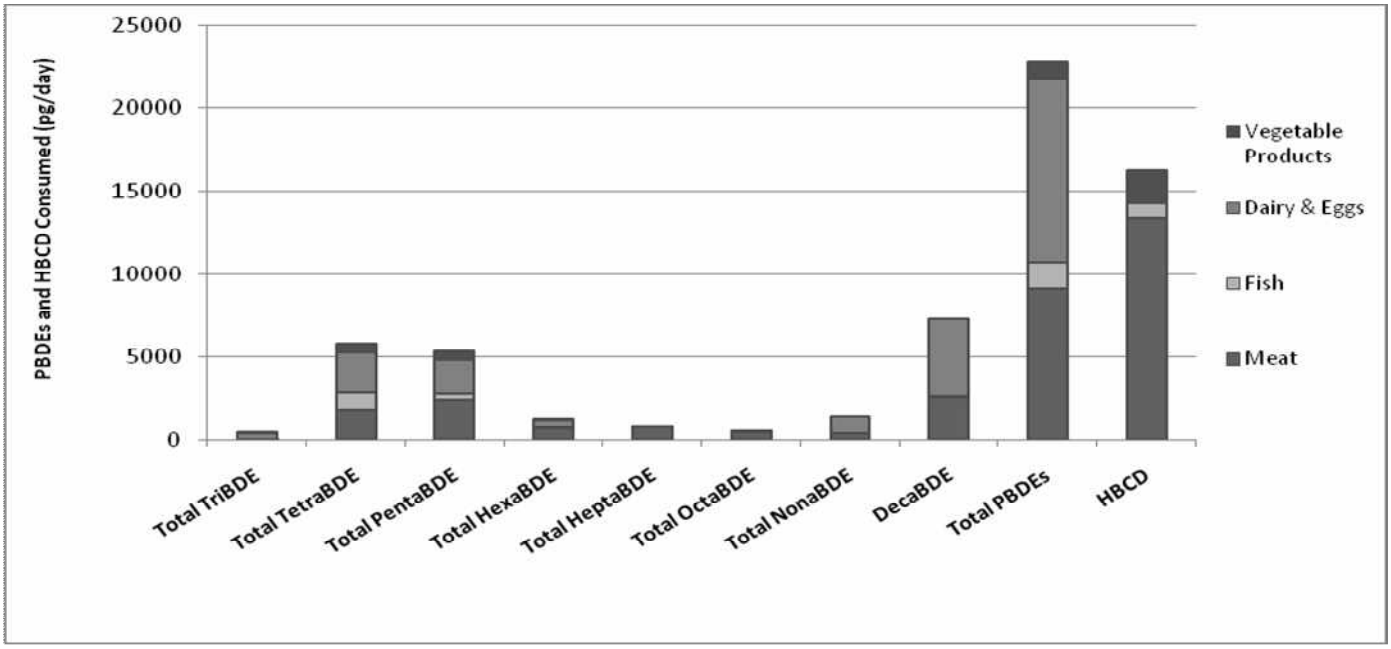
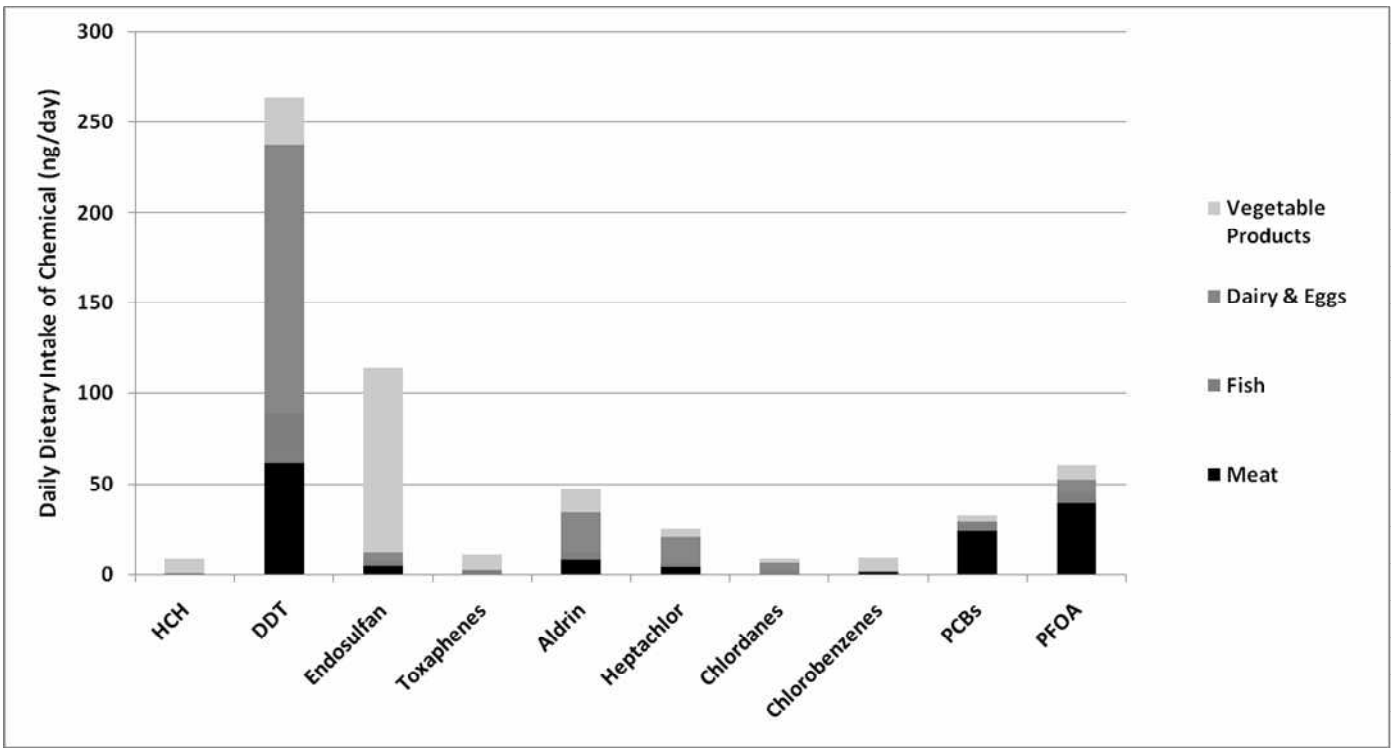
Figure 2: Estimated Dietary Intake of Pesticides, PCBs, and PFOA (ng/g)