

DIOXIN, DIBENZOFURAN AND COPLANAR PCB LEVELS IN HIGH AND LOW FAT AMERICAN ICE CREAM AND YOGURT

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Introduction

We previously presented data on dioxin levels in food from Germany and the US, including beef, pork, poultry, fish, and dairy products¹⁻⁸. Dioxin levels in American "fast food" have been reported separately from supermarket food, as preparation and composition are different⁹. Recently, there has been interest in popular ice cream brands sold in US supermarkets. We decided to test various "Ben and Jerry's®" ice cream flavors having both high and low fat contents. The data is presented on whole weight, as consumed, and with lipid percent. Percent lipid ranged from .5% to 14% and total dioxin toxic equivalents from PCDD/Fs ranged from .0057 parts per trillion (ppt) to .048 ppt, on a whole weight basis.

Methods and Materials

Three containers of Ben and Jerry's ice cream and one of yogurt, a popular American brand of ice cream and frozen yogurt, were purchased at a Dallas, Texas supermarket, and shipped frozen on dry ice to Germany for dioxin analysis. The following flavors, "Chocolate-Chip Cookie Dough Ice Cream", "Peanut Butter Cup Ice Cream", "S'Mores Low Fat Ice Cream", and "Cherry Garcia Low Fat Frozen Yogurt", were chosen at a Dallas, Texas supermarket based on a range of lipid contents. The samples were kept frozen at the laboratory until analyzed using high resolution gas chromatography-high resolution mass spectrometry in a manner previously described^{1, 2, 10, 11}. The laboratory has been certified by the World Health Organization for analysis of food and also for human blood and milk.

Results and Discussion

Table 1 shows congener levels for the four ice cream samples analyzed. All data is presented in pg/g (ppt), with percent lipid indicated. Dioxin toxic equivalents (TEQ) were calculated using 1998 World Health Organization toxic equivalency factors. The highest total TEQ value was from the "Peanut Butter Cup" ice cream with .048 ppt, followed by "Chocolate-Chip Cookie Dough" with .637 ppt, "Cherry Garcia" low fat frozen yogurt with .213 ppt, and "S'Mores" low fat ice cream having .189 ppt. Total measured PCDD/PCDF levels range from .189 ppt for the "cherry Garcia" low fat yogurt sample to .952 ppt for "Peanut Butter Cup" ice cream sample. For all samples measured, dioxin levels contributed more than dibenzofuran levels to the total PCDD/PCDF level.

American ice cream and frozen yogurt, like other dairy products sampled previously, is contaminated by chlorinated dioxins and dibenzofurans^{3, 5-7}. During the past decade, levels of

PCDD/Fs may be decreasing in food and human tissues in the US, as appears to be the case in Germany and elsewhere in Europe 4, 13, 14.

Prior testing of Ben & Jerry's World's Best Vanilla® using both high resolution GC-MS and CALUX method of analysis reported a higher total dioxin TEQ of .898 ppt for GC-MS and $.79 \pm .39$ ppt for CALUX method (% lipid: 5.1 ± 1.3)¹² than was found for all samples represented in Table 1.

At this time, we do not have sufficient numbers or representative samples with congener data from previous American ice cream analyses to compare dioxin and dibenzofuran levels over time. However, this data does document current levels of dioxins and dibenzofurans in one popular brand of American ice cream and frozen yogurt. It can be noted that fat content as well as dioxin content in these and presumably other American ice cream varies considerably.

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Table 1.

Measured Levels and Dioxin Toxic Equivalents of Dioxins and Dibenzofurans in Ice Cream, 2000

Congeners	1998 WHO TEFs	Ben & Jerry's Chocolate -Chip Cookie Dough	Ben & Jerry's Peanut Butter Cup Ice Cream	Ben & Jerry's S'Mores Low Fat Ice Cream	Ben & Jerry's Cherry Garcia Low Fat Frozen Yogurt
2378 TCDD	1	0.004	0.008	0.001	0.002
12378 PnCDD	1	0.014	0.014	0.002	0.003
123478 HxCDD	0.1	0.013	0.013	0.001	0.003
123678 HxCDD	0.1	0.05	0.064	0.005	0.011
123789 HxCDD	0.1	0.016	0.015	0.002	0.004
1234678 HpCDD	0.01	0.148	0.252	0.034	0.044
OCDD	0.0001	0.296	0.448	0.12	0.114
2378 TCDF	0.1	0.009	0.013	0.004	0.008
12378 PnCDF	0.05	ND(.002)	ND(.003)	0.001	0.001
23478 PnCDF	0.5	0.01	0.015	0.001	0.002
123478 HxCDF	0.1	0.01	0.015	0.002	0.001
123678 HxCDF	0.1	0.01	0.013	0.001	0.002
234678 HxCDF	0.1	0.007	0.013	0.001	0.002
123789 HxCDF	0.1	ND(.002)	ND(.003)	ND(.001)	0
1234678 HpCDF	0.01	0.029	0.041	0.006	0.008
1234789 HpCDF	0.01	0.003	0.004	0.001	0.001
OCDF	0.0001	0.016	0.021	0.006	0.007
Total PCDDs		0.541	0.814	0.165	0.181
Total PCDFs		0.096	0.138	0.024	0.032
Total PCDD/PCDFs		0.637	0.952	0.189	0.213
Total PCDD/PCDF TEQs		0.039	0.048	0.0057	0.017
% Fat		8.7	14	0.5	0.6

Whole-weight basis, 1998 WHO Toxic Equivalency Factors