

DIOXIN AND DIBENZOFURAN LEVELS IN THE MILK OF WOMEN FROM FOUR GEOGRAPHICAL REGIONS IN ITALY AS COMPARED TO LEVELS IN OTHER COUNTRIES

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INTRODUCTION

Pooled human milk samples from four different geographical locations in Italy (both urban and rural) were collected in 1987 in order to compare levels of dioxin and dibenzofuran contamination in Italian mothers' milk. In addition, the samples were analyzed for the highly toxic dioxin-like coplanar PCBs. The results are compared with previous findings from Germany and the U.S. Although some variation is observed between the Italian samples, no striking differences are noted from levels seen in other industrialized countries at the present time.

METHODS

The samples were collected from 9 mothers in Pavia (rural villages), 9 mothers in Rome, 27 mothers in the Florence area (half city area and half surrounding villages), and 14 mothers from Milan. Mothers' ages ranged from 16 - 43 years old. Sampling was done between the fourth and ninth week of nursing in all but the Milan sample, which was taken from mothers between the fourth and twenty-seventh week of nursing, with an average of thirteen weeks. Samples were frozen after collection and shipped to the analytical laboratory in a frozen state.

The analytic technique employed was similar to that used by the Canadian dioxin laboratory in its participation in the recent World Health Organization interlaboratory validation studies and will not be repeated here.^{1,2}

RESULTS AND DISCUSSION

The PCDD/F results shown in Table I seem similar to those previously reported from other industrial countries in Europe and elsewhere.^{3,6} This is not unexpected, since over 90% of dioxin body burden in the general population is from meat, fish, and dairy products in the diet. There is some variation in 2,3,7,8-TCDD in these samples with the Pavia, Rome, and Florence samples ranging from 6.9 to 8.6 ppt, and Milan at 3.2 ppt on a lipid basis. The first three show higher levels of TCDD than Germany at 3.2 ppt and the U.S. at 3.3 ppt lipid.^{2,5}

To date, only Vietnam has been found to have widely differing dioxin levels in the nursing mothers' milk from different locations. In Vietnam, northern locations have markedly less industry and lower human dioxin body burdens than the more industrialized south, where a special environmental exposure also occurred from the spraying of Agent Orange, contaminated with 2,3,7,8-TCDD.^{3,5}

For 2,3,4,7,8-PnCDF, which is usually higher in Europe than in the U.S., these Italian samples range from 11 to 21 ppt lipid. These levels are higher than the U.S. at 7 ppt, but lower than the German level at 27 ppt, lipid.³⁻⁶

The level of total coplanar PCBs is similar in these samples, ranging from 201 ppt to 213 ppt. Significantly, the coplanar PCBs contribute from 16.2 to 17.4 ppt to the "Dioxin Toxic Equivalents" (TEQs), based on current estimates of toxicity.⁹

As shown in Figure I, the Italian dioxin and dibenzofuran TEQs⁷⁻⁹ range between 18 and 31 ppt, lipid. They are similar to Germany at 29, but slightly higher than the U.S. at 16. Russia, the north of Vietnam, and Cambodia are markedly lower at 12, 9, and 3 ppt, lipid, respectively. Not surprisingly, the south of Vietnam exhibits the highest TEQ in the series presented, at 34 ppt, lipid, although 2,3,7,8-TCDD levels have been declining in milk samples over the two decades that have passed since the spraying of Agent Orange over South Vietnam ceased in 1970.

Further studies are needed to provide representative data from Italy as well as from other countries. Although this paper focuses attention on dioxins and the coplanar PCBs, other toxic chemicals of concern are also present in human breast milk.^{4,5}

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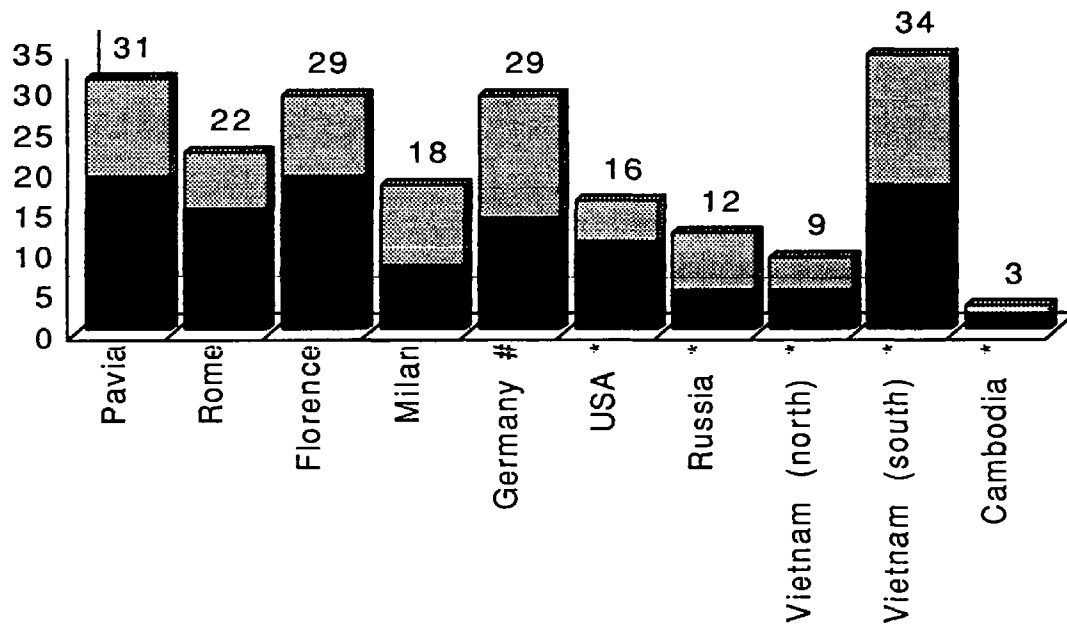
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TABLE I
DIOXINS, DIBENZOFURANS AND COPLANAR PCBs IN HUMAN MILK FROM
ITALY, GERMANY AND THE UNITED STATES

Congener	TEF	Pavia N=9	Rome N=9	Florence N=27	Milan N=14	Germany ⁶ N=526	U.S. ³ N=42
2,3,7,8-TCDD	1	8.6	7.0	6.9	3.2	3.2	3.3
1,2,3,7,8-PnCDD	0.5	10.0	7.2	9.9	4.6	10.1	6.7
1,2,3,4,7,8-HxCDD	0.1	+	+	+	+	8.4	4.9
1,2,3,6,7,8-HxCDD	0.1	41.0	31.0	46.0	18.0	35.8	30.5
1,2,3,7,8,9-HxCDD	0.1	7.2	5.1	9.8	3.9	6.4	6.2
1,2,3,4,6,7,8-HpCDD	0.01	44.0	46.0	92.0	32.0	41.2	42.0
OCDD	0.001	117.0	95.0	191.0	120.0	207.9	233.0
2,3,7,8-TCDF	0.1	2.4	2.1	2.4	2.5	1.7	2.85
2,3,4,7,8-PnCDF	0.5	21.0	11.0	16.0	15.3	26.7	7.3
1,2,3,7,8-PnCDF	0.05	0.6	0.8	0.9	0.9	0.5	0.45
1,2,3,4,7,8-HxCDF	0.1	6.0	3.6	6.1	5.4	7.8	5.55
1,2,3,6,7,8-HxCDF	0.1	5.5	2.9	5.9	7.2	6.5	3.2
1,2,3,7,8,9-HxCDF	0.1	ND(0.5)	ND(0.5)	ND(0.5)	ND(0.5)		ND(0.5)
2,3,4,6,7,8-HxCDF	0.1	2.6	1.6	2.9	8.5	3.4	1.85
1,2,3,4,6,7,8-HpCDF	0.01	4.8	5.2	7.7	15.0	5.5	4.0
1,2,3,4,7,8,9-HpCDF	0.01	ND(0.5)	ND(0.5)	ND(0.5)	ND(0.5)		ND(0.5)
OCDF	0.001	ND(2)	ND(2)	ND(2)	ND(2)	1.4	4.1
3,3',4,4'-TCB	0.01	20.0	9.3	9.7	20.0	*	*
3,3',4,4',5-PnCB	0.1	128.0	149.0	135.0	129.0	*	*
3,3',4,4',5,5',-HxCB	0.05	65.0	49.0	56.0	62.0	*	*
Total Coplanar PCBs		213	207	201	211	*	*
Total Dioxins		228	191	356	182	313	327
Total Dibenzofurans		44	29	43	56	54	30
Total PCDD/Fs		272	220	399	238	367	357
Total Coplanar PCB TEQ		16	17	16	16	*	*
Total PCDD TEQ		19	15	19	8	14	11
Total PCDF TEQ		12	7	10	10	15	5
Total PCDD & PCDF TEQ		31	22	29	18	29	16
Total PCDD/F & PCB TEQ		48	39	45	34	*	*

Samples are from pooled blood except Germany, which is the mean of 526 individual analyses. Totals are rounded * = Coplanar PCBs were not reported in their work. ND = Not detected with detection limit in brackets. + = See 1,2,3,6,7,8-HxCDD for total of both congeners ⁶ See reference number 6. ³ See reference number 5.

FIGURE 1: DIOXIN & DIBENZOFURAN TOXIC EQUIVALENTS IN MILK FROM VARIOUS COUNTRIES PPT, LIPID



PCDF TEQ	12	7	10	10	15	5	7	4	16	1
PCDD TEQ	19	15	19	8	14	11	5	5	18	2

#-See reference 6 *-See reference 5