DIOXIN LEVELS IN MILK AND BLOOD FROM GERMANY AND THE USA. ARE DIOXIN BLOOD LEVELS DECREASING IN BOTH COUNTRIES?

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INTRODUCTION

In previous papers, we and others presented data suggesting a decrease in blood and milk dioxin levels during the past decade for the European samples and American milk, but not for American blood[1].

We have collected new biological specimens from Germany and new specimens from the USA, which will be compared with our previous findings. In the summary of the U.S. EPA Dioxin Reassessment, released in May, 2000, EPA noted that it believed there was a reduction in total known dioxin emissions in the USA[2]. It is not clear however what percent of dioxin emissions are known, and what percent are not known. In addition, U.S. incinerator regulations only require infrequent measurement for dioxins, many incinerators are not state of the art, and recycling is not widely practiced in the USA. In Germany, recycling is more common, and municipal solid waste (MSW) incinerators in operation are of a much higher quality than were earlier incinerators. The EPA recently published an estimate of dioxin emission from household garbage burning, which concluded that a very large part of dioxin production might be from such burning. Further uncertainty is introduced in that systematic representative studies of blood and breast milk for dioxin analysis has not been conducted, as best we know, in any country to date. Samples are usually from select populations. Also, in some studies (one in Sweden), HIV testing for the virus of AIDS has recently been required, limiting the number of women who volunteer for milk testing as compared with previous samplings. In North Rhine Westphalia, Germany, fewer women now volunteer for the State sampling of breast milk each year than was previously the case, limiting sample size considerably.

MATERIALS AND METHODS

Dioxin data from Germany for the past 10 years, from special sources, exist in the files of samples analyzed at ERGO laboratory. Selected analyses where no elevation of dioxins was noted were used for this paper. Our previous presentations and papers indicated a decrease in German blood levels, to a remarkable degree in a short time period, less than 10 years. This paper will add the past years' data to the analysis. In the USA, we collected pooled samples from a younger population (N=100) and from an older population (N=100). These were from left over samples at a Texas hospital which were collected for this study anonymously and which were ready to be discarded after the medical testing had been performed. We wished to see if any difference could

be noted between these new samples and our previous blood dioxin samples from the 1980's and 1990's and also between the younger and older populations.

High-resolution gas chromatography mass-spectrometry was used to analyze the specimens. The laboratory, ERGO, has previously been certified by the World Health Organization for analysis of dioxins, dibenzofurans and PCBs in human milk, human blood, and in food. The methods have been described in detail elsewhere and will not be repeated here[2,3].

RESULTS AND DISCUSSION

The samples of German blood are being collected and evaluated at the time of abstract preparation. As seen in Table 1, our most recent data showed a marked decline in German blood (and also milk) dioxin levels during the past decade[1]. The new (collected in 2000) American samples are being analyzed at the present time. Our recent, previous papers showed no change in dioxin levels in American blood levels but did find a decrease in American milk levels (Table 2)[1]. The sample size for milk was small; and of course, the nursing mothers were younger than those sampled for the general US blood samples, so would be expected to have a lower dioxin content than that found in older persons. However, that would not explain the lower level of dioxins compared to earlier American breast milk samples.

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REFERENCES:

1. Schecter A.J., Paepke O. and Fuerst P. (1996), Is there a decrease in general population dioxin body burden? A review of German and American data. Organohalogen Compounds 30, 57-60.
2. EPA Dioxin Reassessment Summary Document for Intragovernmental Use, May 2000.
3. Paepke O., Ball M., Lis A. and Sheunert (1989), PCDD and PCDF in whole blood samples of unexposed persons. Chemosphere 19, 941-948.
4. WHO Regional Office for Europe Consultation on the third round of interlaboratory quality control studies on levels of PCBs, PCDDs and PCDFs in human milk, blood, cow's milk and fish (1992), Voltera, Italy.

TABLE 1. COMPARISON OF MEAN DIOXIN, DIBENZOFURAN, AND DIOXIN TOXIC EQUIVALENT BLOOD AND MILK LEVELS IN GENERAL POPULATION ADULTS FROM GERMANY AT DIFFERENT TIMES (ppt, lipid)

		German Blood*				German Breast Milk**			
		1989		1994		1991		1995	
		N = 102		N = 134		N = 111		N = 38	
Congeners	TEF	Measured	TEQ	Measured	TEQ	Measured	TEQ	Measured	TEQ
DIOXINS									
2,3,7,8-TCDD	1	3.6	3.6	2.9	2.9	3.4	3.4	2.1	2.1
1,2,3,7,8-PeCDD	0.5	13.8	6.9	6.3	3.15	8.0	4.0	5.7	2.85
1,2,3,4,7,8-HxCDD	0.1	10.9	1.09	6.9	0.69	7.8	0.78	4.8	0.48
1,2,3,6,7,8-HxCDD	0.1	54.6	5.46	26.7	2.67	29.3	2.93	21.8	2.18
1,2,3,7,8,9-HxCDD	0.1	10.6	1.06	4.9	0.49	4.6	0.46	2.9	0.29
1,2,3,4,6,7,8-HpCDD	0.01	92.4	0.92	45.3	0.45	35.8	0.36	21.9	0.22
1,2,3,4,6,7,8,9-OCDD	0.001	610	0.61	370	0.37	170	0.17	121.8	0.12
Total PCDDs		**796**	**20**	**463**	**11**	**259**	**12**	**181**	**8**
DIBENZOFURANS									
2,3,7,8-TCDF	0.1	2.3	0.23	1.9	0.19	0.8	0.08	0.6	0.06
1,2,3,7,8-PeCDF	0.05	2	0.1	0.5	0.025	0.4	0.02	0.3	0.015
2,3,4,7,8-PeCDF	0.5	37	18.5	12.8	6.4	19.2	9.6	13.5	6.75
1,2,3,4,7,8-HxCDF	0.1	15.4	1.54	7.9	0.79	7.5	0.75	4.9	0.49
1,2,3,6,7,8-HxCDF	0.1	13.3	1.33	5.8	0.58	5.4	0.54	3.7	0.37
2,3,4,6,7,8-HxCDF	0.1	4.3	0.43	2.6	0.26	2.6	0.26	1.7	0.17
1,2,3,7,8,9-HxCDF	0.1	1.7	0.17	nd	nd	–	–	–	–
1,2,3,4,6,7,8-HpCDF	0.01	23.4	0.234	11.4	0.114	4.4	0.044	2.8	0.028
1,2,3,4,7,8,9-HpCDF	0.01	1.5	0.015	0.6	0.006	–	–	–	–
1,2,3,4,6,7,8,9-OCDF	0.001	4.2	0.0042	2.6	0.0026	1.3	0.0013	0.7	0.0007
Total PCDFs		**105.1**	**22.6**	**46.1**	**8.4**	**41.6**	**11.3**	**28.2**	**7.9**
Total PCDD/PCDFs		**901**	**42**	**509**	**19**	**300**	**23**	**209**	**16**

* Individual samples analyzed by O. Päpke, ERGO Laboratory (pg/g (ppt)). 1989 mean age = 36.6; mean age 1994 = 40.4
** Samples analyzed by P. Fürst (ng/kg, (ppt))

TABLE 2. MEAN DIOXIN, DIBENZOFURAN, AND DIOXIN TOXIC EQUIVALENT BLOOD AND MILK LEVELS IN GENERAL UNITED STATES POPULATION ADULTS AT DIFFERENT TIMES (ppt, lipid)

		United States Blood										United States Breast Milk			
		1980's		1992		1995		1996		1996		1988		1995/8	
Congeners	TEF	N = 28(a)		N=44(b)		N=4(c)		N = 100 (d)		N = 100 (e)		(n = 43)(f)		N=5	
		Measured	TEQ	Measured	TEQ	Measured	TEQ	Measured	TEQ	Measured	TEQ	Measured	TEQ	Measured	TEQ
DIOXINS															
2,3,7,8-TCDD	1	3.5 (g)	3.5	3.8 (h)	3.8	1.2	1.2	4.3	4.3	4.2	4.2	3.3	3.3	1.45	1.45
1,2,3,7,8-PeCDD	0.5	7.7	3.85	9.3	4.63	2.65	1.33	8.7	4.35	9.8	4.92	6.7	3.35	2.48	1.24
1,2,3,4,7,8-HxCDD	0.1	9.3	0.93	9.8	0.68	3.38	0.34	9.7	0.97	10.6	1.06	6	0.6	3.01	0.30
1,2,3,6,7,8-HxCDD	0.1	64	6.4	72.1	7.21	27.18	2.72	63.7	6.37	67.9	6.79	6.2	0.62	20.1	2.01
1,2,3,7,8,9-HxCDD	0.1	13	1.30	12	1.19	3.6	0.36	7.8	0.78	10.7	1.07	30.5	3.05	3.5	0.35
1,2,3,4,6,7,8-HpCDD	0.01	135	1.35	119	1.19	37.2	0.37	102.1	1.02	116.5	1.17	42	0.42	34.0	0.34
1,2,3,4,6,7,8,9-OCDD	0.001	1113	1.11	794	0.79	270	0.27	780.5	0.781	879.8	0.88	233	0.23	104	0.10
Total PCDDs		**1342**	**18.4**	**1016**	**15.7**	**345**	**6.6**	**977**	**18.57**	**1100**	**20.1**	**328**	**11.6**	**169**	**5.8**
DIBENZOFURANS															
2,3,7,8-TCDF	0.1	–	–	2.3	0.23	1.4	0.14	< (2)	0.10	<(2.00)	1.0	2.9	0.29	0.91	0.09
1,2,3,7,8-PeCDF	0.05	–	–	1.2	0.06	1.9	0.95	ND(1.4)	0.04	ND (1.9)	0.95	7.3	3.65	0.51	0.03
2,3,4,7,8-PeCDF	0.5	9.2	4.60	8.8	4.38	1.0	0.00	11.1	5.55	9.3	9.3	0.5	0.025	2.81	1.40
1,2,3,4,7,8-HxCDF	0.1	13.3	1.33	10.6	1.06	3.8	0.38	14.1	1.41	14.0	14.0	5.6	0.56	3.88	0.39
1,2,3,6,7,8-HxCDF	0.1	7.4	0.74	6.9	0.61	2.5	0.25	7.9	0.79	7.9	7.9	3.2	0.32	2.40	0.24
2,3,4,6,7,8-HxCDF	0.1	2	0.20	2.8	0.28	1.0	0.10	ND (3.7)	0.19	ND (4.1)	2.1	1.9	0.19	1.41	0.14
1,2,3,7,8,9-HxCDF	0.1	–	–	2.8	0.28	1.7	0.17	3.5	0.35	4.00	4.0	–	–	0.15	0.02
1,2,3,4,6,7,8-HpCDF	0.01	27	0.27	19.6	0.20	8.5	0.09	12	0.12	13.9	13.9	4.1	0.041	5.43	0.05
1,2,3,4,7,8,9-HpCDF	0.01	–	–	3.1	0.03	1.4	0.01	ND (4)	0.02	4.9	2.45	4.1	0.041	0.53	0.01
1,2,3,4,6,7,8,9-OCDF	0.001	–	–	9.3	0.01	5.0	0.003	< 5	0.003	ND(5.00)	2.50	4.1	0.0041	2.46	0.002
Total PCDFs		**58.9**	**7.1**	**67.4**	**7.1**	**28.2**	**2.1**	**52.0**	**8.56**	**52.0**	**7.50**	**33.7**	**5.1**	**20.48**	**2.37**
Total PCDD/PCDFs		**1401**	**25.6**	**1084**	**22.8**	**373**	**8.7**	**1029**	**27.1**	**1152**	**27.6**	**398**	**20**	**189**	**8.16**

(a) Mean of 28 individual serum analyses, Massachusettes Vietnam veterans (*ref.6*)
(b) Mean for 44 blood serum samples pooled for one analysis, Michigan Vietnam Veterans (ref.9)
(c) Four U.S. individuals from Florida.
(d) Whole blood analyzed
(e) Serum analyzed
(f) Average of two pooled samples: Binghamton , NY (n=21); Los Angeles, CA (n = 22), collected and analyzed in the late 1980's.
(g) TEQ for TCDD values<10 ppt
(h) TEQs for 44 veterans without elevated TCDD levels