

INFANT EXPOSURE TO PCDD/Fs IN PORTUGAL: FIRST RESULTS FROM AN ENVIRONMENTAL HEALTH SURVEY PROGRAM NEAR LISBON

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Introduction

Breast-feeding may expose infants to high levels of toxic environmental pollutants, such as some polychlorinated dibenzodioxins (PCDDs) and polychlorinated dibenzofurans (PCDFs) (usually termed *dioxins*), that are persistent lipophilic compounds. The responses exhibited by the infant organ systems, that are in varying stages of development, are influenced by several factors, including the chemical nature of the agents and the timing and duration of the exposure during the developmental period¹. Because of the relatively short period of intake and the accepted benefits of breastfeeding, the World Health Organization did not recommend limitations on breastfeeding, even in higher risk of dioxin exposure, as is the case of female workers in industries that manufacture or use products contaminated with PCDD/Fs.

The analysis of dioxins in breast milk provides a non-invasive way of collecting samples from a biological fluid whose levels correlate well with body burden. As part of an Environmental Health Survey Program, relative to the VALORSUL municipal waste incinerator facility (near Lisbon), dioxin breast milk levels in a population sample have been determined. The ultimate objective was to determine whether living in the vicinity of VALORSUL increases the maternal dioxin exposure and accordingly their breast-fed infants. Data will also be collected longitudinally in order to provide information on trends in breast milk dioxin levels, which will indicate whether controls on sources of these pollutants are effective. This type of information will provide a scientifically based message to Health professionals and mothers on the risks and benefits of breast-feeding.

Materials and methods

Fifty-two (52) apparently healthy women (non-occupationally exposed, primiparous and/or breast-feeding first child or, at least, 3 years after breast-feeding the last child), from the seventy-three (73) who volunteered to participate in the study, breast milk samples have been collected during a visit to the women residence four weeks after delivery. Samples of plasma from all parturients and from umbilical cords have also been collected, respectively before labor and after delivery, to evaluate prenatal (transplacental) exposure to heavy metals, namely lead. For gathering relevant information not only on study participants (for example, age, residence, parity, smoking habits, use of medicines, dietary information on recent fat intake, occupational exposure), but also on their newborns, a self-administered questionnaire was applied. Complementary information was obtained from the mothers and newborns records at the Maternidade Dr. Alfredo da Costa in Lisbon, after informed consent given by the women. The study protocol has been approved by both the Ethics Committees of the Faculty of Medicine, University of Lisbon, and of the Maternidade Dr. Alfredo da Costa.

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The analytical procedures (at ERGO, Hamburg, Germany) for the determination of PCDD/Fs included: spiking with ^{13}C -UL-labeled internal standards, extraction with appropriate solvents for ultratrace-analyses, clean-up on multicolumn systems and measurement by means of high resolution gaschromatography and high resolution mass spectrometry on a VG-AutoSpec using DB-5 capillary columns. For each substance, two isotope masses have been measured. The quantification was carried out with the use of internal/external standard mixtures (isotope dilution method). Seventeen PCDDs/PCDFs have been determined and reported. In addition to the single results, calculations of the toxicity equivalents (I-TEQ) according to NATO/CCMS and WHO system have been carried out.

Results and discussion

Table 1 shows the distribution of all the 73 voluntary participants grouped by age and living area (potentially exposed and not exposed).

Table 1. Distribution of participants by age and living area

Age group	Exposed		Not exposed		Total	
	n	%	n	%	n	%
17-19	2	9,5	1	1,9	3	4,1
20-22	1	4,8	4	7,7	5	6,8
23-25	7	33,3	7	13,5	14	19,2
26-28	4	19,0	9	17,3	13	17,8
29-31	2	9,5	15	28,8	17	23,3
32-34	1	4,8	11	21,2	12	16,4
35-37	1	4,8	3	5,8	4	5,5
38-40	3	14,3	2	3,8	5	6,8
Total	21	100,0	52	100,0	73	100,0

No statistically significant differences were observed for breast milk dioxin levels in relation to the specific living area of the 52 participants. As can be seen in Fig. 1, the 52 results obtained for PCDD/F milk levels show a normal distribution, with a mean PCDD/F milk level of 10,8 pg/g WHO-TEQ/g lipid, within a range from 4,8 to 19,9 pg/g WHO-TEQ/g lipid.

Based on the assumptions of mean infant body weight (BW) of 5 kg, mean milk daily intake of 800 ml and a breast milk fat content of 3 %, mean daily intake of PCDD/Fs through breast milk can be estimated as 51 pg/kg BW/day for the breast-feeding babies of the population under study.

In general terms, breast milk dioxin levels for the general population living in the vicinity of VALORSUL are similar to those who are living outside of the potentially exposed area. For the population under study, PCDD/F milk levels are even lower than those previously reported (Fig. 2) for comparable populations in most of the developed countries²⁻⁶.

Considering that the incineration facility started operating not more than three years ago, irrespectively of the population sample the dioxin levels can be considered as background levels for the global area under study.

From a public health point of view, it is imperative that the results can be maintained, if not reduced, pointing out to the need of adopting suitable strategies of surveillance, to promote, at least, the maintenance of the present patterns.

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Levels of PCDD/Fs in breast milk (pg/g lipid based)

N	Mean	Min	Max
52	10,8	4,8	19,9

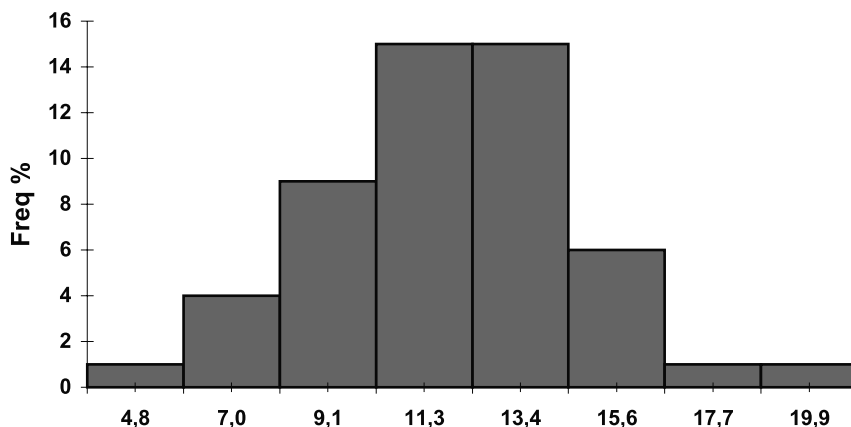


Figure 1. Distribution of PCDD/Fs levels in breast milk samples (pg/g lipid)

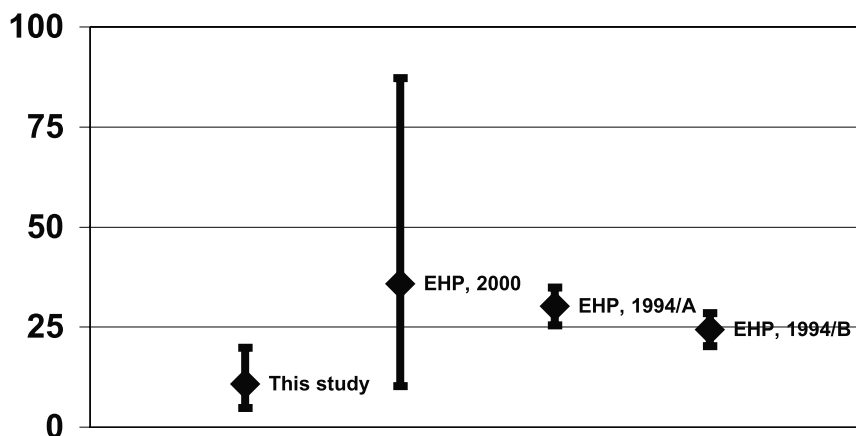


Figure 2. PCDD/Fs levels in Portuguese breast milk samples compared with published²⁻⁶ background levels (pg/g lipid)

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