PCDD/F IN HUMAN MILK AND RIVER NILE FISH FROM EGYPT

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Introduction

Food is considered to be the major source of human exposure to polychlorinated dibenzo-p-dioxins (PCDD) and polychlorinated dibenzofurans (PCDF). Thus, in 1994 a joint project as part of the cooperation between the German Research Society (DFG) of Germany and the Academy of Scientific Research and Technology (ASRT) of Egypt was used for a preliminary study to determine the PCDD/F contamination of Egyptian Food. The results were presented at Dioxin'94 in Kyoto (1) and at Dioxin'96 in Amsterdam (2) . It was found

- that meat products sold in Cairo and its surrounding area had a low PCDD/F contamination,
- that two margarine samples sold in Cairo were low contaminated with PCDD/F, also,
- that butter samples from different areas of Egypt had a wide range of PCDD/F-contamination, however. Nearly all samples from lower Egypt exceeded considerably the 5 pg I-TEQ/g fat which is set as reference value for the ban on trade of milk and dairy products in Germany. As maximum, 28.9 pg I-TEQ/g fat were found. The mean of all 33 samples was 7.60 pg I-TEQ/g fat. Milk from upper Egypt showed a dioxin contamination in a range of 0.6 to 1 pg I-TEQ/g fat which was the usual background contamination in Germany at that time, as well.

Therefore, human milk samples should have been analyzed to see whether these elevated dioxin levels in parts of the food chain had an effect on the Egyptian population. Additionally, fish from the river Nile was included.

Methods and materials

Breast milk samples from different areas were collected in 1997. For the preparation of representative pooled samples, 4 - 7 ml of the individual breast milk samples were mixed. These samples were either centrifuged for fat separation with following freeze-drying of the cream or freeeze dried as whole sample. Selected samples were split into two parts and one part was centrifuged for fat separation, the other part was freeeze dried as whole sample. Thus, cream and milk powder was shipped for analysis. The samples were analyzed according to a method which was tested succesfully in a collaborative study (3).

Fish from 6 locations of the River Nile was caught in 1999. At each location, 3 samples were caught. 250 g of these three samples was mixed for a pooled sample and freeze dried for shipment.

Results and Discussion

Table 1 summarizes the results of the analysis of the breast milk samples. The samples represented the most populated areas: Cairo, Ismaila, Aswan, Asuit and El-Menia. The pooled samples from Cairo represent 45 mother, from Ismaila 30 mothers and from El-Menia 12 mothers. Therefore, these samples give a representative overview. The pooled samples of Cairo and Ismaila which were divided and analyzed as cream or completely freeze dried samples show a good correspondence of the results.

Table 1: Results of the breast milk samples (in pg I-TEQ/g fat)

sample	consistency	source	no. of collected samples	result (pg I-TEQ/g fat)
human milk	cream / fat	Cairo	45 mothers	19.9
human milk	powder	Cairo	45 mothers	24.1
human milk	cream / fat	Ismailia	30 mothers	23.5
human milk	powder	Ismailia	30 mothers	20.6
human milk	cream / fat	Aswan	unknown	11.0
human milk	powder	El-Menia	12 mothers	23.6

These data can be compared to data from Germany: At the end of the 80s the average contamination was about 30 I-TEQ/g fat (range 5.6 to 87.1) (4). Thus, numerous measures were taken to reduce the dioxin levels in the environment. Gradually, a decrease of the dioxin content in breast milk samples was observed (5, 6, 7, 8). Own results from pooled human milk samples from Baden-Württemberg collected in 1997 and 1998 show that the average contamination was in the range of about 11 pg I-TEQ/g fat (9). A study for determination of PCDD/F in human milk samples from Jordan revealed a wide range of contamination (up to 96 ng I-TEQ/kg fat) (10). Specific living conditions were discussed to explain the high contamination.

With respect to the Egyptian human milk samples it can be concluded that the present contamination is higher in the Cairo, Ismailia and El-Menia region than it is now in Germany, but lower than it was in Germany 10 years ago. The Aswan region has obviously the same range of dioxin contamination as Germany now.

The butter results from the previous studies clearly hint at the contribution of considerable dioxin sources to the contamination of food in lower Egypt. This could help to explain the elevated levels in human milk in comparison to actual data from Germany. However, more data are necessary to identify possible dioxin emitters in Egypt and to show their effect on the food chain in Egypt. It would be interesting to see whether vegetable food is contaminated by deposition in certain regions. Egypt is highly populated with the vast majority living along the River Nile valley. Here, industrial production sites or open burning of waste and agricultural areas are close together. Additionally, it seems to be important to follow a time trend in Egypt and to check whether the levels are possibly rising, as indication of the effect of any measures to reduce the dioxin emission.

As additional investigation, fish from the River Nile was caught starting at the southern border of Cairo (Helwan) and ending at the northern border (El-Mattaria). Table 2 summarizes the results. Obviously, fish of the southern parts has a tendency to higher dioxin contents. For comparison, 19 fish samples from the River Rhine had 39 pg I-TEQ/g fat on average (range 2.47 to 107.5), 61 trout samples 7.44 pg I-TEQ/g fat (range 1.88 to 29.3), and 42 salt-water fish samples 14.7 pg I-TEQ/g fat (range 0.27 to 60.4) (11).

Dioxin levels in fish vary considerably. This has two reasons: First, the dioxin contamination is different on different locations. Second, the level is strongly dependent on the fat content of the fish which can vary extremely (e.g. between 0.04 % for a pike and 40 % for an eel, see lit. 11). Because of the accumulation of PCDD/F in adipose tissue the extreme different fat amounts can cause extreme different dioxin levels when correlated to fresh weight or fat base. The extreme differences in fat content of different sorts of fish can lead to problems in comparison of dioxin levels of fish. Thus, it is recommendable to compare the same sort of fish rather than different sorts of fish, because for the same sort of fish the variation of the fat amount is not so extreme and the eating habits (e.g. predatory fish or others) are the same.

Table 2: Results of fish samples from River Nile (in pg I-TEQ/g fat and pg WHO-TEQ/g fat)

Sample	source	pg I-TeQ/ g fat	pg WHO-TeQ/ g fat	fat (%) in dry matter
Cat fish	El-Mattaria	7.01	8.36	5.1
Cat fish	El-Aiatt (S)	5.17	5.88	7.5
Telapia	El-Aiatt (N)	2.77	3.03	2.6
Telapia	Shubrant	16.14	16.82	4.2
Cat fish	El-Giza (S)	23.77	28.24	5.7
Cat fish	El-Giza (N)	26.75	31.94	6.2
Cat fish	El-Maadi (S)	27.05	32.17	8.2
Cat fish	El-Maadi (N)	24.94	29.19	6.3
Telapia	Helwan (S)	27.34	28.59	8.4
Telapia	Helwan (N)	14.82	16.05	11.3

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