Determination of Polychlorodibenzo-p-dioxins (PCDDs) and Polychlorodibenzofurans (PCDFs) in Milk Powder and Infant Formula produced in Brazil in 1998

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Introduction

Cows milk and products thereof play an important role in the human diet, especially for infants and children, therefore their potential contamination with PCDD/F is of public concern. In some countries monitoring systems are in place that allow an overview of current background contamination as well as detection of new contamination sources such as through cattle feed. In Brazil there are no data reported on current background contamination in milk.

The PCDD/F contamination level of milk and milk products decreased slowly but constantly between 1993 and 1997 in Germany. In late 1997 an increase in contamination was detected, and PCDD/F levels in milk increased by a factor of two within a few months[1]. In single samples an even higher increase was observed. In other European countries similar increases were reported[2].

Further investigation about the source of increased PCDD/F levels in milk revealed that citrus pulp pellets (CPP) originating from Brazil, used as cattle feed in several European countries, contained elevated levels of dioxins[3]. CPP is manufactured from orangepeel which is dried before being used as animal feed. Approximately 1.3 million tons of CPP were exported from Brazil to Europe during the 1997/98 season. Many hundred samples of CPP and milk have been analyzed at that time in European laboratories. Similar to Germany, the average dioxin contamination of milk from the Netherlands was found to be twice the typical background level for cows milk[2].Since the source of the contamination was clearly traced to CPP ex Brazil and in the absence of legislation for dioxin levels in animal feed, producers and users, in agreement with the European Commission and authorities of the Member States, decided in the summer of 1998 to temporarily halt imports and use of Brazilian CPP[3].

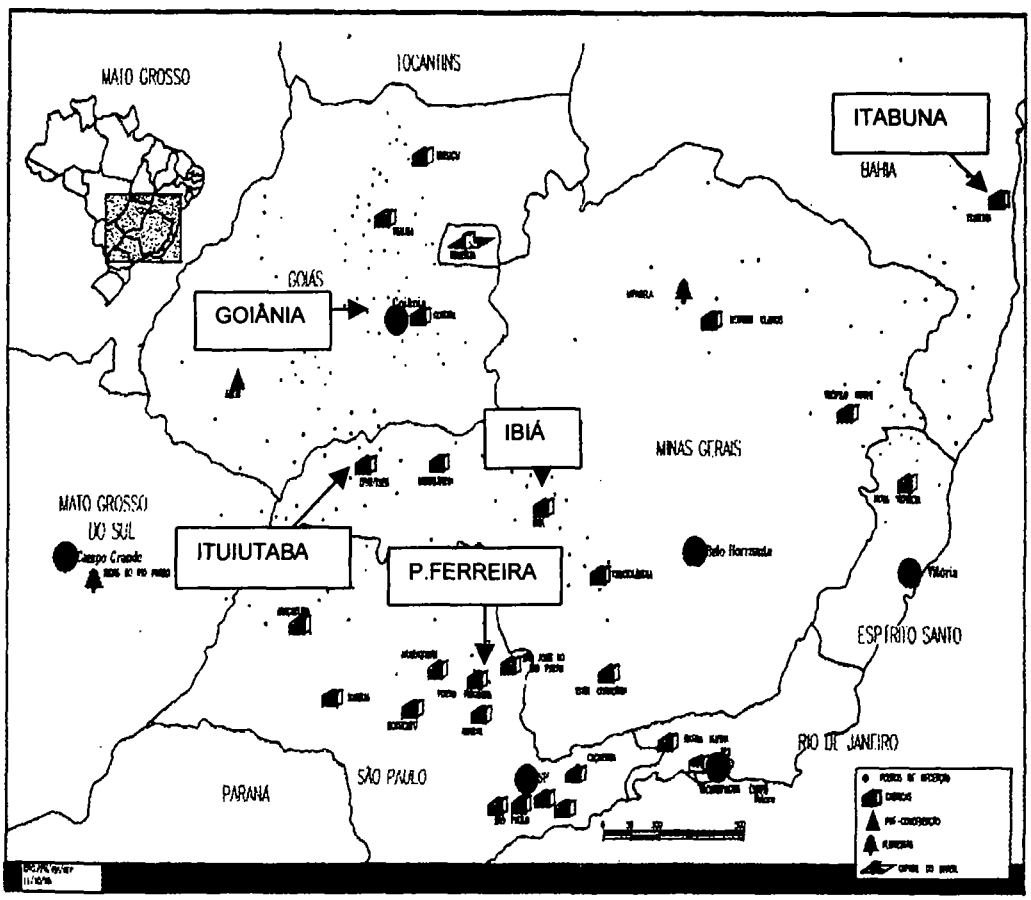
This raised concern about the use of contaminated CPPs as cattle feed in Brazil, therefore individual samples of milk powder and milk fat containing infant formula from different geographical regions in Brazil have been analyzed for PCDD/Fs.

Methods and Materials

Samples have been sent from Brazil to the laboratory in Hamburg by courier. The milk powder and the infant formula have been produced locally from Brazilian milk between June and July 1998 in different locations of the country and arrived at the laboratory in August 1998. The

topographical origin of the milk for the production of milk powder and infant formula is given in Figure 1.

For the analytical treatment all samples were reconstituted with tap water according to manufacturer's instructions to obtain the original liquid product ready for consumption. After this procedure the determination of PCDD/PCDF followed the analytical treatment described in detail elsewhere[4]. The measurements have been performed by HRGC/HRMS using a VG AutoSpec operating at a resolving power of R = 10.000. The method applied has been validated by the successful participation of national and international quality control studies [5, 6].



Results and Discussion

The analytical results for the 3 milk powder samples and 4 different infant formulas analyzed for PCDD/F are presented in table 1, together with compositional information on the fat content.

Table 1: Information for milk samples from Brazil

Milk sample	% Milk fat	%Vege-table fat	% Total fat in powder	% Total fat ready to drink*	Origin	I-TEQ pg/g lipid
1-Milk powder	26	-	26	3.3	Itabuna Bahia State	**0.17**
2-Milk powder	26	-	26	3.3	Ibia Minas Gerais State	**0.12**
3-Milk powder	26	-	26	3.3	Ituiutaba Minas Gerais State	**0.24**
4- Infant formula	20,6	5,2	25,8	3.4	Porto Ferreira São Paulo State	**0.22**
5- Infant formula	16,5	4,7	21,2	3.3	Porto Ferreira São Paulo State	**0.27**
6- Infant formula	20,0	5,5	25,5	3.4	Porto Ferreira São Paulo State	**0.45**
7- Infant formula	17,2	4,3	21,5	3.3	Porto Ferreira São Paulo State	**0.34**

* approximate values for comparison (e.g. with cows' milk or human milk)

For comparison, typical PCDD/PCDF levels found in milk samples of various origin are given in Table 2.

Table 2: Background concentrations of PCDD/PCDFs in milk and milk products of different origin (pg I-TEQ/g lipid)

Country	Product	Year of	n	**Mean**	Range	Author/Reference
Finland	Cows' milk			**0,83**	< 0,5 – 1,8	Vartiainen and
Ireland	Cows' milk	1995	20	**0,21**	0,14 – 0,5	Concannon [8] (1996)
Germany	Cows' milk	1994	120	**1,02**	0,61 – 1,75	Fürst and Wilmers [9]
Germany (BW)	Cows' milk	1993	27	**0,83**	0,19 – 1,52	Malisch [1] (1998)
Germany (BW)	Cows' milk	1994	37	**0,68**	0,46 – 1,38	Malisch [1] (1998)
Germany (BW)	Cows' milk	1995	92	**0,64**	0,27 – 2,00	Malisch [1] (1998)
Germany (BW)	Cows' milk	1996	66	**0,55**	0,19 – 0,87	Malisch [1] (1998)
Netherlands	Cows' milk	1992/93		**1,3**	0,9 - 2,0	Liem and Theelen [10]
Germany (BW)	Cows' milk	1997	112	**0,71**	0,35 – 1,92	Malisch [2] (2000)
USA	Dairy prod.	1994			0,8 - 1,5	Schecter et al [11] (1994)
New Zealand	Cows' milk	1990			0,18 – 0,22	Buckland et al [12] (1990)

(NRW) = North Rhine Westphalia, (BW) = Baden Württemberg

Although only based on few samples, the results presented in table 1 demonstrate a very low background contamination with PCDD/F based on comparison of the I-TEQ data reported for other countries. The mean for the 3 milk powder samples was 0.18 pg I-TEQ/g lipid while the mean for the 4 infant formula resulted in 0.32 pg I-TEQ/g lipid. For the infant formula it has to be noted that the lipid in the material represents a mixture of milk fat and a minor part of vegetable fat. The pattern observed in the Brazilian samples is similar to those observed normally in milk samples from other countries.

The low levels of dioxins are consistent with currently known sources for background contamination. The regions where the milk was sampled are all rural areas with very little industrial activity, with the exception of Porto Ferreira, Sao Paulo State. Here several smaller industries are present, such as potteries, sugar mills, cotton mills. Another relevant activity contributing to background levels could be the regular burning of sugar cane on the fields between harvest.

In general the results on the few samples of milk powder and infant formula demonstrate that the normal background contamination of milk in Brazil is very low. In addition the results do not give any indication for an elevated contamination due to cattle feed in light of the contaminated citrus pulp pellets that were detected in 1998 in Brazil.

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