CONTAMINATION OF FEEDING STUFF - POSSIBLE ASSOCIATION WITH INCREASE OF PCDD/PCDF CONCENTRATION IN HUMAN SAMPLES ?

Bärbel Vieth[1], Michael Albrecht[2], Elke Bruns-Weller[3], Peter Fürst[4], Barbara Heinrich-Hirsch[1], Annette Knoll[3], Bernhard Link[5], Rainer Malisch[6], Richard Mayer[2], Isolde Piechotowski[5], Wolfgang Mathar[1]

[1]Federal Institute for Health Protection of Consumers and Veterinary Medicine (BgVV), P.O. Box 33 00 13, D-14191 Berlin, Germany
[2]Bavarian Institute for Health and Food Safety (LGL), Department Oberschleißheim, Veterinärstr. 2, D-85764 Oberschleißheim, Germany
[3]Lower Saxony Office for Consumer Protection and Food Safety (LAVES), Food Institute Oldenburg, P.O. Box 24 62, D- 26014 Oldenburg, Germany
[4]Chemical and Veterinary State Control Laboratory, Sperlichstr. 19, D-48151 Münster, Germany
[5]State Health Agency (Landesgesundheitsamt) Baden-Württemberg, P.O. Box 10 29 42, D-70025 Stuttgart, Germany
[6]State Institute for Chemical and Veterinary Analysis of Food, Bessierstr. 5, D-79114 Freiburg , Germany

Introduction

As a result of measures and regulations to reduce dioxin emissions, the dioxin levels in human milk and blood samples decreased continuously in Germany between 1990 and 1997[1,2,3]. A similar decline has been observed in other European countries[4]. This distinct decrease of the background body burden is in the same range as the decrease of dioxin concentrations in food of animal origin and, therefore, is reflected by the dietary dioxin intake[1].

In contrast, in 1998 the mean dioxin levels in human milk observed in 2 federal Länder of Germany were slightly higher than in 1997. The same tendency has been found in blood levels of children[5]. During the same time period a strong rise of dioxin levels in some cow's milk samples occurred, which had been caused by Brazilian citrus pulp as a component of cow's feed highly contaminated with dioxins [6].

The question whether the slightly higher body burden is associated with the consumption of food contaminated with dioxins from Brazilian citrus pulp is discussed in the following.

Origin of data

Cow's milk data

Data on dioxins in cow's milk were recorded by the food control laboratories of the federal Länder Baden-Württemberg (BW), Bavaria (BV), Lower Saxony (LS) and North-Rhine/Westphalia (NRW). The data were included in the dioxin database established at the German Federal Environmental Agency.

Human milk data

In most cases, human milk samples were analysed on request of mothers by the food control laboratories of the above-mentioned federal Länder.

Data on dioxins in blood of children

In a survey conducted in 4 areas of Baden-Württemberg (rural, 2 urban and industrial), PCDD/PCDF concentrations in blood samples from children (age 9-11 years) collected between 1993/94 and 1998/99 (4 sampling periods) were analysed[5]. The blood samples were pooled before analysis according to sex, areas and sampling periods.

The data on dioxins in human milk and blood were included in the data bank for residues in human milk and dioxins in other human tissues established at the BgVV.

Results and Discussion

In Germany, between 1990 and 1997 mean values and 95th percentiles of dioxin concentrations in human milk samples decreased by about 60 % to 11.6 ng I-TEQ/kg fat and 13.5 ng WHO-PCDD/F-TEQ/kg fat, respectively[1]. This continuous decline could be observed for the TEQ values and for the 2,3,7,8-substitued congeners, as shown in Figure 1 for data from Baden-Württemberg. The congener pattern did not change during that period. The same trend was found in blood[3,5].

In contrast, in 1998 a slight increase of the mean TEQ levels in human samples of 2 federal Länder was observed. In particular, this effect was noticeable in human milk (increase of mean I-TEQ: 23 %) and blood samples from children (simultaneous increase of I-TEQ in 4 areas: 20-39 %) in Baden-Württemberg and in human milk samples of North-Rhine/Westphalia (increase of mean I-TEQ: 16%). In 1998, the dioxin concentrations reached levels as found 2 to 3 years earlier. No increase but a decrease was observed in human milk samples of Lower Saxony (I-TEQ: -3 %) and Bavaria (I-TEQ: -18 %) in 1998[7]. Because of the partly small number of samples (see Fig 2) and different composition of the collected human milk samples (age and parity of the mothers), the percentages of decrease or increase of TEQ levels should be considered more as reflecting a tendency rather than precise differences between the federal Länder.

Between autumn 1997 and spring 1998, i.e. for about half a year, distinctly elevated dioxin levels up to a factor of 10 and characteristic changes of the congener pattern had been observed in cow's milk, milk products, beef and veal[6]. These changes had been caused by highly contaminated Brazilian citrus pulp used as an additive in feeding stuff. In Figure 2A, the differences in concentrations of the most important dioxin congeners in cow's milk before and during the feeding period with highly contaminated feed are presented. It is clearly seen that TCDD and PeCDD show the highest increase. As these congeners contribute most to the TEQ values, these have increased by about a factor of 4. To a lesser extent also 2,3,4,7,8-PeCDF, HxCDFs and HxCDDs congeners were elevated. This is clearly seen in food samples showing higher levels of contamination (see Fig. 2A).

Normally, cow's milk and milk products, beef and veal account for about 50 % of the daily dietary dioxin intake in Germany[1]. Since cow's milk and milk products were additionally contaminated (mean TEQ level 2.5 times higher in comparison with samples of background contamination), other relevant food of animal origin was produced using contaminated citrus pulp and since duration of this additional dioxin intake was about half a year, elevated levels of the body burden could not be excluded in regions where these foods were consumed.

To verify this, we compared the concentrations of single congeners in human milk and blood before (1997, 1996/97) and after (1998, 1998/99) the contamination event with citrus pulp in the 4 federal Länder of Germany where data from human milk and cow's milk were available. Data on dioxin levels and congener pattern in cow's milk were used as an indicator for the extent of food contamination resulting from Brazilian citrus pulp containing feed.

The Figures 2C (human milk, NRW), 2E (human milk, BW) and 2F (children's blood, BW) clearly show higher levels at the time after the contamination period. TCDD concentrations were higher by 30, 25 and 60 %, 1,2,3,7,8-PeCDD by 11, 28, and 30 %, and 2,3,4,7,8-PeCDF by 21, 22 and 22 %,

respectively. The increase of concentrations in human samples is especially pronounced for those congeners, which are characteristic for food contaminated by citrus pulp. In both federal Länder, the extent of cow's milk contamination caused by citrus pulp was relatively high (data not shown). This feed component should be considered as the cause for the change of the trend in the dioxin body burden from a long-term decline to a short-term (interim) increase.

In contrast to the situation in NRW and BW, the dioxin concentrations and the relevant congeners in human milk continued to decrease in Bavaria (BV, Fig. 2D) and to a lesser extent in Lower Saxony (LS, Fig. 2B) during the period examined. This could be explained by a comparatively low contamination of food resulting from citrus pulp-containing feed in these federal Länder. For Bavaria, this is reflected by normal dioxin levels in cow's milk of wide-spread origin. In LS, there were indications of a rise of dioxin levels in cow's milk which, however, was less pronounced than in BW and NRW.

Since the river Rhine is the main route of transport from the harbour of Rotterdam, it may be assumed that in Germany the contaminated Brazilian citrus pulp was mainly distributed to feed producers in the neighbouring federal Länder (e.g. NRW and BW). Based on this, differences between the federal Länder can be explained.

Conclusions

Presumably, the use of highly contaminated citrus pulp as a feed component resulted in an increase of the dioxin body burden of humans in 2 Länder of Germany, which is not tolerable under the aspect of preventive health care and exposure of breast-fed babies. Therefore, continued efforts to reduce dioxin intake are required. An effective control of samples of human origin, food and also of feed is a necessary precondition for an early detection of an avoidable additional body burden and a successful strategy to prevent additional dioxin input.

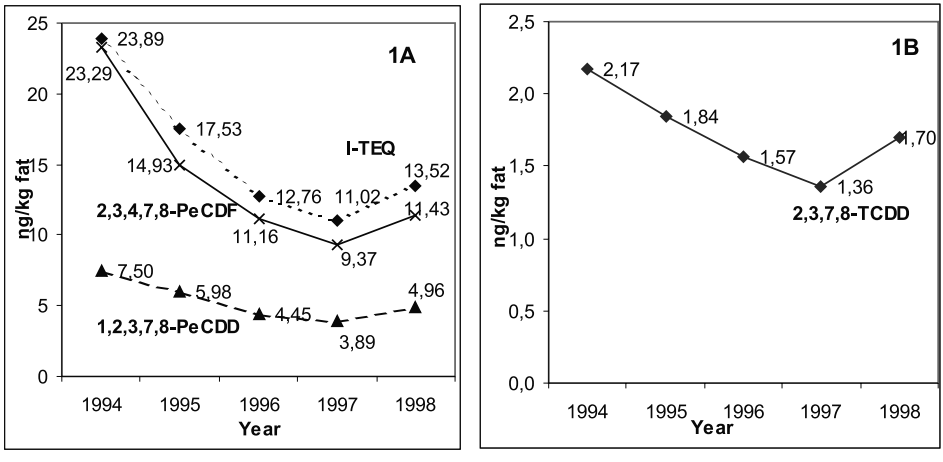

Figure 1. Trends of I-TEQ and relevant congeners in human milk of Baden-Württemberg (mean values)

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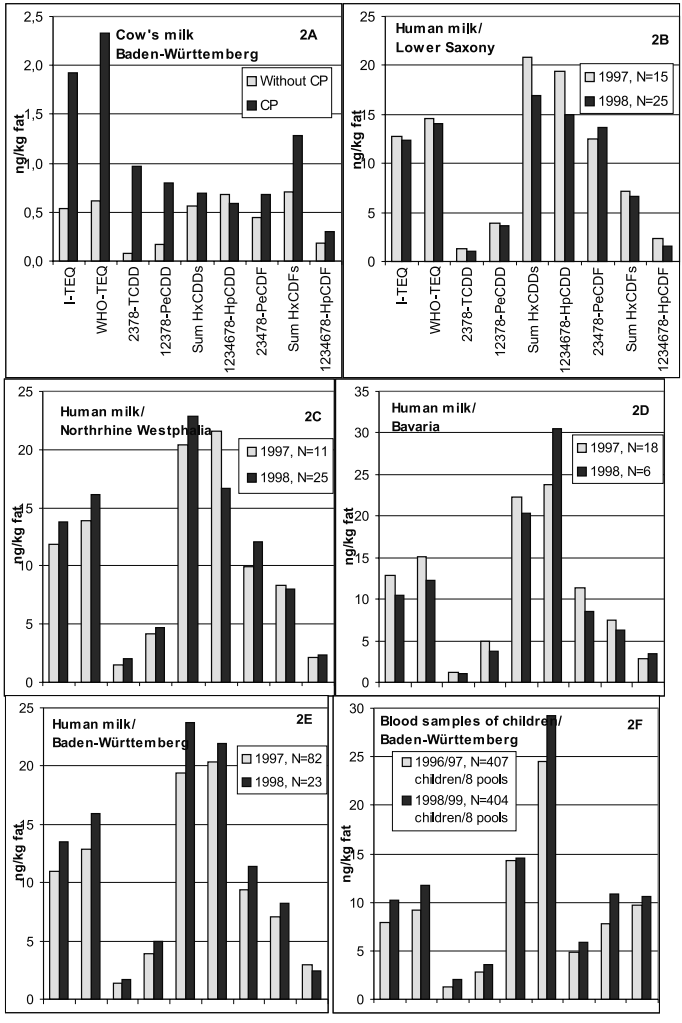

Figure 2. Changes of congener pattern in cow's milk (CP: mean of prominent contaminated samples from different regions), human milk and blood samples from children of 4 federal Länder of Germany before and after the contamination event with citrus pulp (CP) (mean concentrations)

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