

PCDD/F Levels in Dairy Products 1994 versus 1990

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1. Abstract

In 1994 cow's milk and milk products were collected from all 30 dairies in North Rhine-Westphalia and analyzed for polychlorinated dibenzo-p-dioxins (PCDD) and dibenzofurans (PCDF). Each dairy was sampled four times between spring and fall. The sampling was performed at the same times as in 1990, when a comparable investigation was conducted¹⁾. The objective was to investigate whether a decline in PCDD/F levels in such an important food category as dairy products can already be observed as a consequence of the measures taken to reduce PCDD/F emissions of known sources.

The comparison of the analytical results obtained in 1990 and 1994 shows that the average PCDD/F levels, based on toxic equivalents (I-TEq, NATO/CCMS), of cow's milk and dairy products decreased in the past four years by almost 25%. While in 1990 a mean level of 1,35 pg I-TEq/g milk fat was measured, the corresponding level in 1994 amounted only to 1,02 pg I-TEq/g milk fat.

2. Introduction

Analyzes of human milk samples performed in our institute between 1989 and 1994 revealed that the mean PCDD/F levels in mothers milk decreased by approximately 30% in the last six years²⁾. Consequently, it was assumed, that the average daily PCDD/F intake for humans must nowadays be lower than a couple of years ago, since it is known that human diet represents the main route of exposure to PCDDs and PCDFs. With respect to contamination of food stuffs, PCDD/F levels in milk are of special concern due to the high consumption of dairy products. It is estimated, that for adults they contribute 30-40% to the daily intake of toxic equivalents via food. For children, this relative contribution might even be significantly higher. Therefore, the North Rhine-Westphalian Government already conducted an extensive PCDD/F survey in 1990 including inter alia a fourfold sampling of all dairies in our state, which is the largest in Germany. This investigation was repeated in 1994 in order to proof the above mentioned hypothesis of declining PCDD/F levels in milk and milk products.

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3. Materials and Methods

Each of the 30 dairies was sampled four times in 1994 (March/April, June, July and September). The samples were collected in the morning directly before bottling in order to avoid a potential contamination from the packaging material. In case where dairies did not produce milk, respective products such as butter, cheese or cream were taken.

Analytical determination was performed using validated methods which have been successfully tested in a number of national and international quality control studies. For example, our laboratory qualified inter alia in the past WHO quality control studies for PCDD/F levels in cow's milk. The stability of the methodology is assured by analyzing a quality control pool since several years.

4. Results and Discussion

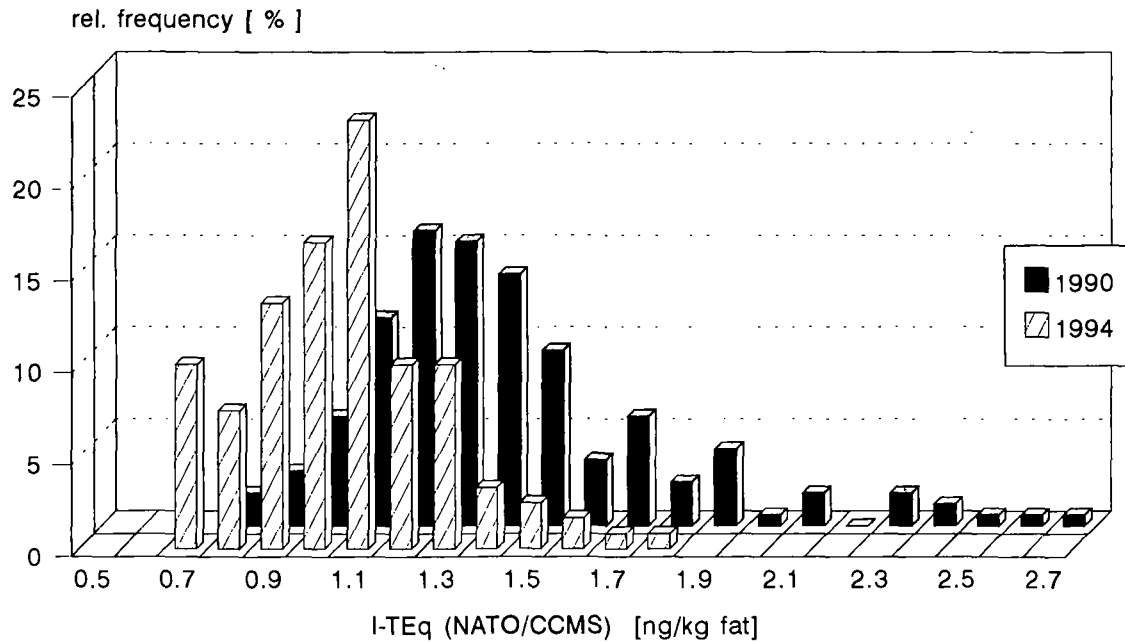
Since the 1990 survey 13 dairies closed down. So only 30 dairies were sampled in 1994 compared to 43 during the first investigation.

A common characteristic of all PCDD/F congeners determined is the predominance of 2,3,7,8-chlorine substitution. This pattern is typical of specimens originating from mammals. All 120 samples analyzed revealed an almost constant relative ratio of the congeners regardless of the absolute level. Moreover, differences in the PCDD/F pattern between the various matrices investigated could not be observed.

The following table shows a summary of all results, expressed as pg I-TEq/g milk fat. The results from all 120 samples were combined, because no significant differences between PCDD/F levels in the various matrices (milk, butter, cream, cheese) were determined. For better comparison, this table also contains the results of the survey conducted in 1990.

PCDD/F levels in dairy products 1994/1990 (pg I-TEq/g milk fat)		
	1994 dairies: 30 samples: 120	1990 dairies: 43 samples: 168
mean	1,02	1,35
range	0,61 - 1,75	0,76 - 2,62
90 percentile	1,29	1,83
95 percentile	1,45	2,04

PCDD/F in dairy products 1990 / 1994



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A comparison of the data indicates that the mean PCDD/F contamination of milk and milk products decreased in the past four years by 25%. While in 1990 a mean level of 1,35 pg I-TEq/g milk fat was measured, the corresponding level in 1994 amounted only to 1,02 pg I-TEq/g milk fat. Moreover, the range in 1994 is much narrower as in 1990. Whereas in 1990 the levels ranged up to 2,62 pg I-TEq/g milk fat, the highest value in 1994 was found to be 1,75 pg I-TEq/g milk fat.

The frequency histogram in Fig. 1 shows the tendency to lower levels of the samples analyzed in 1994 compared to the specimens of the investigation in 1990.

5. Conclusion

The results seem to indicate that efforts to reduce PCDD/F emissions, such as optimization of waste incineration technology, ban of production and use of pentachlorophenol in several countries, phasing out of leaded gasoline containing scavengers and substitution of chlorine in paper pulp bleaching with other reagents, are already beginning to have positive effects to a certain extent. This reduction seems to be mandatory in order to reduce the PCDD/F levels in the environment as a prerequisite to diminish the body burden of humans.

6. References

- 1) Fürst P. (1993): Contribution of different pathways to human exposure to PCDDs/PCDFs. *Organohalogen Compounds*, Vol. 13, 1-8.
- 2) Fürst P, Chr. Fürst, and K. Wilmers (1992): Survey of dairy products for PCDDs, PCDFs, PCBs and HCB. *Chemosphere* 25, 1039-1048