

POLYCHLORINATED DIBENZO-P-DIOXINS AND DIBENZOFURANS IN MEAT AND MEAT PRODUCTS OF GERMANY- **Their importance was overestimated during the past**

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Introduction

Polychlorinated dibenzo-*p*-dioxins and dibenzofurans, often shortly called „dioxins“ are polychlorinated aromatic hydrocarbons mainly accumulated in fatty tissues of mammals and fish. Dioxins belong to the most toxic chemical compounds. Using expensive analytical methods dioxin residues are found in all kinds of food of animal origin. Due to the inability of accumulation they are found only in small amounts in plants. Dioxins are a mixture of more than 200 congeners of very different toxic potential. The congeners being substituted at the positions 2, 3, 7, 8 by chlorine atoms have the greatest toxic potential against men and animals strongly depending on the substituted positions and number of chlorine atoms. To describe the toxicity of dioxin congener mixtures often the so-called International Toxicological Equivalence Factors are used. The results of investigations are expressed as the sum of these toxic equivalences e.g. as pg i-TE/kg fat.

Material and Methods

Selection and collection of the samples were done by the Federal Centre for Meat Research at Kulmbach. This important, often disregarded first step of such studies was accurately planned and carried out taking into account the consumption habits of the different kinds of meats and meat products on one side. On the other hand the variations of the density of the population was considered. 200 was the total sample size. Samples of pork, beef, poultry, smoked liver sausages,

lyoner type sausages, salami and bacon were collected. The meat samples were always taken from the same kind of muscles and collected at local butcher's shops all over the Federal Republic regarding the density of the population. The dioxin analyses were done at the Federal Dairy Research Centre at Kiel already published [1].

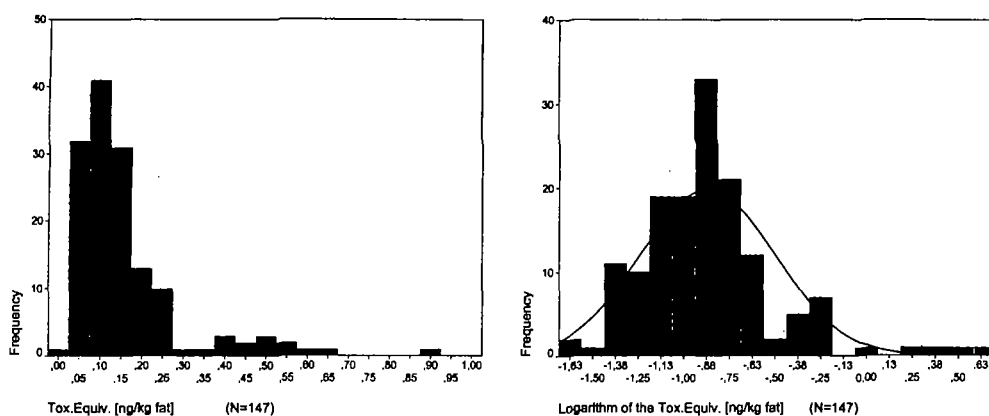


Fig. 1: Distribution of the toxic equivalents in the fat of meat and meat products before (left side) and after (right) logarithmic transformation of the concentrations

Results and Discussion

Due to the complicated and expensive analytical methods which are necessary to quantify the amounts of the dioxin congeners, in most of the studies only a limited number of samples was analysed being not representative for the foods investigated. Nevertheless the results of these analysis were used to derive far reaching conclusions. Recently it became possible as a result of a collaboration between several Federal Research Centres to take and analyse representative samples in order to obtain an overview on the real situation of the dioxin contamination of the foods eaten in Germany. One of the main results of this study presented here is that the dioxin contamination of meat and meat products is much lower than reported in literature. Using International Toxic Equivalents the following rank of contamination was found

	pork	<	meat products	<	Poultry	<	beef	
median	0.073	:	0.13	:	0.22	:	0.46	ng i-TE/kg fat

We could show that the statistical distribution of the dioxin contents in fats of meat are logarithmic normal like all other nonessential substances in biological systems (fig. 1). Calculations and descriptions of such a distribution by the linear arithmetic mean (value) is from the statistical point of view not permitted. Not taking this into account often too high (sometimes senseless) mean values are obtained, leading to overestimations. Instead of the mean value the median (50. percentile) must be used, which is near the logarithmic mean value.

The overestimation of the central (median) dioxin contamination by meat and meat products using the arithmetic linear mean value was 1.75 times. Wide ranged differences of the dioxin contents respective their toxic equivalences were found between the different kinds of meats as it is shown by the Box-Whiskers-Plots in fig. 2.

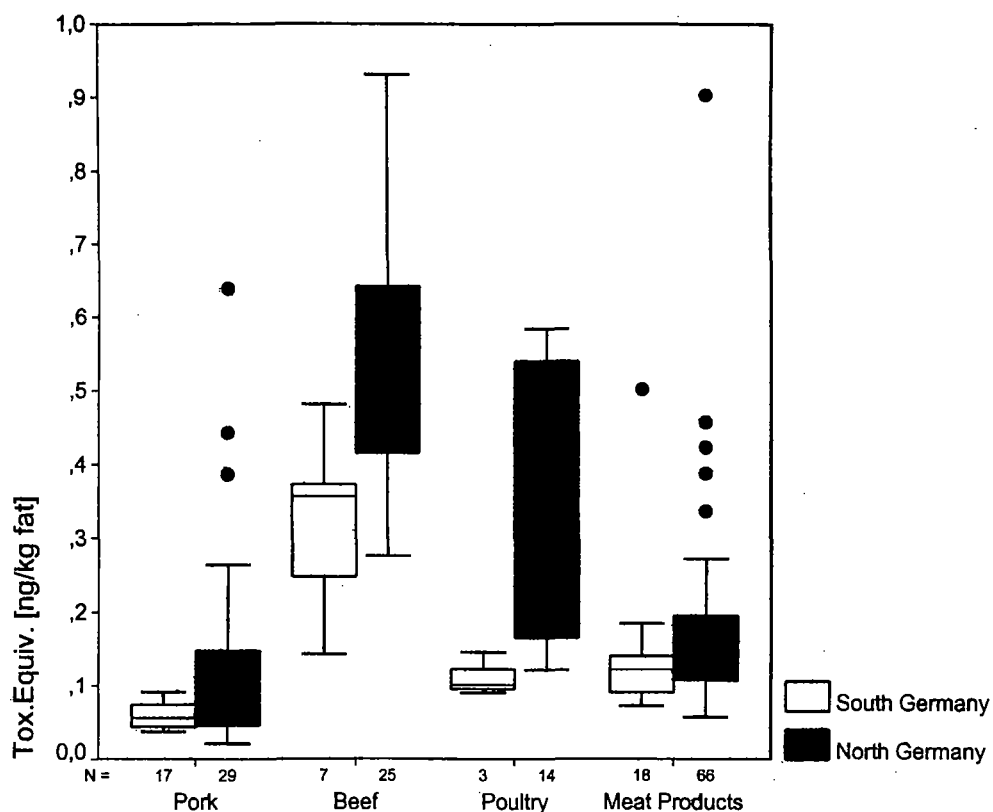


Fig. 2: Dioxin toxic equivalents of different kinds of meat and meat products from northern and southern Germany

Additionally a clearly expressed difference between the south and the north of Germany was detected. Meat and meat products from the south were always less contaminated (fig. 2). Due to the sample size it was possible to get detailed congener patterns on the basis of box-whisker-plots which offer much more information than the commonly used balk diagrams. Fig. 3 shows the congener pattern of pork which is also typical for meat products of Germany, because they contain significantly more pork than beef or poultry which show other patterns. The pattern of beef and poultry shows more penta- and hexachlorinated furans causing the higher dioxin toxicity of these kinds of meat.

Fig. 4 shows the portions of the total dioxin intake or their total toxic equivalents of the German population by the different kinds of their foods in absolute concentrations (right) or as percentages (left) using the most recent data of our collaboration study.

Congeneres Pattern in Pig Fat

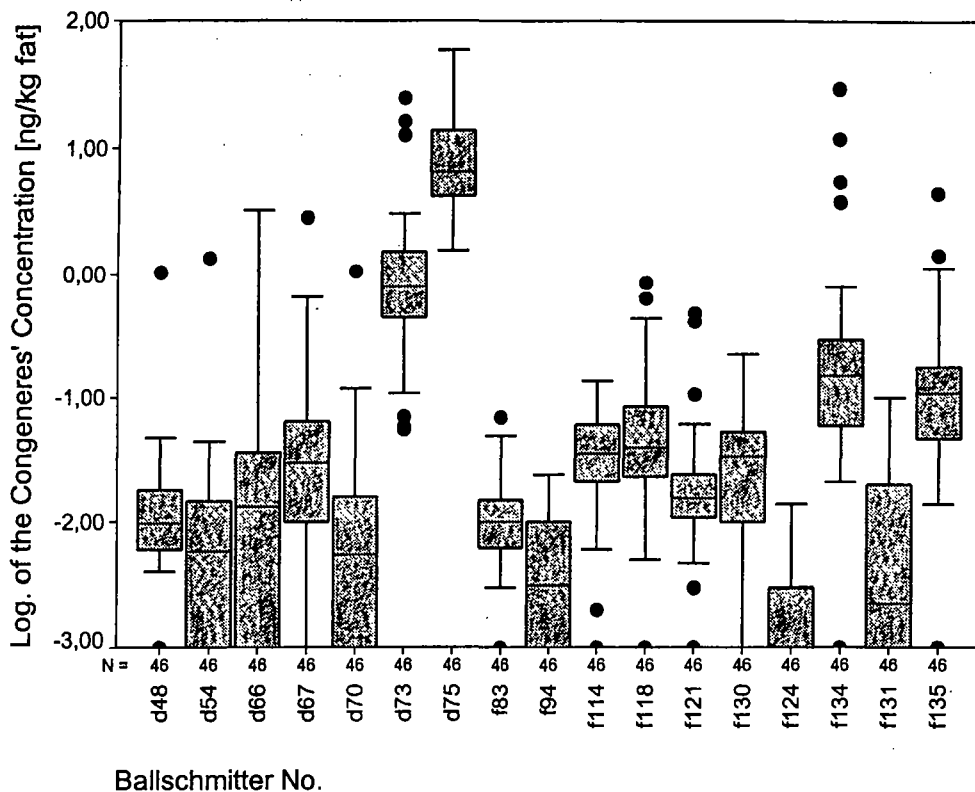


Fig. 3: Dioxin congener pattern in German pork fat

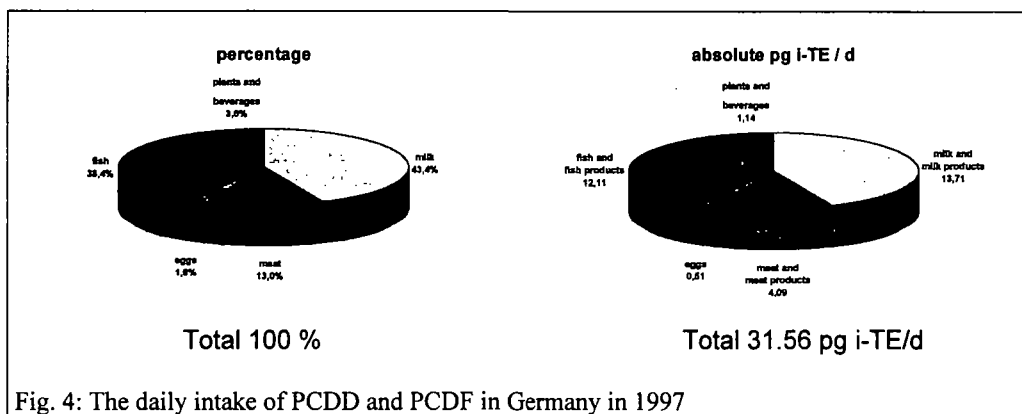


Fig. 4: The daily intake of PCDD and PCDF in Germany in 1997

References

- [1] Blüthgen, Heeschen, Ruoff; Kieler milchwirtschaftliche Forschungsberichte 46, 130-150 (1994)