

## Correlation of levels of PCDD/Fs and PCBs in eggs with levels in meat from hens with elevated levels

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### Introduction

Council Regulation (EC) No 2375/2001 sets maximum levels for PCDD/Fs in foodstuffs. In general, these regulations have to be applied from 1 July 2002. For hen's eggs and egg products, a maximum level of 3 pg WHO-PCDD/F-TEQ/g fat was set. Free-range or semi-intensive eggs must comply with the maximum level from January 2005. For meat and meat products from poultry, the maximum level is 2 pg WHO-PCDD/F-TEQ/g fat ([\[1\]](#)). Mainly free range eggs from small farms are at risk to exceed the tolerance due to the chicken's dioxin intake from soil. If eggs exceed the tolerance, it is important to know whether also poultry meat is expected to exceed the tolerance. Therefore, the correlation of levels of PCDD/Fs and PCBs in eggs with levels in meat from the same hens was examined to give quick guidance in this question. For this, chickens and eggs with elevated dioxin levels were taken from farms where elevated dioxin levels were found in eggs. All chickens had eggs in their Fallopian tube which allowed to determine an animal-specific correlation.

### Materials and Methods

#### *Samples*

Chickens and eggs were provided by Mrs Wörner, Kehl, Dr. Laufer, Tuttlingen, and Dr. Schwarz, Rottweil. Meat, adipose tissue and eggs from the Fallopian tube were separated by Dr. Baumbach, Freiburg.

#### *Analysis for egg and meat samples*

After freeze-drying of the whole sample, fat and contaminants of interest were extracted in a hot extraction device ("Twisselmann extractor") with cyclohexane/toluene. Gel permeation chromatography on Bio Beads S-X3 removed fat. Small amounts of remaining lipophilic and oxidizable substances were removed on sulfuric acid impregnated silica gel. Separation of PCBs, chlorinated pesticides, chlorobenzenes, polychlorinated diphenyl ethers (PCDE) and chlorophenols from PCDD/Fs was performed on a florisil column. The PCDD/F-fraction was purified on Carbopack C. Determination was performed by HRGC/HRMS (ThermoFinnigan MAT 95 XP; resolution 10,000). On a Carbopack B-column, PCBs were separated into three fractions of di-ortho, mono-ortho and non-ortho PCBs. These different groups were determined by HRGC/HRMS (MicromassAutospec; resolution 10,000) in three separate runs.

The method was successfully applied in 15 interlaboratory studies with altogether 72 samples to be analysed in the fields "food and feedingstuffs" for the determination of PCDD/F and/or dioxin-like PCBs, including a special study with eggs ([\[2\]](#)).

### Results and Discussion

The levels of PCDD/Fs and PCBs in individual eggs from free-range hens can vary between different animals even on the same farm. To derive data on basis of individual animals, 6 chickens from 5 different farms with elevated dioxin levels in eggs were chosen. After slaughtering, meat and eggs of the Fallopian tube from the same animals were prepared for analysis. In three cases, in addition adipose tissue was separated. In two cases, eggs were collected also before slaughtering. Results are shown in table 1.

Table 1: Results of determination of PCDD/F and PCBs in chicken's meat and eggs (in pg WHO-PCDD/F-TEQ/g fat and pg WHO-PCB-TEQ/g fat)

sample	WHO-TEQ	ratio	WHO-TEQ	ratio
no.	PCDD/F	meat or fat: egg	PCB	meat or fat: egg
1 a chicken's meat	4.82		6.25	
1 b egg in Fallopian tube	5.04	0.96	5.06	1.23
1 c eggs of this chicken	7.86	0.61	7.39	0.84
2 a chicken's meat	2.47		5.13	
2 b egg in Fallopian tube	1.14	2.17	2.41	2.13
2 c eggs of this chicken	2.02	1.22	5.60	0.92
3 a chicken's meat	3.76		15.20	
3 b egg in Fallopian tube	3.50	1.07	11.22	1.35
3 c chicken's fat	4.47		18.74	
3 b egg in Fallopian tube	3.50	1.27	11.22	1.67
4 a chicken's meat	8.33		15.88	
4 b egg in Fallopian tube	7.28	1.15	11.34	1.40
5 a chicken's meat	35.30		56.61	
5 b egg in Fallopian tube	14.18	2.49	28.71	1.97
5 c chicken's fat	49.57		72.31	
5 b egg in Fallopian tube	14.18	3.50	28.71	2.52
6 a chicken's meat	12.05		32.49	
6 b egg in Fallopian tube	13.43	0.90	28.23	1.15
6 c chicken's fat	16.68		41.53	
6 b egg in Fallopian tube	13.43	1.24	28.23	1.47
only eggs in Fallopian tube:				
Minimum	1.14	0.90	2.41	1.15
Median	6.16	1.11	11.28	1.38
Maximum	14.18	2.49	28.71	2.13

A comparison of the levels found in meat with levels found in eggs of the Fallopian tube shows that in four samples the dioxin levels in meat are nearly the same (ratio meat : egg between 0.9 and 1.2). In these samples, the ratio for PCB-TEQ is generally slightly higher (ratio meat : egg between 1.2 and 1.4). Two samples had considerably higher ratios between meat and eggs of the Fallopian tube (2.2 respectively 2.5 for WHO-PCDD/F-TEQ; 2.1 respectively 2.0 for WHO-PCB-TEQ).

In addition to the meat samples, in three samples also adipose tissue was analyzed. It was found that the ratios fat : eggs were always slightly higher than the ratios between meat and eggs.

In two cases, eggs were collected from the chickens before slaughtering. Analyses of these samples show a variation of the ratios in comparison to the eggs from the Fallopian tube. This variation hints at a biological variation of the dioxin levels in free range chicken. It could be explained by their presumably wide range of levels of differently contaminated sources on their farm and the resulting variation in daily intake. Only in one case, egg samples collected before slaughtering had higher levels of PCDD/Fs and PCBs than the corresponding chicken's meat. Here, the lowest ratio between meat and eggs was found with 0.61 for WHO-PCDD/F-TEQ.

As a result, chicken's meat is contaminated with about the same level of PCDD/Fs and PCBs or with higher levels as eggs in the Fallopian tube. If egg samples were collected before slaughtering, a biological variation became obvious. With regard to legal consequences one has to take into consideration the fact that the maximum level for chicken's meat is 2 pg WHO-PCDD/F-TEQ/g fat in comparison to 3 pg WHO-PCDD/F-TEQ/g fat for eggs. All results of this study showed that also the tolerance for chicken's meat will be exceeded if the eggs exceed the tolerance for dioxins.

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### References

[1] Council Regulation (EC) No 2375/2001, Official Journal of the European Communities L 321/1-5

[2] Malisch, R, Schmid, P, Frommberger, R and Fürst, P. 1996. Results of a Quality Control Study of Different Analytical Methods for Determination of PCDD/PCDF in Egg Samples. Chemosphere 32, 31 - 44.