PCDD/Fs AND PCBs IN BUTTER SAMPLES FROM NEW EUROPEAN UNION MEMBER STATES AND CANDIDATE COUNTRIES

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INTRODUCTION

The objectives of the Community Strategy for dioxins, furans and PCBs are to assess the current state of the environment and the ecosystem, to reduce human exposure to dioxins and PCBs in the short term and to maintain human exposure at safe levels in medium to long term [i]. The strategy addresses also the issue of enlargement of the European Union: It was assumed that this enlargement could increase the average exposure in the EU. The EU candidate countries would likely produce higher emissions than the EU at the present time through variation in legislation and due to the vast abundance of older industrial plants and other particular sources, like combustion of coal in residential heating. One of the Council conclusions in late 2001 was that the situation on the emissions of dioxins, the levels of dioxins in the environment and the exposure of the population in the Candidate Countries was uncertain and more research was needed in that subject. A recent communication to the Council by the European Commission on the implementation of the Community Strategy summarizes the main progress over the first two years (end of 2001 to end of 2003) [ii], while another technical report on sources, emission inventories, reduction policies and measures goes into detail on the actions dedicated to this subject by the Joint Research Centre of the European Commission [iii].

Milk and milk products are good indicators for the contamination of persistent organic pollutants (POPs) in the food chain. Thus, butter has been used for comparison of the PCDD/F contamination in several countries [iv, v]. To get an indication on whether exposure to dioxins and PCBs might cause a problem in the Candidate Countries, a study of their levels in 16 butter samples coming from 8 Candidate Countries was commissioned. The analysis needed to be performed at the same level of accuracy as with the analysis on the WHO field study [vi] in order to allow comparison of the findings. Therefore, the reference laboratory of the 3rd round of the WHO study was selected to perform the analysis [vii]. First results of five countries were presented at Dioxin 2003 [viii]. On May 1, 2004, 10 new member states joined the EU. This changed the status of seven countries of this study from “Candidate countries” to “Member States”. Romania still remains a candidate country.

METHODS

Eight countries sent two samples each between December 2002 and March 2003: Cyprus, Czech Republic, Estonia, Lithuania, Poland, Romania, Slovenia and Slovakia. The analytical method and data on reliability of the results are described elsewhere [6, ix, x].

RESULTS AND DISCUSSION

To meet the requirements of a strict quality control programme, all butter samples were analysed in duplicate and a significant number of quality control samples was included. Together with the 16 butter samples from these 8 countries, 3 reagent blank samples and 6 quality control samples were analysed. The quality control parameters proved to be in the same range of reliability as demonstrated for performance of WHO exposure study [see lit. 6].

		Cyprus		Czech Rep.		Estonia		Lithuania	
		1	2	1	2	1	2	1	2
PCDD/F-TEQ	lb	0,37	0,35	0,37	0,30	0,11	0,20	0,30	0,31
	ub	0,37	0,35	0,41	0,34	0,21	0,26	0,34	0,33
mono-ortho PCB-TEQ	lb	0,06	0,07	0,14	0,14	0,07	0,30	0,11	0,12
	ub	0,07	0,07	0,14	0,15	0,07	0,30	0,11	0,12
non-ortho PCB-TEQ	lb	0,30	0,28	0,68	0,42	0,29	1,31	0,61	0,58
	ub	0,30	0,28	0,68	0,42	0,29	1,31	0,61	0,58
sum PCB-TEQ	lb	0,35	0,34	0,81	0,56	0,36	1,62	0,72	0,70
	ub	0,36	0,35	0,82	0,57	0,36	1,62	0,72	0,70
sum WHO-TEQ	lb	0,72	0,69	1,18	0,86	0,47	1,82	1,02	1,00
	ub	0,73	0,70	1,23	0,90	0,57	1,87	1,06	1,03
% difference	l/u	2	1	4	5	17	3	3	2
% PCB of sum WHO-TEQ		49	50	66	63	64	86	68	68

		Poland		Romania		Slovakia		Slovenia	
		1	2	1	2	1	2	1	2
PCDD/F-TEQ	lb	0,51	0,58	0,43	0,98	0,45	0,29	0,29	0,25
	ub	0,51	0,59	0,47	0,98	0,50	0,39	0,29	0,26
mono-ortho PCB-TEQ	lb	0,07	0,09	0,13	0,20	0,09	0,16	0,07	0,05
	ub	0,07	0,10	0,13	0,20	0,10	0,16	0,08	0,05
non-ortho PCB-TEQ	lb	0,45	0,43	0,56	1,55	0,46	0,56	0,30	0,27
	ub	0,45	0,43	0,56	1,55	0,46	0,56	0,30	0,27
sum PCB-TEQ	lb	0,52	0,52	0,68	1,74	0,55	0,71	0,37	0,32
	ub	0,52	0,52	0,69	1,75	0,55	0,72	0,38	0,32
sum WHO-TEQ	lb	1,03	1,10	1,11	2,72	1,00	1,01	0,66	0,57
	ub	1,04	1,11	1,15	2,73	1,05	1,11	0,67	0,58
% difference	l/u	1	1	3	0	5	9	1	1
% PCB of sum WHO-TEQ		51	47	60	64	53	65	56	56

Tab. 1: Results of WHO-PCDD/F-TEQ, mono-ortho PCB-TEQ, non-ortho PCB-TEQ, sum PCB-TEQ and sum WHO-TEQ (PCDD/F + PCB) in pg/g fat (lb = lower bound; ub = upper bound; l/g = lower / upper-bound)

Summary results are presented in table 1 (for WHO-PCDD/F-TEQ, mono-ortho PCB-TEQ, non-ortho PCB-TEQ, sum PCB-TEQ and sum WHO-TEQ [as sum of PCDD/F-TEQ and PCB-TEQ]). For a comparison with other data or with tolerances it is important above all in the low

concentration range to consider whether TEQ results were calculated as upper- or lower-bound concentrations [xi]. Therefore, for each TEQ parameter lower and upper bound concentrations are given.

All samples except for one (Romania no. 2) are in the range of 0.21 to 0.59 pg WHO-PCDD/F-TEQ/g fat (upper bound), all samples except for two (Romania no. 2 and Estonia no. 2) in the range of 0.32 to 0.82 pg WHO-PCB-TEQ/g fat (upper bound) and all samples except for two (Romania no. 2 and Estonia no. 2) in the range of 0.57 to 1.23 pg sum WHO-TEQ/g fat (upper bound). The maximum values were found in the samples Romania no. 2 (0.98 pg WHO-PCDD/F-TEQ/g fat; 1.75 pg WHO-PCB-TEQ/g fat; 2.73 pg sum WHO-TEQ/g fat) and Estonia no. 2 (0.26 pg WHO-PCDD/F-TEQ/g fat; 1.62 pg WHO-PCB-TEQ/g fat; 1.87 pg sum WHO-TEQ/g fat).

The Community Strategy to reduce the presence of dioxins and PCBs in feed and food comprises legislative measures which consist of three pillars: the establishment of maximum levels at a strict but feasible level in food and feed, the establishment of action levels acting as a tool for "early warning" of higher than desirable levels of dioxin in food or feed and the establishment of target levels, over time, to bring exposure of a large part of the European population within the limits recommended by the Scientific Committee [see ref. 1]. Council Regulation (EC) No. 2375/2001 sets a maximum level of 3 pg WHO-PCDD/F-TEQ/g fat for milk and milk products, including butter fat [xii]. The Commission has recommended an action level of 2 pg WHO-PCDD/F-TEQ/g fat [xiii]. So far, these regulations and recommendations do not include dioxin-like PCBs. According to Council Regulation 2375/2001 the inclusion of dioxin-like PCBs should be reviewed by 31 December 2004. Thus, as an important conclusion, all samples are below the EU maximum tolerances and EU action levels for PCDD/F.

For a comprehensive evaluation, one has to consider not only the legal situation but also to compare the results with the average background contamination in different regions. The EU SCOOP database [xiv] covers ten countries and the period 1982 – 1999. EU SCF has considered the national figures contained in this database selecting only data since 1995 and calculated frequency distributions for a number of foods [xv]. The mean concentrations of two subgroups of milk and its products ranged approximately from 0.6 to 1.0 pg I-TEQ/g or 0.6 to 1.3 pg PCB-TEQ/g, lipid basis. The upper confidence limits were in the order of 1 pg I-TEQ/g fat and 2-10 pg PCB-TEQ/g fat for dioxin-like PCBs. The range of PCDD/F concentrations in 65 butter samples from 39 countries was found to be between 0.02 to 2.02 pg WHO-PCDD/F-TEQ/g fat [see ref. 3], in butter from 24 countries between 0.06 pg to 4.80 pg WHO-PCDD/F-TEQ/g fat [see ref. 4]. JECFA summarized food data from Western Europe, Japan, New Zealand and North America for PCDD/Fs and PCBs; however, the results are in pg/g whole food and therefore not comparable with data on fat basis [see ref 10]. Data from 135 butter samples collected between 2000 and 2002 and analysed in CVUA Freiburg show the actual low range of background contamination in Germany: mean 0.38 pg WHO-PCDD/F-TEQ/g fat (range 0.10 to 1.05; upper bound). In 21 of these samples, also PCB-TEQ was determined: mean 0.88 pg WHO-PCB-TEQ/g fat (range 0.23 to 1.62; upper bound) [xvi]. These and previous data [xvii] are in accordance with reports that in Germany PCDD/F contribute only about 30 % of the total TEQ value whereas about 70 % are caused by PCB-TEQ when a mean of 26 dairy products 0.77 pg WHO-PCDD/F-TEQ/g fat (range 0.55 to 1.16) and of 1.83 pg WHO-PCB-TEQ/g fat (range 0.71 – 3.04) was found [xviii].

As a conclusion, all samples except for Romania no. 2 are in the range of the actual low background contamination for PCDD/F found in many parts of Europe. Sample Romania no. 2 is above this level, but below the EU action and maximum level. All samples except Romania no. 2

and Estonia no. 2 are also in the actual low range for dioxin-like PCBs. In all samples except Estonia no. 2, the contribution of dioxin-like PCB to sum WHO-TEQ is in the range from 47 to 68 % which reflects the usual range especially in Europe. In sample Estonia no. 2, this contribution is 86 % which is an indication of a particular PCB source. The maximum sum WHO-TEQ values of 1.87 pg/g fat for Estonia no. 2 and of 2.73 pg/g fat for Romania no. 2 are below or in the range of the upper confidence limits as identified by EU SCF using data from 1995 to 1999 [see 14].

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