

LEVELS OF PCDD/FS, DIOXIN-LIKE PCB'S AND INDICATOR PCB'S IN BUTTER FROM TURKEY

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Abstract

Polychlorinated dibenzo-p-dioxin (PCDD/F's) and polychlorinated biphenyls (PCB's) dioxin-like and indicator were monitored in butterfat obtained from 18 different areas in Turkey both rural and industrial. At four locations levels are slightly elevated however NRL's or action levels were not exceeded. Ratios of PCDD/F's and PCB's indicate that the contamination at the elevated areas is caused by different sources

Introduction

The Turkish Ministry of Agricultural and Rural Affairs (MARA) has signed a contract with The Government of the Netherlands to implement methods for contaminant analysis in food. Within the framework of this memorandum of understanding RIKILT, as a national reference laboratory, is on behalf of The Netherlands government responsible for the training and final implementation of a method for the determination of Dioxins at Ankara Provincial Control Laboratory (APCL). Analysis of butter samples gives in general a good indication for the situation of the environment of cows (1,2,3). As a part of the training it was decided to determine dioxin and pcb levels in samples butterfat at RIKILT and at APCL. The analysis at RIKILT were performed by APCL coworkers under supervision of RIKILT. For comparison the same samples were also analyzed at APCL. These are the first results on pcdd/f's and PCB's in food samples from Turkey

Materials and methods

Samples butterfat were collected by provincial inspectors in Turkey at 14 different cities and 18 different areas, rural and industrial areas. Butter was mixed with sodium sulphate and fat was extracted with pentane. Subsequently fat was purified using a Powerprep System (FMS) containing two silica columns jumbo and classical, an alumina columns and a carbon column (4). Levels were quantified by GC/HRMS (AUTOSPEC) at 10.000 resolution using selected ion monitoring on a DB5-MS column (60 m x 0,25 mm x 0,25 µm). Levels were expressed in pg TEQ/gram fat (5). At both laboratories for quality control the same sample butterfat from a hot spot in the Netherlands is used. This QA sample code 3019 contains pcdd/f's and dl-pcb's around MRL. At APCL this sample was after installation of the equipment and training at RIKILT initially analyzed for comparison with previously obtained results from RIKILT

Results and discussion

In table 1 the averaged results of the QA sample butterfat 3019 is given. Both institutes analyzed this QA sample six times on one day using their own native standards. Results on congener and on TEQ basis are similar.

Table 1 : Comparison of QA sample butterfat. Content in pg/gram fat and total in pg TEQ/gram fat.

(n=6) Dioxins	APCL		RIKILT	
	Average	RSD%	Average	RSD%
2,3,7,8-TCDF	0,10	25,01	0,11	11,02
1,2,3,7,8-PeCDF	0,10	17,03	0,11	9,19
2,3,4,7,8-PeCDF	2,28	1,39	2,11	2,48
1,2,3,4,7,8-HxCDF	1,09	5,01	1,01	0,89
1,2,3,6,7,8-HxCDF	1,13	3,18	1,06	4,63
2,3,4,6,7,8-HxCDF	1,48	1,73	1,51	4,33
1,2,3,7,8,9-HxCDF	0,04	86,39	0,04	32,99
1,2,3,4,6,7,8-HpCDF	0,64	5,53	0,56	5,76
1,2,3,4,7,8,9-HpCDF	0,11	33,94	0,12	21,30
OCDF	0,14	32,68	0,09	49,15
2,3,7,8-TCDD	0,39	3,40	0,40	10,73
1,2,3,7,8-PeCDD	1,17	4,09	0,98	3,20
1,2,3,4,7,8-HxCDD	0,61	3,99	0,49	3,84
1,2,3,6,7,8-HxCDD	1,48	2,26	1,33	3,79
1,2,3,7,8,9-HxCDD	0,47	5,38	0,44	5,90
1,2,3,4,6,7,8-HpCDD	1,30	5,89	1,11	3,13
OCDD	3,05	7,62	2,85	2,63
Total TEQ	3,37	1,89	3,05	1,43
non-ortho-PCB's				
PCB 81	3,11	4,18	3,57	0,93
PCB 77	5,19	10,98	5,42	1,26
PCB 126	26,83	1,67	29,67	1,36
PCB 169	5,13	2,87	5,11	2,11
Total TEQ no PCB	2,74	1,65	3,02	1,33

The results of the dioxin and dl-pcb's and indicator pcb's of the eighteen samples butterfat analysis are given in table 2. In figure 1 the total dioxin and dl-pcb content in pg TEQ/gram fat in Turkish butter analyzed at RIKILT is shown in the map of Turkey. In the majority of Turkish samples butterfat levels of dioxin and DL-PCB's are comparable with Dutch background levels 0.5-1.0 pg TEQ/gram fat. Four samples contain elevated levels around the EU action level of 2.0 pg TEQ/gram fat. Ratio's between dioxin and DL-PCB's vary from 0.5 until 1.8. This might be caused by different sources of contamination. On basis of the first results it is recommended to resample Turkish butter especially from areas with elevated levels. Congener pattern has to be studied in detail to elucidate source of contamination. The four slightly elevated location are:

T1(Zonguldak), which is located in the northern part of Turkey. The first coal mine of Turkey is located in this area. Coal production is still the most important source of industry. Also there is one big iron-steel production factory. **T2 (Denizli)** This city is one of the most expanding cities with respect to industrial activities. Especially textile industry, there are many textile dyeing factories in this area. Another important industry in this area is marble and production of cement.

T8 (İzmit) This city is the center of the Turkish industry, more than fifty percent of the industry is localized here. There are many factories for production of e.g. paint, metal, pharmaceuticals, cement, ceramics, machinery etc. With respect of dioxin contamination the most important industry could be

İzaydaş, which is a waste incinerator. **T17(İzmir)** is the third biggest and most crowded city in Turkey. Two samples butterfat are collected from İzmir, one from a big dairy factory which collects milk outside of İzmir. The second sample is obtained at a local dairy factory in Aliaga near a power plant and a big cement factory.

Table 2: Results of dioxin and dl-pcb's analysis in Turkish butter analyzed at RIKILT and APCL
Content in pg TEQ/gram fat

Origin	Dioxins		DL-PCBs		Total		Σ ind-PCB's		Ratio Dioxin/DL-PCBs	
	RIKILT	APCL	RIKILT	APCL	RIKILT	APCL	RIKILT	APCL	RIKILT	APCL
T1 Zonguldak	1,21	1,11	1,03	0,94	2,23	2,05	1007	1119	1,2	1,2
T2 Denizli	0,82	0,71	1,30	1,19	2,12	1,90	1036	1267	0,6	0,6
T3 Konya	0,30	0,30	0,18	0,19	0,48	0,49	324	396	1,6	1,6
T4 Istanbul	0,50	0,44	0,86	0,79	1,35	1,23	952	1188	0,6	0,6
T5 Istanbul	0,50	0,64	0,58	0,53	1,08	1,16	645	797	0,9	1,2
T6 Izmit	0,83	0,92	0,96	0,92	1,79	1,84	1122	1363	0,9	1,0
T7 Izmit	0,77	0,86	0,86	0,84	1,62	1,70	1011	1317	0,9	1,0
T8 Izmit	1,56	1,55	1,85	1,72	3,41	3,27	2594	3179	0,8	0,9
T9 Mersin	0,57	0,52	0,52	0,48	1,09	1,00	659	839	1,1	1,1
T10 Bursa	0,57	0,56	0,64	0,60	1,21	1,16	731	883	0,9	0,9
T11 Batman	0,19	0,21	0,11	0,09	0,30	0,30	188	215	1,8	2,4
T12 Karaman	0,19	0,18	0,18	0,16	0,38	0,34	289	326	1,1	1,1
T13 Kayseri	0,33	0,27	0,30	0,27	0,63	0,54	403	453	1,1	1,0
T14 Bilecik	0,44	0,55	0,35	0,32	0,79	0,87	433	507	1,2	1,7
T15 Adana	0,56	0,48	0,51	0,46	1,07	0,94	675	769	1,1	1,0
T16 Sakarya	0,66	0,64	0,63	0,58	1,29	1,23	750	911	1,0	1,1
T17 Izmir	1,26	1,15	2,72	2,50	3,98	3,65	2776	3309	0,5	0,5
T18 Izmir	0,17	0,11	0,11	0,10	0,29	0,21	303	344	1,5	1,2

The results obtained at RIKILT and at APCL are in good agreement. As the comparison is only between two laboratories no statistical treatment of the results was done. On TEQ basis the difference between the two laboratories in general is less than 10 %. For the very low contaminated samples the difference varies somewhat more. For the indicator pcb's results of APCL are approximately 15 % higher.



Figure 1: Total dioxin and dl-pcb content in pg TEQ/gram fat in Turkish butter analyzed at RIKILT.

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