Investigation into levels of PCDD/Fs, PCBs and PBDEs in Irish produce

Christina Tlustos[1], Iona Pratt[1], Shaun White[2], Alwyn Fernandes[2], Martin Rose[2]

[1]Food Safety Authority Of Ireland
[2]Central Science Laboratory

Introduction

The Food Safety Authority of Ireland (FSAI) has a statutory responsibility to assure the safety of food consumed, distributed, produced and sold on the Irish market. The results of a targeted surveillance study on levels of dioxins, furans (PCDD/Fs), polychlorinated biphenyls (PCBs) and polybrominated diphenyl ethers (PBDEs) in a variety of food available on the Irish market, including meat, offal, dairy products, fruit and vegetables are presented here.

The study was undertaken against the background of increased awareness in the European Union of the possible health risks posed by PCDD/Fs, PCBs and PBDEs in the food chain, and builds on previous studies undertaken by FSAI into levels of these contaminants in milk[1], fish and fish oils[2] and eggs[3].

Materials and Method

For this survey the following types of food samples were collected: (1) Animal carcass fat, (2) Offal, (3) Cereals, (4) Fruit, (5) Vegetables, (6) Dairy products, (7) Fats & Oils and (8) soup powder.

Groups 1 to 5 were provided by officers of the Department of Agriculture and Food at production level and the remainder taken by officers of the Food Safety Authority of Ireland at retail level. An overall total of 65 samples (N) were collected, the majority being pooled samples, comprising a number of sub-samples (Sub-N, see Table 1).

Analysis of the samples was undertaken by CSL (Central Science Laboratory, York, UK), under contract to FSAI. Samples were analysed using established methodology [4] accredited to the ISO 17025 standard and to meet EU quality legislation for analysis of dioxins in food[5].

Results and Discussion

Table 1 presents results expressed as ng/kg WHO-TEQs for (a) PCDD/Fs, (b) dioxin-like PCBs, (c) the sum of PCDD/Fs & dioxin-like PCBs (see Figure 1 also), and as results expressed in µg/kg for (d) the ICES 7 marker PCBs 28, 52, 101, 118, 138, 153 and 180 and (e) the sum of PBDEs 17, 28, 47, 49, 66, 71, 77, 85, 99, 100, 119, 126, 138, 153, 154 and 183 . In each case results are presented as mean upper-bound values (

1 Mean upper-bound levels (

			WHO TEQs ng/kg			µg/kg	
		N (sub-N per N)	dl-PCBs	PCDD/PCDF	Σ dl PCBs& PCDD/F	Σ ICES 7 PCBs	Σ PBDEs
			fat weight based (upper-bound)				
			ng/kg			µg/kg	
Carcass fat	Bovine	10(10)	0.45	0.43	0.88	1.73	1.01
	Avian	7(10)	0.19	0.18	0.37	1.04	1.26
	Avian (Duck)	1(10)	0.05	0.12	0.17	0.26	0.89
	Ovine	8(10)	0.29	0.35	0.64	1.87	1.01
	Porcine	8(10)	0.08	0.09	0.17	1.14	1.33
Dairy products	Butter	1(10)	0.27	0.24	0.51	1.24	1.00
	Cheddar	1(10)	0.22	0.23	0.45	1.21	1.06
	Processed cheese	1(8)	0.24	0.25	0.49	1.35	1.13
	Soft cheese	1(10)	0.18	0.2	0.38	0.78	0.86
	Dairy spread	1(10)	0.05	0.08	0.13	0.92	1.03
	Yoghurt	1(4)	0.12	0.11	0.23	0.78	1.00
Offal (Liver)	Bovine	1(10)	0.52	1.6	2.12	2.72	1.10
	Avian (Chicken)	3(40)	0.13	0.39	0.51	0.99	1.36
	Avian (Turkey)	1(40)	0.49	0.47	0.96	2.97	1.49
	Ovine	1(10)	1.42	4.04	5.46	3.34	1.02
	Porcine	1(10)	0.13	1.09	1.22	0.75	1.35
Soup	Soup	1(3)	0.07	0.12	0.19	0.47	0.85
			WHO TEQs ng/kg			µg/kg	
		N (sub-N per N)	dl-PCBs	PCDD/PCDF	Σ dl PCBs& PCDD/F	Σ ICES 7 PCBs	Σ PBDEs
			whole weight (upper-bound)				
			ng/kg			µg/kg	
Cereals	Various	3	0.03	0.03	0.06	0.11	0.22
Fruit	Various	3	0.03	0.03	0.06	0.07	0.17
Vegetables	Various	8	0.03	0.03	0.06	0.07	0.17
Fat	Vegetable/animal	1(6)	0.21	0.24	0.45	1.16	0.75
Oil	Vegetable Oil	2(3)	0.05	0.05	0.1	0.43	0.34

Dioxins, furans and PCBs:

Cereals, Fruits and Vegetables: Only low amounts of hepta- and octa- congeners were detected in some of these samples, and combined levels for dioxins, furans and dioxin-like PCBS were all below the Limit of Detection (LOD) when expressed on a TEQ basis (0.06 ng/kg total WHO TEQ). Regarding non-dioxin-like PCBs, the majority of congeners tested were below the LOD, with a minor percentage of congeners having levels slightly in excess of the LOD. The relative absence of these contaminants can be attributed to the low percentage of fat in these foods.

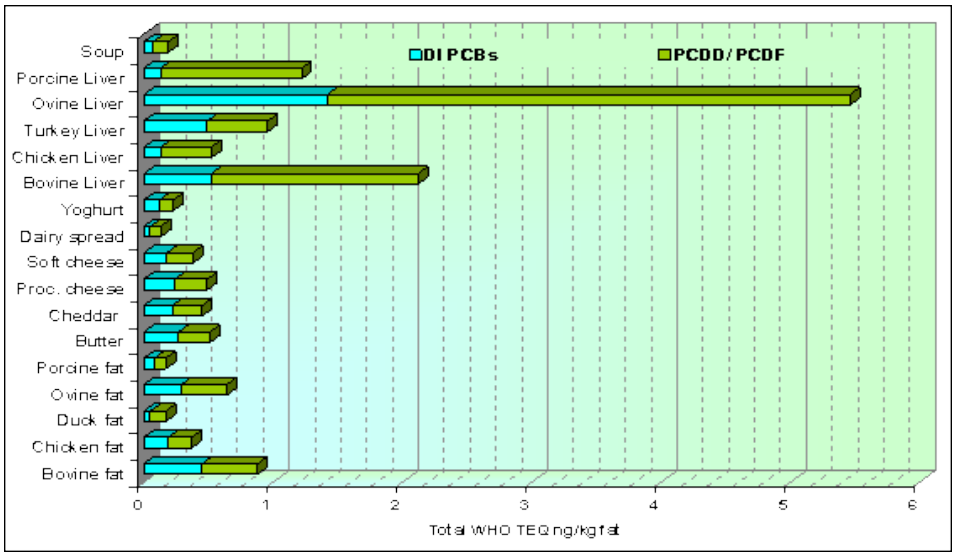
Carcass fat: The mean upper-bound levels for PCDDs, PCDFs and dioxin-like PCBs expressed as ng/kg fat based WHO TEQs were as follows: beef 0.88, sheep 0.64, poultry 0.37 and pork 0.17. Dioxins/furans and dioxin-like PCBs contributed approximately equally to the total TEQ.

Dairy products: The mean upper-bound levels for PCDDs, PCDFs and dioxin-like PCBs expressed as ng/kg fat based WHO TEQs were as follows: Butter 0.51; processed cheese 0.49; Cheddar cheese 0.45; Soft cheese 0.38; Yoghurt 0.23; Dairy spread 0.13. These levels are in line with the findings of a previous survey conducted on milk in Ireland.

Offal: Of all products tested in this survey, liver showed the highest concentration of PCDDs, PCDFs and dioxin-like PCBs expressed as ng/kg fat WHO TEQs, which were as follows: Sheep liver 5.46; beef liver 2.12; pig liver 1.22; chicken liver 0.51. Whereas for all other food categories an equal share of dioxins/furans and dioxin-like PCBs could be observed, in the case of liver dioxins contribute on average 74% to the total TEQ, and in the case of pork this proportion was 89%. Although there is a paucity of data, similar observations regarding the latter have been made in other EC Member States.

Fats & Oils: For the vegetable oils analysed, levels for dioxins, furans and dioxin-like PCBS were all below the LOD. Regarding non-dioxin-like PCBs, the majority of congeners tested were also below the LOD, with a minor percentage of congeners being slightly above the LOD. A mixture of animal/vegetable fat recorded a total TEQ ng/kg of 0.45 for PCDDs/ PCDFs and dioxin-like PCBs.

Figure 1 Total WHO-TEQs in ng/kg for PCDD/Fs and dioxin-like PCBs and added sum of PCDD/Fs and dioxin-like PCBs



Brominated flame retardants:

Total PBDE occurrence ranged from 0.89 – 1.33 µg/kg fat weight in carcass fat, 0.86 – 1.13 µg/kg fat weight in dairy products, 1.02 – 1.49 µg/kg fat weight in offal and mean values were recorded for soup powder (0.85 µg/kg fat weight), cereals (0.22 µg/kg fresh weight), fruit and vegetables (0.17 µg/kg fresh weight), fat (0.75 µg/kg fresh weight) and in oil (0.34 µg/kg fresh weight).

No PBDE levels were found above the Limit of Detection in vegetables, fruit and soup powder and levels reported in table 1 represent the maximum possible levels, calculated at their limit of detection (upper-bound values). For the remaining foods tested, levels above the LOD were recorded mainly for PBDE congeners BDE-47, BDE-99, BDE153, BDE 154 and BDE-100, which is in line with findings in previous FSAI surveys[3] and may be compared to findings in other countries[6],[7].

Conclusions

This study has demonstrated that levels of dioxins, furans, PCBs and PBDEs in the food commodities analysed were generally low, and were well below the maximum limits laid down in Council Regulation 2375/2001. The Regulation does not currently establish maximum limits for PCBs, but dioxin-like PCBs will be included in 2005 and

concentrations found in all foods covered by this survey are well below currently proposed legislation in this area. Levels of the marker or indicator PCBs 28, 52, 101, 118, 138, 153, and 180 dioxin-like PCBs are similarly low, as are levels of those PBDEs measured in the study. The results of the study are in line with those from previous FSAI studies on dioxin levels in milk, fish and eggs and confirm that dioxin levels in these foods are relatively low compared with similar products from more industrialised countries in the European Union. These findings support the interpretation that exposure of consumers of Irish food to dioxins is likely to be lower than the European average, a conclusion which should be reassuring to Irish consumers.

Acknowledgements

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