

PCDD/Fs (DIOXINS) AND PCBs IN THE UK DIET: 1997 TOTAL DIET STUDY SAMPLES

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Introduction

The UK Total Diet Study (TDS) is used to provide information on dietary exposures of the general UK population to chemicals such as nutrients and contaminants. The Total Diet Study is a model of the average domestic diet in the UK.^{1,2} A total of 121 categories of food and drink are specified for inclusion in the Total Diet. These are assigned to one of twenty broad food groups.

Previous Total Diet surveys carried out by the Ministry of Agriculture, Fisheries and Food (MAFF) showed that estimated dietary exposures of UK consumers to dioxins (PCDD/Fs) and dioxin-like polychlorinated biphenyls (PCBs) fell substantially between 1982 and 1992.³ The current survey was carried out to produce new estimates of dietary exposure to these chemicals in the UK. This would allow a review of exposure with regard to public health concerns.

Materials and Methods

The analytical methodology for determining PCDD/F and PCBs concentrations in food has been reported previously.⁴ All of the 17 PCDD/Fs and the 12 dioxin-like PCBs congeners with assigned WHO-TEFs⁵ were measured in this survey. The following additional PCB congeners were also analysed: PCB 18, 28, 31, 47, 49, 51, 52, 99, 101, 128, 138, 180 and 153. These were selected as they have other non-dioxin-like toxic effects, are routinely analysed by the International Committee for the Exploration of the Sea (sometimes referred to as the 'ICES 7' congeners), and/or are commonly reported to occur in food and/or in human milk.

All samples were analysed by high resolution gas chromatography coupled with high or low resolution mass spectrometry (GC-MS). The reporting limit for *ortho* substituted PCBs in this survey was set to 0.05 µg/kg fat.

Results and discussion

Comparisons of concentrations of PCDD/F and PCBs in 1997 with those found in 1992 and 1982 can only be made for those food groups which were measured in the earlier surveys. The data is shown in Table 1. Most individual congeners were lower in most food groups in 1997 than those found in the 1992 and 1982 TDS surveys. This is most noticeable in the poultry, offals, milk and eggs food groups, especially for eggs. In the meat products, oils and fats, and milk products food groups there appeared to be slight increases in dioxin concentrations in 1997 compared with 1992, although they may not be significant. In the case of dioxin-like PCBs, there were increases in the concentrations between 1992 and 1997 in most of the food groups, especially in the carcass meat,

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milk and eggs food groups. The reasons for the apparent increase in dioxin-like PCB concentrations in several food groups are not clear. The combined concentrations of dioxins and dioxin-like PCBs decreased in the offals, and especially in the milk food groups, increased in the meat products food group, but showed relatively little change in the remaining food groups. The general decrease in concentrations of dioxins between 1992 and 1997 is in line with that found previously in retail cows' milk.⁶

Dietary exposure

The estimated mean consumer dietary exposures of adults, children and toddlers to dioxins and dioxin-like PCBs via the total diet in 1997 are all below the UK TDI of 10 pg WHO-TEQ/kg bw/day, as shown in Table 2. The estimated high-level consumer dietary exposures of adults, children and of most toddlers to dioxins and dioxin-like PCBs are also below the UK TDI (Table 3). The estimated high level dietary exposure of toddlers in the youngest age range (1.5-2.5 years) is at the UK TDI.

The estimated average and high level dietary exposures of adults and schoolchildren via the total diet in 1997 are also estimated to be within the recently recommended WHO TDI of 1-4 pg TEQ/kg bw/day, but the estimated dietary exposures of toddlers are all at or above the upper end of the range. For the youngest age group, average consumption is estimated to exceed the WHO TDI by 28 per cent, and high-level toddler consumption to exceed it approximately two-fold.

However, despite the fact that toddlers may exceed the WHO TDI, estimated exposures for all age groups have declined substantially since 1982 and are anticipated to decline further still in the future. The UK Committee on Toxicity of Chemicals, in Food, Consumer Products and the Environment (COT) concluded that the current concentrations of dioxins and dioxin-like PCBs in food are unlikely to pose a risk to health. Consumers of all age groups are therefore not recommended to change their diets on the basis of the results of this survey.

Acknowledgements

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Table 1: Concentrations of dioxins and dioxin-like PCBs in TDS food group samples in 1982, 1992 and 1997

Food group	Concentration (ng WHO-TEQ/kg fat basis)								
	1982			1992			1997		
	Dioxins	PCBs	Dioxins+ PCBs	Dioxins	PCBs	Dioxins+ PCBs	Dioxins	PCBs	Dioxins+ PCBs
Carcase meat	3.16	1.88	5.04	1.15	0.86	2.01	0.80	1.07	1.87
Offals	15.76	3.29	19.05	10.33	2.88	13.21	6.29	2.47	8.76
Meat products	1.50	0.70	2.20	0.43	0.33	0.77	0.77	0.61	1.38
Poultry	5.89	2.29	8.18	1.85	0.89	2.74	1.01	1.31	2.32
Fish	5.83	11.24	17.07	3.14	4.60	7.75	2.40	4.53	6.93
Oils and fats	1.29	1.24	2.54	0.29	0.34	0.64	0.44	0.36	0.80
Potatoes	*	*	*	*	*	*	0.53	0.17	0.70
Milk	5.21	2.68	7.88	2.38	1.23	3.61	0.83	0.74	1.57
Milk products	4.08	1.69	5.77	0.89	0.56	1.44	1.12	0.88	2.00
Eggs	8.93	2.20	11.12	1.97	0.94	2.91	0.77	0.64	1.41
Misc. cereals	1.79	1.67	3.46	2.15	0.35	2.50	0.43	0.38	0.81
Bread	1.38	0.95	2.33	1.35	0.69	2.04	0.74	0.28	1.02
Nuts	*	*	*	*	*	*	0.44	0.13	0.57
Sugar and preserves	*	*	*	*	*	*	0.97	0.33	1.30
Fruit products	*	*	*	*	*	*	2.59***	0.49	3.08***
Green vegetables**	*	*	*	*	*	*	0.69	0.21	0.90
Other vegetables	*	*	*	*	*	*	0.50	0.20	0.70
Canned vegetables	*	*	*	*	*	*	0.77	0.27	1.04
Fresh fruit	*	*	*	*	*	*	9.66***	3.01***	12.67***

Notes: Concentrations in the 1982 and 1992 TDS samples are those from Food Surveillance Information Sheet No. 105,¹ re-expressed as WHO-TEQs. Combined concentrations of dioxins and dioxin-like PCBs may not equal the sum of the concentrations due to rounding.

* These food groups were not analysed in the 1982 and 1992 TDS surveys. Dietary exposures were estimated by assuming each individual dioxin and dioxin-like PCB was present at their fresh weight limits of determination.

** The concentrations of non-ortho PCBs could not be determined due to analytical difficulties. Non-ortho PCBs were assumed to be present at the averages of their concentrations in the potatoes, other vegetables and canned vegetable food group samples.

*** These samples had very low fat contents. The fresh weight concentrations were low.

Table 2: Summary of estimated *upper bound* mean dietary exposures of all age groups to dioxins and dioxin-like PCBs in 1982, 1992 and 1997 (pg WHO-TEQ/kg bodyweight/day)

Age group	Estimated mean dietary exposure (pg WHO-TEQ/kg bodyweight/day)								
	1982			1992			1997		
	Dioxins	PCBs	Dioxins+ PCBs	Dioxins	PCBs	Dioxins+ PCBs	Dioxins	PCBs	Dioxins+ PCBs
<i>Toddlers:</i>									
1.5-2.5 years	15	7.9	23	5.0	2.6	7.5	2.6	2.6	5.1
2.5-3.5 years	12	6.6	19	4.2	2.1	6.3	2.3	2.2	4.4
3.5-4.5 years (boys)	11	5.9	17	3.7	1.9	5.6	2.1	1.9	4.0
3.5-4.5 years (girls)	11	5.8	17	3.7	1.9	5.6	2.1	1.9	4.0
Schoolchildren	5.6	3.0	8.6	2.0	1.0	3.0	1.2	1.0	2.2
Adults	4.6	2.6	7.2	1.6	0.9	2.5	0.9	0.9	1.8
Population average	4.7	2.7	7.5	1.5	0.9	2.4	1.0	0.8	1.7

Table 3: Summary of estimated *upper bound* high level dietary exposure of all age groups to dioxins and dioxin-like PCBs in 1982, 1992 and 1997 (pg WHO-TEQ/kg bodyweight/day)

Age group	Estimated high level dietary exposure (pg WHO-TEQ/kg bodyweight/day)								
	1982			1992			1997		
	Dioxins	PCBs	Dioxins+ PCBs	Dioxins	PCBs	Dioxins+ PCBs	Dioxins	PCBs	Dioxins+ PCBs
<i>Toddlers:</i>									
1.5-2.5 years	34	16	49	8.9	5.0	14	5.2	4.9	10
2.5-3.5 years	27	14	41	7.5	4.0	11	4.3	4.1	8.4
3.5-4.5 years (boys)	22	11	33	6.0	3.3	9.2	3.6	3.4	6.9
3.5-4.5 years (girls)	24	11	34	6.6	3.2	9.6	3.8	3.4	7.2
Schoolchildren	10	5.2	15	3.2	1.6	4.7	1.9	1.7	3.5
Adults	8.3	4.6	13	2.8	1.6	4.3	1.6	1.6	3.1