

LEVELS OF PCDD, PCDF, *NON-ORTHO* PCB AND *MONO-ORTHO* PCB IN CHICKEN, BUTTER, BEEF, HUMAN MILK, SALMON AND COD LIVER FROM NORTHERN EUROPE COMPARED TO THE CURRENT EU LIMIT VALUES FOR THESE TYPES OF FOODS

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Introduction

The European exposure to dioxins via food has declined considerably during the last decades. This is due to successful efforts that have led to the reduction of many known dioxin sources. Today the estimated intake by the European population of PCDD, PCDF and non-ortho PCB, expressed as WHO-TEQs, is 1.2-3.0 pg/bw/day. Since the 80's various tolerable daily intake 'recommendations' have been used, and for many population groups, such as new-borns and high fish consumers, these recommendations have been exceeded, and still are. Recently a tolerable weekly intake (TWI) of dioxins, furans and *non-ortho* PCBs, corresponding to 14 pg WHO-TEQ/kg bw, was set by the Scientific Committee on Food (SCF) of the European Commission¹. Considering the newly reported current dioxin intake levels in the Netherlands², among other European countries, it can be seen that still about 1/10 of the general population, and in addition new-borns and some fish consumers, exceed the new SCF TWI.

The SCF has, as of 2002, also established maximum limit values for dioxins and furans in consumer foods on the European market in order to reduce the overall dioxin contamination of the food-chain, and the exposure of the European population. The goal is to have a 25 % decline in the exposure by year 2006. The WHO_{PCDD/F}-TEQ maximum limits, based so far on the concentrations of PCDDs and PCDFs only, are set for foods such as meat, fish, poultry, dairy products and oil and fats. They range from 0,75-6 pg/g lipid. With one exception the WHO_{PCDD/F}-TEQ maximum limit is set on lipid bases, namely for fish. For fish the EU limit is 4 pg WHO_{PCDD/F}-TEQ/g fresh weight.

In identifying dioxin sources in the food-chain as well as geographical, temporal and species related trends it is important to closer examine the contributions of the different dioxin-like residue groups, i.e. PCDD, PCDF, *non-ortho* PCB and *mono-ortho* PCB, to the total TEQ. Also, the analytical accuracy in determining dioxin concentrations in foods is of importance when implementing the new EU regulation. This aspect was elucidated recently by Lindström et al., and it was shown that mean RSD for the WHO_{PCDD/F/non-ortho PCB}-TEQ measurements ranged from 36 to 57 % for three foods tested by highly renowned dioxin laboratories³. For a chicken sample the consensus level was 1.2 ppt TEQ on lipid basis, and the levels reported by 24 laboratories were between 0.53 and 2.2 ppt. For butter the consensus was 0.55 ppt TEQ, and 27 laboratories reported levels from 0.18 up to 1.5 ppt. For a salmon sample levels ranging from 5.9 to 38 ppt TEQ (measured by 25 laboratories) were reported, 15 ppt being the consensus value.

Methods and Materials

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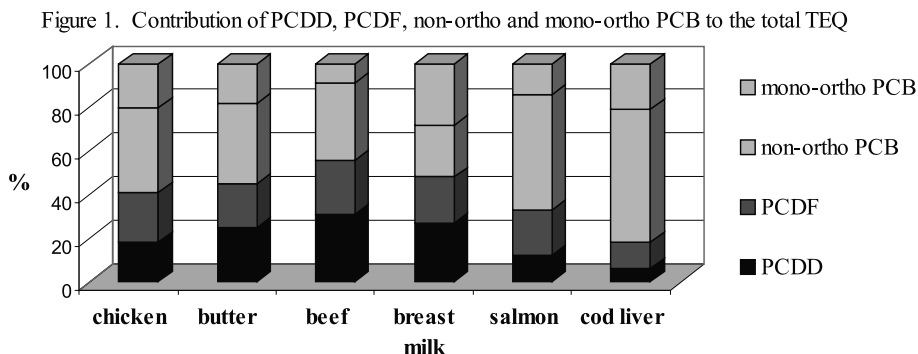
In this study we compare the absolute and relative contributions of PCDDs, PCDFs, *non-ortho* PCBs and *mono-ortho* PCBs to the total WHO-TEQs of six foods - chicken, beef, butter, human milk, salmon and cod liver. We further compare the TEQ levels in the foods on fresh weight and lipid weight bases. Finally the TEQ levels, including as well as excluding the PCBs, are compared to the current EU limit values.

Levels of PCDD, PCDF, *non-ortho* PCB and *mono-ortho* PCB in samples of chicken, beef, butter, human milk, salmon and cod liver were reported by 9 to 52 laboratories participating in two interlaboratory studies, in 2000 and 2001, co-ordinated by the National Institute of Public Health in Norway ^{4,5}. The food samples were all natural consumer food homogenates from the Norwegian market. In this comparative study we use the consensus levels (best estimates of the accurate levels) which were calculated for the 6 foods and the 29 congeners determined in the two interlaboratory studies. A majority (up to 60 laboratories) of the most experienced dioxin laboratories that perform dioxin analysis in food participated in the study and generated the data used here.

Results and Discussion

Relative contribution of PCDD, PCDF, non-ortho PCB and mono-ortho PCB to the total WHO-TEQ

In Figure 1 the relative contributions of the four dioxin-like congener groups, PCDD, PCDF, *non-ortho* PCB and *mono-ortho* PCB are shown for the six food samples.



The TEQ levels presented on lipid bases vs. wet weight basis for the six different foods

In figure 2a and 2b the total TEQ levels (in pg/g) are given for the six foods on fresh weight basis and on lipid weight bases.

WHO-TEQ determinations and their relations to the current EU limit values

In figure 3a and 3b the lipid adjusted levels of WHO_{PCDD/F}-TEQs and WHO_{PCDD/PCDF/non-orthoPCB/mono-orthoPCB}-TEQs for the chicken, butter, beef, human milk, salmon and cod liver samples are compared to the established EU maximum limit values for these foods. It should be noted that the current EU limit values include only PCDD and PCDF.

Conclusions

For all foods studied here the PCBs contribute to more than 50% to the total WHO-TEQ. For cod liver the contribution of PCBs to the total WHO-TEQ is remarkable, more than 80%. Breast milk and cod liver exceeds the limit value set by EU's SCF for milk and fish oil. The total TEQ levels in the salmon and cod liver reflects the relatively highly contaminated aquatic food-chain. If the EU limit

Figure 2a Total TEQ on fresh and lipid wight basis

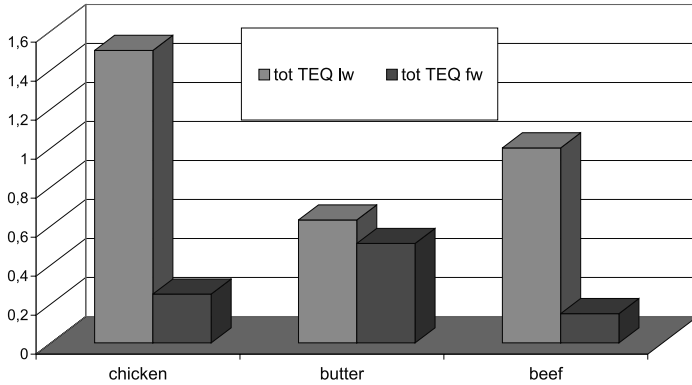


Figure 2b Total TEQ on fresh and lipid wight basis

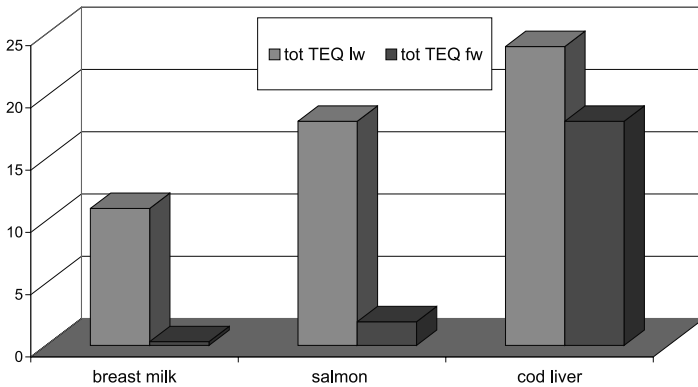
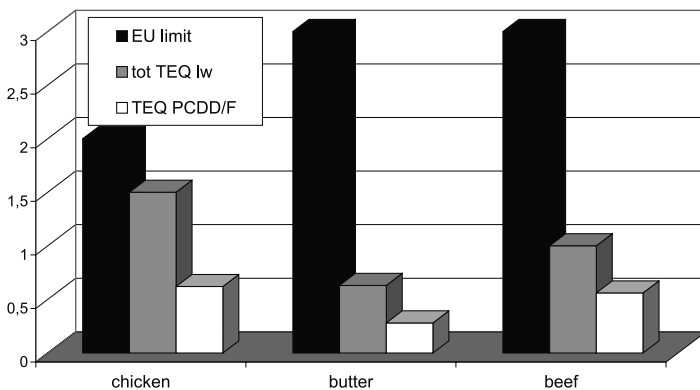
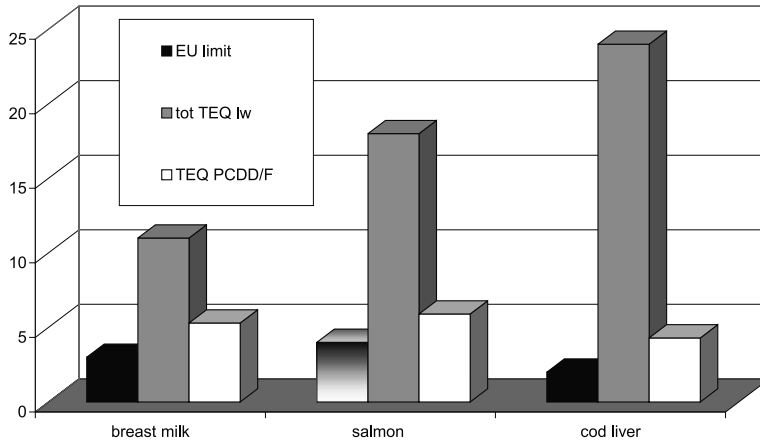


Figure 3a EU limit value compared to total TEQ and TEQ based on PCDD/F



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Figure 3b EU limit value compared to total TEQ and TEQ based on PCDD/F



value would be given on lipid bases for fish, as for the other foods, then in this case for the salmon sample (11 % lipid) a 4 pg/g limit on fresh weight basis would correspond to 36 pg/g on lipid basis.

Acknowledgements

All the participating laboratories in the Interlaboratory Studies on Dioxin in Food 2000 and 2001 are greatly acknowledged for their important work in generating data for this evaluation.

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