

## SWEDISH CONSUMPTION OF FATTY BALTIC FISH IN RELATION TO THE TOTAL DIOXIN INTAKE AND THE RECOMMENDED TDI

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### Introduction

The dietary intake of persistent organic pollutants (POPs) is an important issue, as adverse effects due to a high intake from food cannot be excluded. In Sweden, the consumption of fatty fish from the Baltic region is regarded as an important contributor to the total POP intake. The Swedish National Food Administration has since many years issued dietary restrictions for these fishes, with the purpose of prohibiting the potential effects of an excessive POP intake. The dietary recommendations, chiefly based on risk assessments of dioxins and PCBs, are of two kinds, one for girls and women in childbearing ages, and one for all other consumers. The more restrictive recommendation for girls and women is a consequence of the adverse effects of dioxins that could affect the offspring at comparably lower levels.

#### *The Swedish dietary recommendations for fatty Baltic fish*

Girls and women in childbearing age

- do not eat more than one meal per month of Baltic herring, wild salmon and trout from the Baltic Sea (incl. the Gulf of Bothnia), and of salmon and trout from lake Vänern and arctic char from Lake Vättern
- do not eat liver from cod and burbot

Women above childbearing age, boys and men

- one meal per week of the specified fishes, and only occasional servings of liver from cod and burbot

Recently, a Swedish intake calculation on POPs was finalised<sup>1</sup>. In this report the dioxin intake for the Swedish consumers was estimated. The results of this estimation will be discussed in some detail in this abstract, in relation to the tolerable intake of dioxins proposed by SCF-EU (TDI = 2 pg total WHO-TEQ/kgbw/day). The intake of dioxins from fatty fish among Swedish consumers has a special interest as Sweden and Finland as been given a derogation from the general EU directive on maximum dioxin levels in fish. This derogation was given as Sweden and Finland have well-known dietary restrictions for intake of fatty fish from the Baltic, avoiding a too high intake of these fishes.

### Methods

The consumption study (Riksmaten 1997-98) was performed during the mentioned years in co-operation with the Central Bureau of Statistics<sup>2</sup>. The study consisted of two parts, a 7 days-recall consumption diary and a questionnaire mainly concerning detailed fish consumption queries. About 60% (1212) of the 2000 persons contacted gave a complete set of data that was used in the intake calculations. The participating consumers were between 17 and 79 years of age and 631

(52%) were women and 581 (48%) were men. The food samples used for dioxin analyses were obtained mainly 1998-99, either directly at the producers or by direct purchase in grocers' shops in major Swedish towns. The collected samples were almost entirely of animal origin, because of earlier data showing low or non-detectable dioxin levels in vegetable samples. 17 PCDD/PCDF congener and 3 dioxin-like PCB congeners (PCB.77, 126, 169) were analysed at Dr Wessling Laboratorien GmbH, Altenberge, Germany. Additional 6 PCB congeners with TEF factors were analysed at the National Food Administration (NFA) in Uppsala. Thus, the obtained TEQ values (according to the TEFs recommended by WHO<sup>3</sup>) are based on 17 PCDD/PCDF and the 9 mentioned PCB congeners. In case of occurrence levels beneath limit of determination (LOD), half the LOD was used. As regards fish intake calculations from portion, a portion was set equal to 125 g. That is, a recommendation of one meal a week will correspond to 17.8 g/day, and one meal per month will give 4.17 g/day.

### Results and Discussion

The estimated Swedish median dioxin intake is, based on the consumption study Riksmaten 1997-98, 1.0-1.1 pg total WHO-TEQ/kgbw/d, and the mean intake is somewhat higher (Table 1). The relative contribution from PCDD/F- and PCB-TEQ to the total TEQ seems about equal, although the PCDD/F part slightly overweighs. There was a skewed distribution in dioxin intake with a few, high intake values (Fig. 1). In Fig. 1 could be shown that almost 13% of the Swedish adult (17-79 yr) consumers are calculated to have a dioxin intake above the TDI of 2 pg total TEQ/kgbw/d.

As stated in Introduction, the Swedish dietary recommendations on fatty Baltic fish are of two kinds, one given to girls and women in child-bearing age, and one to all other consumers. Consequently, the intake data have been divided into these two groups and subsequently closer studied. In Fig. 2, the data on dioxin intake (total TEQ) for women  $\leq 40$ yr and its relation to the intake of fatty Baltic fish is presented. The delimitation lines show consumers with an intake of more than 2 pg total TEQ/kgbw/d (to the right of 2 pg on the x axis) and with a consumption of fatty Baltic fish of more than the recommended (above 4.17 g/d on the y axis), respectively. If the data are tabulated (Table 2) it is seen that about 12% (32/272) of women  $\leq 40$ yr eat more than the dietary recommendation, and that about 6% have an intake exceeding the TDI of 2 pg total TEQ/kgbw/day (between 2.1 and 9.4 pgTEQ/kgbw/d). By use of these data, it is shown that 75% (12/16) of the women with an intake above the TDI eat too much fatty Baltic fish, whereas only 8% of women below TDI have this consumption pattern.

When it comes to the other consumer group, women above 40 and men, data shows that about 5% (50/922) eat more than the recommended intake (in this case it is one meal of fatty Baltic fish per week, i.e. 17.8 g/d) (Table 2). Of the 14% (130/922) with a dioxin intake above TDI, about 33% (43/130) have an intake of fatty Baltic fish that exceeds the recommendation.

To conclude, we report on the estimated Swedish dioxin intake that (on median total TEQ basis) is 1.0-1.1 pg/kgbw/d, thus below the SCF TDI of 2 pg/kgbw. However, the distribution in intake results in an intake above TDI for a certain fraction of the consumers. For women  $\leq 40$ yr, representing women in childbearing age, a majority with a TEQ intake above TDI also ate too much fatty Baltic fish compared to the recommendations. Thus, the intake of fatty Baltic fish seems to be an important factor, although not the only, for modulating the TEQ intake. The actual Swedish dietary restrictions, which according to our study most consumers follow, may

therefore help in maintaining the dioxin intake at a reasonably low level. However, even if the recommendations are followed some consumers, because of their dietary habits, will exceed the TDI for dioxins, according to our calculations. However, a number of extrapolations, analytical uncertainties and the relatively small number of subjects indicate that these observations should be interpreted with care.

### Acknowledgements

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### References

1. Lind, Y. et al. (2002) Report from the Swedish NFA (in Swedish), report 26-2002
2. Becker, W. (1999) Vår Föda (in Swedish), 51(1), 24-27
3. van den Berg, M. et al. (1998) Environ. Health Perspect. 106, 775-792

**Table 1.** Dioxin intake among Swedish adult consumers (17-79 yr), based on the consumption study Riksmaten 1997-98 (median/mean, 95%ile; in pg WHO-TEQ)

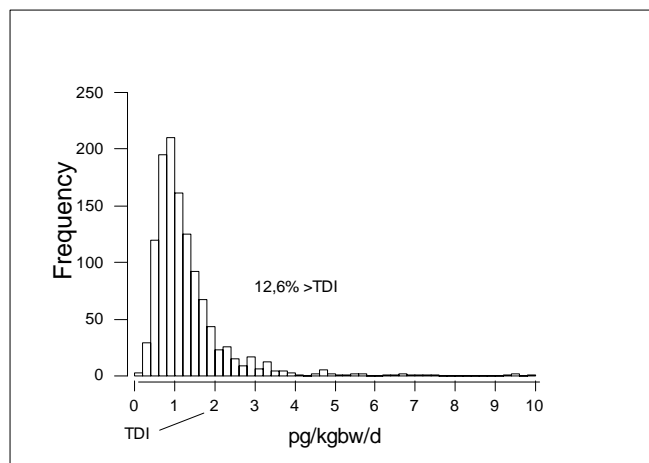
	Intake/day		Intake/kgbw/day	
	women	men	women	men
PCDD/F-TEQ	40 / 51	48 / 63	0.62 / 0.78	0.61 / 0.79
PCB-TEQ	29 / 38	33 / 43	0.44 / 0.58	0.41 / 0.54
Total-TEQ	70 / 89	81 / 106	1.1 / 1.4	1.0 / 1.3
Total-TEQ 95%ile	195	243	2.9	3.1

**Table 2.** No. of subjects in the Riksmaten consumption study and their estimated dioxin intake and consumption of fatty Baltic fish in relation to SCF TDI and the Swedish dietary recommendations on these fishes

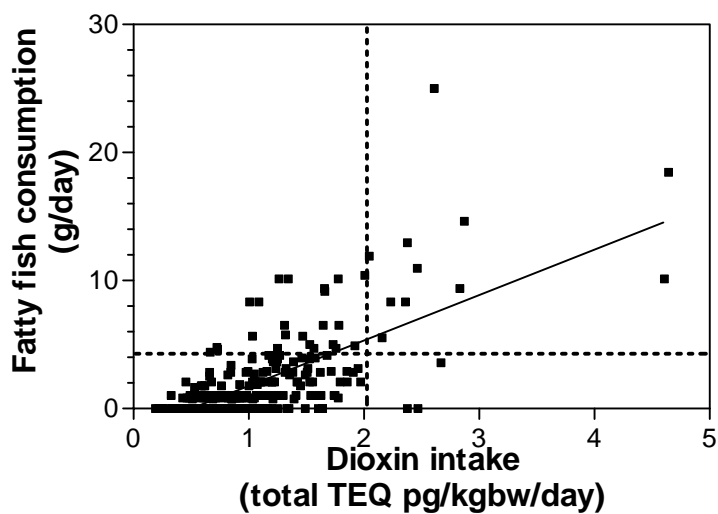
	Women $\leq$ 40yr (n)	Men and women >40 yr (n)
All subjects	272	922
Total-TEQ intake >TDI	16 (6%)	130 (14%)
FBF* cons. >dietary recom.**	32 (12%)	50 (5%)
>TDI and > dietary recom.**	12 (12/16=75% of all >TDI)	43 (43/130=33% of all >TDI)
<TDI and > dietary recom.**	20 (20/256=8% of all <TDI)	7 (7/792=<1% of all <TDI)

\* FBF = fatty Baltic fish

\*\* note that the dietary recommendations are different for women  $\leq$ 40yr, and for men and women > 40 yr (see the recommendations, first page of abstract)



**Figure 1.** Frequency diagram showing dioxin (total TEQ) intake based on all subjects in Riksmaten 1997-98. The bar intervals are 0.2 pg/kgbw/d. The TDI limit of 2 pg/kgbw/d is indicated. Three subjects with an intake above 10 pg/kgbw/d are not shown in the figure



**Figure 2.** The estimated dioxin (total TEQ) intake for women  $\leq 40$ yr plotted against the consumption of fatty Baltic fish, for each subject. The delimitation lines for the TDI (2 pg/kgbw/d) and the dietary restriction (4.17 g/d for women in childbearing age) is indicated. One subject with an intake of 9.4 pg total TEQ/kgbw/d is not shown in the figure. (slope of regression line =  $3.5 \pm 0.2$ ;  $r^2 = 0.46$ )