Contents of dioxins, planar and other PCBs in 168 Dutch human milk samples

L.G.M.Th. Tuinstra[A)], M. Huisman [B)], E.R. Boersma [B)]
C. Koopman-Esseboom[C)], P.J.J. Sauer[C)]

[A)] State Institute for Quality Control of Agricultural Products (RIKILT-DLO)
P.O. Box 230, 6700 AE Wageningen, the Netherlands.

[B)] University of Groningen, Department of Obstetrics and Gynaecology,
P.O. Box 30001, 9700 RB Groningen, the Netherlands.

[C)] Dept. of Pediatrics Erasmus University & University Hospital/Sophia Childrens Hospital,
Dr. Molewaterplein 60, 3015 GJ Rotterdam, the Netherlands.

INTRODUCTION

In the Dutch PCB/dioxin study seven institutes in the Netherlands were collaborating on a project: "Long term effects of early (foetal/neonatal) exposure to toxic substances (polychlorinated biphenyls (PCBs) and dibenzo-p-dioxins (PCDDs) and dibenzofurans (PCDFs))". The project was funded by the Dutch Toxicological Research Program and the Health Research Promotion Program.
In two areas (Groningen and Rotterdam) individual human milk samples (24 hr.) were obtained 10 and 42 days after delivery from about 200 mothers. In all samples non-planar PCBs, including some mono- and di-orthochlorine substituted PCBs were determined. All first samples, and a smaller number (#=44) of the second samples were analyzed for dioxins and coplanar PCBs[1)].
Below results are reported obtained on milk samples (10 days samples) wherein 17 dioxins, 3 non-ortho substituted PCBs (=NOPs); 3 mono-ortho PCBs (MOPs) and 2 di-ortho PCBs (DOPs) are determined and expressed as TEQs (Toxic Equivalents) using recent proposed[2)] or already accepted TEFs[3)] (Toxic Equivalency Factor).

MATERIALS

Human milk samples were collected at the 10th (9-17) and 42th (40-45) day after delivery. Before each suckling both breasts were emptied with an electrical breast pump (type Kaweco, Babyluxus 2). The obtained milk was mixed thoroughly and a 10% aliquot was taken to make up a 24 hr sample. This 24 hr sample was deep frozen (-20°C) till analysis was performed. Human milk sample volumes ranged from 20 - 100 mls.

METHOD

Extracted fat was cleaned on GPC, alumina and porous graphitized carbon columns. Planar compounds were determined with GC-HRMS, other PCBs were determined with GC-ECD. Method is fully described in [4)].

RESULTS

Recently suggestions have been made to modify the TEFs for a number of PCB congeners[2]. In line with these suggestions new calculations have been made using the original date set. As the number of complete data sets for the second sampling was low (number of samples=44) it was decided to use only complete data sets from the first sampling. Another reason was that for the MOPs and DOPs content (expressed as TEQ) a significant difference could be found between first and second sampling (paired samples; number of samples = 180).
The t-test showed that for each of the four analyte groups (dioxins, NOPs, MOPs and DOPs), expressed as TEQs, no differences could be found between the two areas.
All data from the first sampling obtained in Groningen and Rotterdam (#=168) were therefore considered to belong to one population.
In this total data set 84 mothers got their first child, 80 mothers a second child, three mothers their third and only one mother her fourth child. The t-test was applied to check for parity differences between mothers with one child and the rest. No significant differences were observed for each of the four analyte groups.
In table 1 for each of the four analyte groups mean, standard deviation and range is given (expressed as pg TEQ/g fat). With the used TEFs, the contribution of the dioxins to the total TEQ seems to be less than 50%.

Table 1
Dioxin, planar and other PCB content in 168 Dutch human milk samples in TEQ (pg/g fat).

	dioxins	NOP	MOP	DOP	total TEQ
mean	30,0	15,98	14,86	4,41	65,25
st. dev.	10,53	7,65	5,66	2,35	22,76
min	11,13	4,42	5,87	1,53	25,07
max	76,44	45,71	44,35	26,17	154,98
% of total	46,0	24,5	22,8	6,8	

LITERATURE

1. Tuinstra, L.G.M.Th., Huisman, M., Boersma, E.R.
Chemosphere 29 (1994) 2267-2277.
2. Ahlborg, U.G., Becking, G.C., Birnbaum, L.S., Brouwer, A., Derks, H.J.G.M., Fecley, M., Golor, G., Hanberg, A., Larsen, J.C., Liem, A.K.D., Safe, S.H., Schlatter, C., Waern, F., Younes, M., Yrjänheikki, E.
Chemosphere 28 (1994) 1049-1067
3. Zorge, J.A. van, Wynen, J.H. van, Theelen, R.M.C., Olie, K., Berg, M. van den,
Chemosphere 19 (1989) 1881-1895.
4. Tuinstra, L.G.M.Th., Traag, W.A., Rhijn, J.A. van, Spreng, P.F. van de,
Chemosphere 29 (1994) 1859-1875