

TEMPORAL TRENDS OF PERSISTENT ORGANIC POLLUTANTS (POPS) IN HUMAN MILK FROM SWITZERLAND SINCE 1970

Schmid P¹, Zennegg M¹, Gujer E¹, Kuchen A²

¹Swiss Federal Laboratories for Materials Testing and Research (Empa), Laboratory of Organic Chemistry, Überlandstrasse 129, CH-8600 Dübendorf, Switzerland

²Swiss Federal Office of Public Health (FOPH), Plant Protection Products and Biocides, CH-3003 Bern, Switzerland

Introduction

The bioaccumulation of organochloro pesticides in human milk is known since the early 1950s when Laug et al. detected high levels of DDT in human milk and adipose tissue.¹ Environmental effects of these compounds have impressively been described in Rachel Carsons book.² As a consequence, most of these products have eventually been banned worldwide since the early 1970s. In order to manage known and possible global long-term effects of the most important persistent organic pollutants (POPs) the Stockholm Convention initiated by the United Nations Environment Programme (UNEP) has entered into force in 2004.

As a consequence of these bans, steady decreases of POP concentrations in biota and other environmental compartments could be observed after approx. 1980. Temporal trends in human milk from various countries were recorded and compiled in a review.³ In Switzerland, many of the compounds have been monitored since 1970.⁴⁻⁶ In 2002, levels of many lipophilic contaminants with bioaccumulative properties including POPs have been determined in 36 samples of breast milk collected in Switzerland. Based on these data, temporal trends of hexachlorobenzene (HCB), hexachlorocyclohexane (HCH), dichlorodiphenyltrichloroethane (DDT), Dieldrin, heptachlor *exo*-epoxide (HEPX), and polychlorinated biphenyls (PCB) can be traced back to 1970.

Materials and Methods

In the course of the present study, 36 breast milk samples were collected in 2002 throughout Switzerland. Mothers were between 25 and 37 years of age. As the study was designed to represent the average exposure of infants, no restrictive criteria were applied in the selection of the mothers. 50% of the women were *primiparae*, the remaining mothers had their second or third child. 150 – 250 ml of milk was collected between 1 and 4 months after delivery. To record the relevant factors potentially influencing the exposure of the mothers a sampling protocol based on the protocols proposed by the WHO was used.⁷ Extraction, cleanup procedures (gel permeation chromatography) and gas chromatography/high resolution mass spectrometry (GC/HRMS) were based on methods described elsewhere.^{8,9} Isotopically labelled analogues of the analytes were used as internal standards.

Results and Discussion

To observe the temporal development of concentrations of persistent contaminants in Swiss breast milk, data from earlier studies carried out in 1970/71 (n = 50), 1977/78 (n = 50), 1984/85 (n = 66), 1993/95 (n = 45) were included.⁴⁻⁶ Temporal trends of average levels of some important POPs in human milk from Switzerland are shown in Figure 1. The figure shows steady decreases of all persistent chemicals since 1985. The culmination of the levels of HCH and PCB after 1970 is in accord with observations from other European countries.³

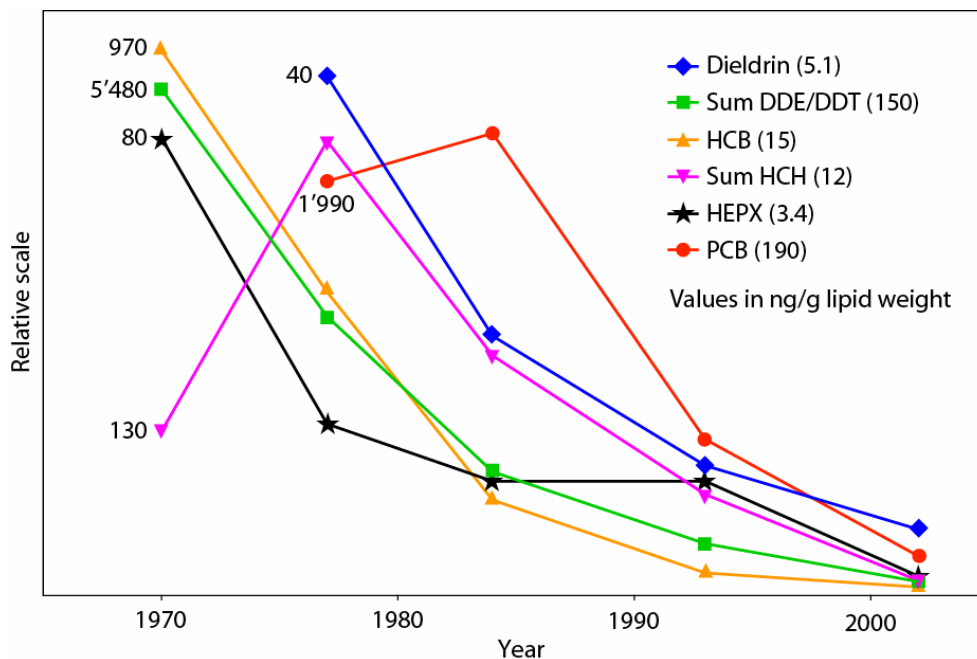


Figure 1: Temporal course of concentrations of POPs incl. HCH between 1970 and 2002 in human milk from Switzerland, with starting concentrations and levels in 2002 (in parentheses) given. All values in ng/g lipid weight.

Acknowledgements

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References

1. Laug EP, Kunze FM, Pitchett CS. *Arch Ind Hyg* 1951;3:245.
2. Carson R. *Silent Spring*, Houghton Mifflin Company, Boston, 1962.
3. Solomon GM, Weiss PM. *Environ Health Perspect* 2002;110:A339.
4. Schüpbach MR, Egli H. *Mitt Gebiete Lebensm Hyg* 1979;70:451.
5. Reichert A, Durrer H, Egli H, Schüpbach MR. *Mitt Gebiete Lebensm Hyg* 1986;77:554.
6. Ramseier C, Raggini S, Eymann W. *Mitt Gebiete Lebensm Hyg* 1998;89:741.
7. WHO, 1989. *Levels of PCBs, PCDDs, and PCDFs in breast milk*, Grandjean E. (ed.), Environmental Health Series, WHO, Copenhagen.
8. Fürst P, Fürst C, Meemken HA, Groebel W. *Z Lebensm Unters Forsch* 1989;189:338.
9. Schmid P, Gujer E, Zennegg M, Lanfranchi M. *Organohalogen Comp* 2004;66:1716.