WHO exposure study on levels of PCBs, PCDDs and PCDFs in human milk

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WHO-coordinated exposure studies on the levels of PCBs, PCDDs and PCDFs in human milk

<table>
<thead>
<tr>
<th>Round</th>
<th>Period</th>
<th>Organization</th>
<th>Countries</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st Round</td>
<td>1987-1988</td>
<td>WHO-EURO</td>
<td>12 countries</td>
</tr>
<tr>
<td>2nd Round</td>
<td>1992-1993</td>
<td>WHO-EURO</td>
<td>19 countries</td>
</tr>
<tr>
<td>3rd Round</td>
<td>2001-2002</td>
<td>WHO-EURO GEMS Food IPCS</td>
<td>26 countries</td>
</tr>
</tbody>
</table>
OBJECTIVE

- To produce reliable and comparable data on the levels of PCBs, PCDDs and PCDFs in human milk for improvement of health risk assessment in infants.

- To determine temporal trends in exposure in countries/areas also studied in 1st and 2nd round.

- To provide an overview of levels in various countries.

- To identify highly exposed local populations for guidance on risk management actions.

- To promote, if necessary, additional national studies
Protocol of the 3rd round of the WHO-coordinated exposure study

At least two pooled samples (preferentially more) per country from expected high- and low-exposure groups.

Each pool should contain milk from 10 donating mothers; 50 ml from each donor.

Donors should be primiparae, healthy, exclusively breast feeding one child, and residing in the area for about 5 years.

Frozen samples to be sent to reference laboratory: State Institute for Chemical and Veterinary Analysis of Food, Freiburg, Germany.

Completion of questionnaire (demographic data) is compulsory.
Countries participating in the 3rd round of the WHO-coordinated exposure study

Australia | Italy
Belgium | Luxembourg
Brazil | New Zealand
Bulgaria | Norway
China | Philippines
Croatia | Romania
Czech Republic | Russia
Egypt | Slovak Republic
Fiji | Spain
Finland | Sweden
Germany | The Netherlands
Hungary | Ukraine
Ireland | USA
### Individual congeners included in the study

<table>
<thead>
<tr>
<th>Indicator PCBs</th>
<th>Non-ortho’s</th>
<th>Mono-ortho’s</th>
</tr>
</thead>
<tbody>
<tr>
<td>PCB 28</td>
<td>PCB 77</td>
<td>PCB 105</td>
</tr>
<tr>
<td>PCB 52</td>
<td>PCB 81</td>
<td>PCB 114</td>
</tr>
<tr>
<td>PCB 101</td>
<td>PCB 126</td>
<td>PCB 118</td>
</tr>
<tr>
<td>PCB 138</td>
<td>PCB 169</td>
<td>PCB 123</td>
</tr>
<tr>
<td>PCB 153</td>
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<td>PCB 156</td>
</tr>
<tr>
<td>PCB 180</td>
<td></td>
<td>PCB 157</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>PCDDs</th>
<th>PCDFs</th>
</tr>
</thead>
<tbody>
<tr>
<td>2,3,7,8-TCDD</td>
<td>2,3,7,8-TCDF</td>
</tr>
<tr>
<td>1,2,3,7,8-PeCDD</td>
<td>1,2,3,7,8-PeCF</td>
</tr>
<tr>
<td>1,2,3,6,7,8-HxCDD</td>
<td>2,3,4,7,8-PeCDF</td>
</tr>
<tr>
<td>1,2,3,4,7,8-HxCDD</td>
<td>1,2,3,6,7,8-HxCDF</td>
</tr>
<tr>
<td>1,2,3,7,8,9-HxCDD</td>
<td>1,2,3,4,7,8-HxCDF</td>
</tr>
<tr>
<td>1,2,3,4,6,7,8-HpCDF</td>
<td>1,2,3,7,8,9-HxCDF</td>
</tr>
<tr>
<td>1,2,3,4,6,7,8,9-OCDD</td>
<td>2,3,4,7,8,9-HxCDF</td>
</tr>
</tbody>
</table>
Analysis of PCDD, PCDF and PCB

- Interlaboratory Quality Assessment of Levels of PCBs, PCDDs and PCDFs in Human Milk and Blood Plasma, 4th Round of WHO-coordinated study (2000).

- Out of 11 participants only one laboratory met all the quality criteria for the analysis of PCDD, PCDF and PCB in human milk.

- Reference laboratory of the study: Chemisches und Veterinäruntersuchungsamt, Freiburg, Germany.
Quality control program

- Blank samples

- Spiked vegetable oil samples (different levels)

- Quality control samples:
  - two kinds of butter samples
  - two kinds of egg samples
  - breast milk samples (remained from WHO interlaboratory quality assessment study)

- Limit of quantification:
  - PCDD/F: 0.1 pg WHO-TEQ/g fat
  - Mono-ortho PCB: 0.03 pg WHO-TEQ/g fat
  - Non-ortho PCB: 0.05 pg WHO-TEQ/g fat
3rd Round of the WHO-coordinated exposure study

CURRENT STATUS

18 Countries sent samples for analyses to the reference laboratory before 31 December 2001.

8 Countries sent samples in 2002.

All analysis of PCDDs, PCDFs and PCBs have been finalised by mid March 2003.

Analysis of POPS and BDPE ongoing (preliminary data of 11 countries available).

Evaluation of demographic data is ongoing.
Levels of dioxins and PCBs to total TEQ in human milk in various countries

WHO TEQ (pg/g fat)

PCB
PCDD/F

Countries:
- Fiji
- Philippines
- Brazil
- Australia
- Hungary
- Bulgaria
- New Zealand
- Ireland
- USA
- China
- Croatia
- Finland
- Norway
- Romania
- Sweden
- Spain
- Slovak Rep.
- Russia
- Germany
- Czech Rep.
- Italy
- Ukraine
- Luxembourg
- Belgium
- Netherlands
- Egypt
Levels (median) of indicator PCBs in human milk in various countries

![Bar chart showing the levels (median) of indicator PCBs in human milk from various countries.](chart.png)
Dioxin-like congeners in human milk

![Bar chart showing TEQ (pg/kg fat) for different congeners in human milk samples from the Netherlands, Egypt, and the Czech Republic. The chart includes congeners such as 2,3,7,8-TCDD, 1,2,3,7,8-PeCDD, 1,2,3,6,7,8-HxCDD, 1,2,3,7,8,9-HxCDD, 2,3,4,7,8-PeCDF, PCB126, PCB169, PCB118, PCB156. The bars for each country are color-coded: yellow for the Netherlands, orange for Egypt, and green for the Czech Republic.](chart.png)
Dioxin-like congeners in human milk

- 2,3,7,8-TCDD
- 1,2,3,7,8-PeCDD
- 1,2,3,6,7,8-HxCDD
- 2,3,7,8-TCDF
- 1,2,3,7,8-PeCDF
- PCB126
- PCB169
- PCB118
- PCB156

TEQ (pg/kg fat)

- Bulgaria
- Romania
- Czech Rep.
Indicator PCBs in human milk

The graph shows the concentration of PCBs in human milk from the Netherlands, Hungary, Ukraine, and Romania. The x-axis represents different PCB numbers (PCB 28, PCB 101, PCB 138, PCB 153, PCB 180, PCB 170), and the y-axis represents ng/g fat. The bars indicate the concentration levels for each country.
Indicator PCBs in human milk

- PCB 28
- PCB 52
- PCB 101
- PCB 138
- PCB 153
- PCB 180
- PCB 170

ng/g fat

- Russia
- Slovak Rep.
- Czech Rep.
Temporal trend of PCDD/F in human milk

![Temporal trend of PCDD/F in human milk](image)