Polychlorinated Biphenyl Levels (PCBs) in Subarctic Regions of the Northwest Territories

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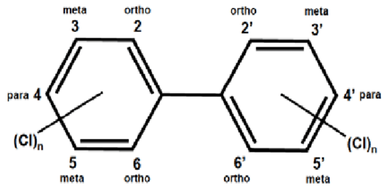
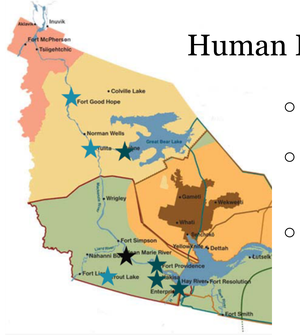
Background

Polychlorinated Biphenyl's



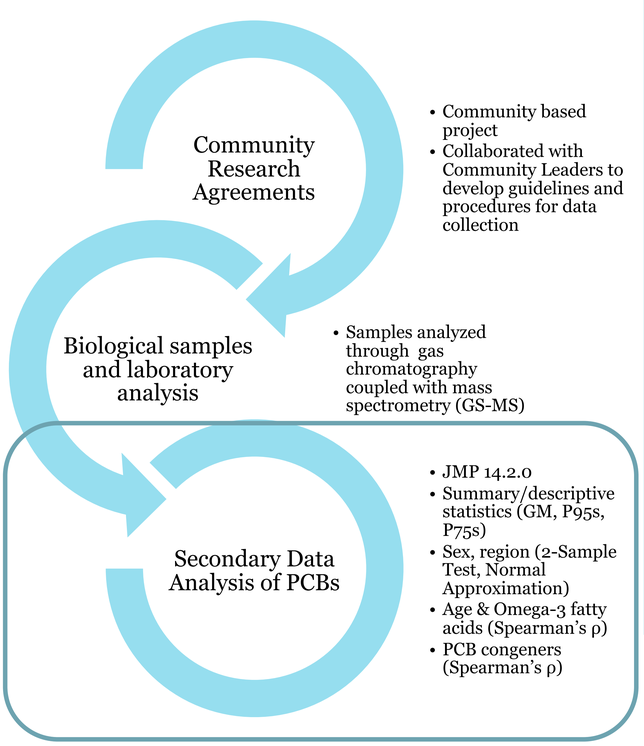
- Man-made organochlorine contaminants
- Belong to a group of toxic chemicals known as Persistent Organic Pollutants (POPs)
- Used in industrial and commercial settings
- Persistent, long-range transport

Human Biomonitoring



- Implemented between the years 2016-2019
- Assessed exposures to contaminants, including organic pollutants
- **In this study we report PCB and omega-3 fatty acid levels from the Dehcho and Sahtú regions, NWT**.

Methods



Participants and Biological Samples

- 533 participants
- 50% of participants chose to provide blood samples
- Approximately 130 (47.8%) male and 142 (52.2%) female participant blood samples.
- Mean age = 43.4 years (95% CI: 41.1-45.7) and the median age was 44.
- 272 PCB blood plasma (µg/L) samples were analyzed for each of the 25 PCBs (and mixture) with the exceptions of PCB203 and PCB206 (n=271)

Results and Discussion

PCB Data

Table 1 shows PCB levels from the 6 PCBs with an LOD>60% from both regions. GM PCB levels in the Dehcho and Sahtú regions appeared similar, if not lower, than the CHMS RV95 levels and BE levels. As well, the GM PCB levels in the Dehcho and Sahtú appear well below the LoAs and LoCs for PCBs in Canada.

Table 1. Descriptive Statistics of PCB levels (µg/L) in plasma from participating communities of the Dehcho and Sahtú regions.

PCB Congener	Detection (%)[1]	N	Geometric Mean	Quantiles 75	Quantiles 95	CHMS GM[2]
PCB, Aroclor 1260	87.9	272	0.579	1.875	6.345	0.90
PCB138	79.4	272	0.033	0.097	0.350	0.06
PCB153	90.4	272	0.077	0.250	0.937	0.1[illegible]
PCB170	71.0	272	0.020	0.058	0.194	0.03
PCB180	79.8	272	0.054	0.190	0.754	0.09
PCB187	67.3	272	0.024	0.076	0.280	0.02

Table 1 Abbreviations: GM, geometric means. PCB, polychlorinated biphenyls. Aroclor 1260, PCB mixture. 1. Detection rates are taken from the Mackenzie Valley Biomonitoring report (Ratelle et al., 2019) 2. CHMS GMs are taken from the Report on Human Biomonitoring of Environmental Chemicals in Canada

PCBs vs Region

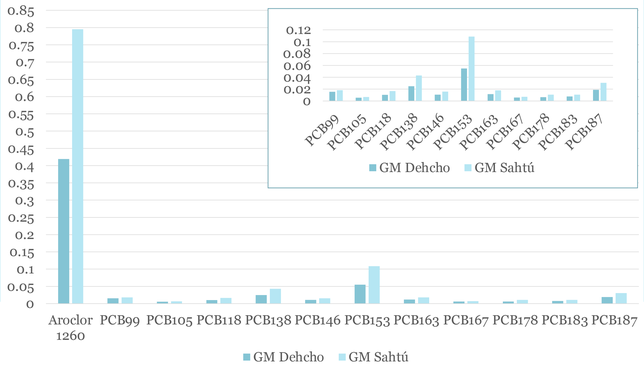


Figure 1. Vertical bar plot depicting levels of PCBs compared by region specific plasma samples. 12 PCBs with p-value <0.05. GM PCB levels were between 1.15-fold (PCB167) and 1.98-fold (PCB 153) higher in the Sahtú than in the Dehcho

On average, the GM of PCB levels were 1.5-fold higher in the Sahtú region than for the Dehcho region. Differences observed between regions could be due to environmental exposures or dietary exposures. For example, several lakes exist in both regions and differences within species among lakes in these regions have been noted from previous environmental monitoring studies.

PCBs vs Sex

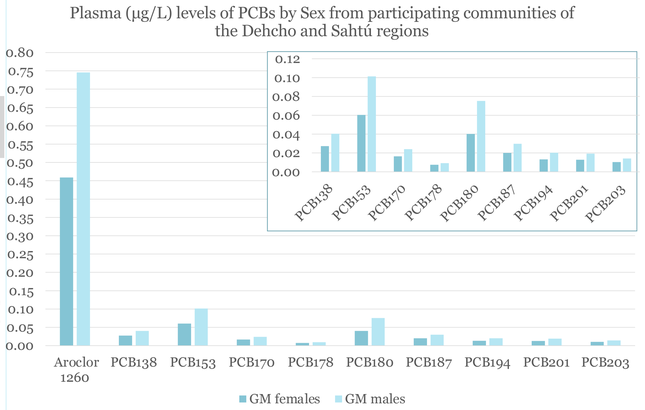


Figure 2. Vertical Bar Plot depicting levels of PCBs compared by male and female participant plasma samples. 10 PCBs with p-value <0.05. GM for PCBs were between 1.22 (PCB163) and 1.87-fold (PCB180) higher for male participants than for female participants.

On average the GM of PCBs were 1.5-fold higher for male participants than for female participants. Male participants and female participants may have different levels of PCBs due to body burden differences. For example, body burden in women can be offset by breastfeeding which may explain why some men appear to have higher concentrations in tissue for POPs.

PCBs vs Age and Omega-3 fatty Acids

Many PCBs show a strong or very strong association with omega-3 fatty acid levels and age. In general, PCB levels and age have a stronger association than PCBs and omega-3 fatty acids. The highest correlation coefficient was 0.91 for PCB180 and age. Some PCBs showed no association with omega-3 fatty acids including PCB28, PCB52, PCB66. Figure 3 highlights the highest PCB congener association with age and omega-3 fatty acid.

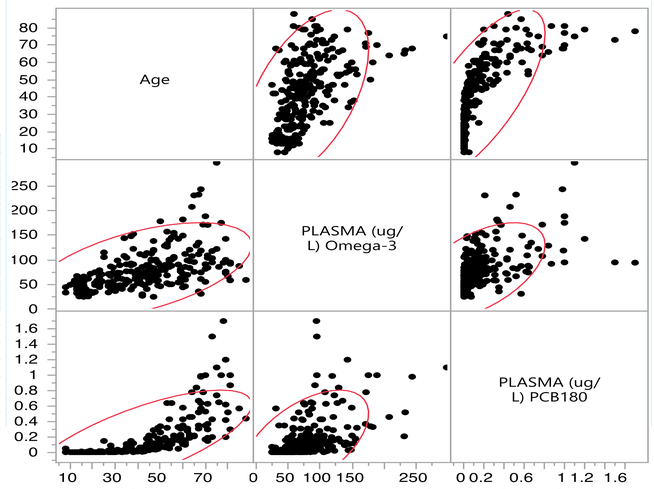


Figure 3. Scatterplot Matrix of PCB Congener180 with Age and Omega-3 fatty Acid using Spearman's rank correlation coefficient

PCBs vs PCBs

The 6 PCBs identified in Figure 4 were all significantly and positively correlated with one another (p<.0001). As one PCB level increases, so do the others. All the identified PCB congeners have a correlation coefficient above 0.9. The strongest association occurs between Aroclor 1260 and PCB 153 (Spearman ρ =0.99). The lowest correlation coefficient occurs between PCB 170 and PCB 138 (0.90).

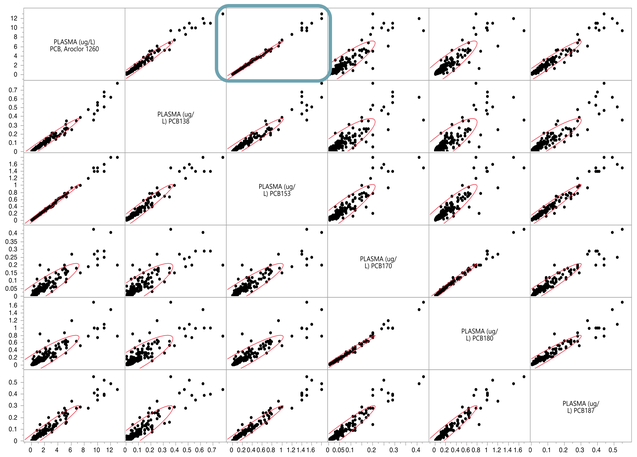


Figure 4. Scatterplot Matrix Spearman's ρ for PCB PLASMA (µg/L) of 6 PCBs with LOD>60%

Conclusion

- PCB levels were generally lower or similar in Dehcho and Sahtú regions, compared to the Canadian population.
- Age sex and region appear to be determinants of PCB exposure levels
- PCB levels were higher in males than females and PCB levels were higher in the Sahtú than the Dehcho
- PCB levels increased as age increased
- Omega-3 fatty acids and PCB levels were moderately correlated with each other and most PCB levels were very highly correlated with one another

References & Acknowledgements

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