Urinary Pesticide Metabolite Concentrations in Pregnant Women from Suriname

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BACKGROUND

- In Suriname, pesticides are commonly used in both agricultural and residential settings.
- The Caribbean Consortium for Research in Environmental and Occupational Health (CCREOH) implemented an environmental epidemiology cohort study of 1100 pregnant women and their children residing in three areas of the country: Paramaribo, Nickerie, and the interior (Figure 1).

Objective:

- To evaluate pesticide exposures in a sub-set of participants enrolled in the CCREOH cohort study.

METHODS

- Urine samples (25 ml) from 218 CCREOH participants were analyzed for 18 pesticide metabolites, representing 3 pesticide classes.
- Mann Whitney U and the Kruskal-Wallis tests were used to assess the differences between pesticide metabolite concentrations and the residential locations of the pregnant women in Suriname. Statistical significance was determined at $p<0.05$.

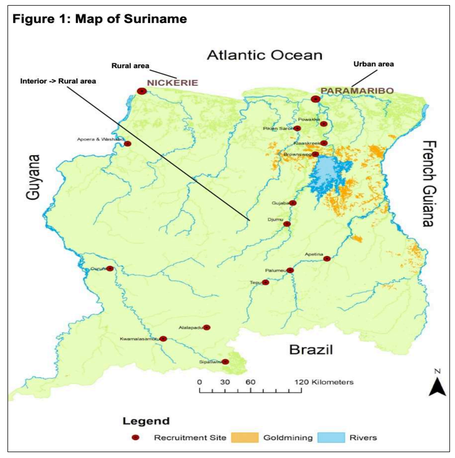
- **Pyrethroid insecticides and phenoxyacetic acid herbicide metabolite concentrations were higher in pregnant women residing in rural areas of Suriname compared to those in urban areas.**
- **Pregnant women living in an urban area of Suriname had higher organophosphate insecticide metabolite concentrations compared to those living in rural areas.**

Table 1: Urinary Pesticide Metabolite Concentrations (ug/L) in Pregnant Women from the CCREOH cohort, N= 218

Analyte	Analyte Code	LOD	Standard Deviation	Mean	Median
Chemical Class: Phenoxyacetic Acid Herbicides					
2, 4- Dichlorophenoxyacetic acid	24D	0.15[1,2]	0.30[a], 1.27[b], 0.65[c]	0.28, 1.12, 0.42	0.11, 0.74, 0.20
Chemical Class: Organophosphate Insecticides					
Malathion dicarboxylic acid	MAL	0.50[1,2]	0.44[a], 1.11[b], 7.32[c]	0.48, 0.75, 1.58	0.35, 0.35, 0.35
3,5,6-Trichloro-2-pyridinol	CPM	0.10[1,2]	1.22[a], 2.94[b], 6.72[c]	0.66, 2.08, 1.93	0.41, 0.92, 0.49
2-isopropyl-4-methyl-6-hydroxypyrimidine	OXY2	0.10[2,3]	3.75[a], 5.88[b], 0.25[c]	1.61, 1.55, 0.23	0.33, 0.49, 0.18
para-Nitrophenol	PAR	0.10	1.02[a], 1.60[b],10.48[c]	0.99, 0.98, 2.29	0.65, 0.52, 0.59
Diethyldithiophosphate	DED	0.10	0.01[a], 0.01[b], 0[c]	0.07, 0.07, 0.07	0.07, 0.07, 0.07
Diethylphosphate	DEP	0.10[2,3]	2.49[a], 8.01[b], 0.86[c]	2.15, 2.91, 0.59	1.23, 0.82, 0.32
Dimethyldithiophosphate	DMD	0.10[3]	0.94[a], 1.60[b], 0.89[c]	0.35, 0.44, 0.26	0.07, 0.07, 0.07
Dimethylphosphate	DMP	0.10[2,3]	4.59[a], 2.32[b], 2.08[c]	2.19, 1.80, 1.50	1.32, 1.06, 0.67
Dimethylthiophosphate	DMT	0.10[1,2]	3.58[a], 3.89[b], 3.83[c]	2.96, 2.36, 2.48	1.67, 0.89, 0.83
Diethylthiophosphate	DTP	0.10[1,2,3]	3.49[a], 6.55[b], 0.32[c]	1.52, 1.30, 0.26	0.57, 0.31, 0.14
Chemical Class: Pyrethroid Insecticides					
4-fluoro-3-phenoxybenzoic acid	4FP	0.10	0.02[a], 0.02[b], 0[c]	0.07, 0.07, 0.07	0.07, 0.07, 0.07
3-phenoxybenzoic acid	OPM	0.10[1,2]	1.48[a], 6.13[b], 0.88[c]	0.94, 2.50, 0.81	0.51, 1.08, 0.43
trans-3-(2,2-Dichlorovinyl)-2,2-dimethylcyclopropane carboxylic acid	TCC	0.60	3.81[a], 3.51[b], 1.48[c]	1.81, 1.76, 1.09	0.42, 0.42, 0.42

Limit of detection is also known as the LOD.
[a] Paramaribo, N= 92
[b] Nickerie, N= 78
[c] Interior, N= 48
[1] The mean difference was statistically significant between Nickerie and Paramaribo, $p<.05$.
[2] The mean difference was statistically significant between Nickerie and the interior, $p<.05$.
[3] The mean difference was statistically significant between Paramaribo and the interior, $p<.05$.

Figure 1: Map of Suriname



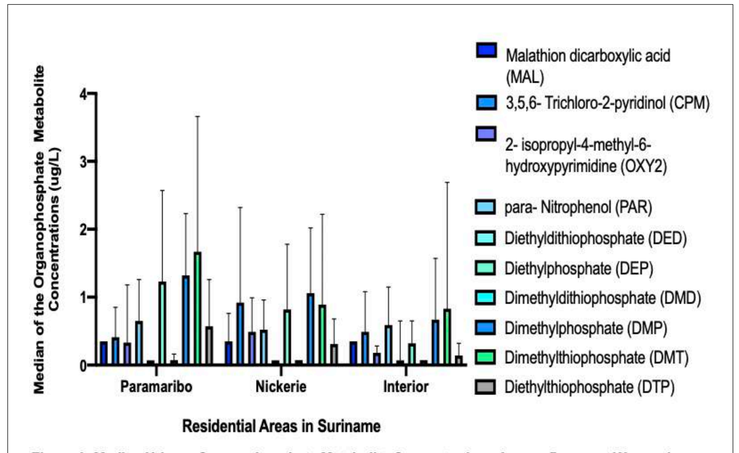


Figure 2: Median Urinary Organophosphate Metabolite Concentrations Among Pregnant Women in Suriname

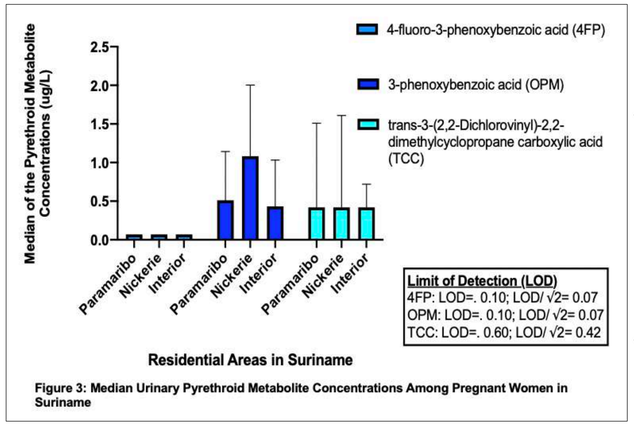


Figure 3: Median Urinary Pyrethroid Metabolite Concentrations Among Pregnant Women in Suriname

RESULTS

- Pesticide exposures varied based on area of residence probably due to different pesticide applications (Table 1).
- Pregnant women residing in Paramaribo had higher median concentrations of organophosphate metabolites compared to those living in Nickerie and the interior (Figure 2).
- Pregnant women residing in Nickerie had higher median concentrations of phenoxy acid herbicide and pyrethroid metabolites compared to those living in Paramaribo and the interior (Figure 3).

NEXT STEPS AND FUTURE ACTION

- An assessment of the associations between the biomarker data and potential adverse birth outcomes, as well as pediatric neurodevelopment.
- An evaluation of pesticide literacy regarding use, storage, and disposal with a primary public health goal of preventing exposures to pesticides in pregnant women.
- The development and implementation of effective interventions including strengthening policies to improve maternal and child health.

Acknowledgements: Research reported in this publication was supported by the Fogarty International Center of the National Institutes of Health under Award Numbers U01TW010087 and U2RTW010104. The content is solely the responsibility of the authors and does not necessarily represent the official views of the National Institutes of Health. This project was supported by NIH Research Training Grant # D43 TW009340 funded by the NIH Fogarty International Center, NINDS, NIMH, NHBLI and NIEHS. The content is solely the responsibility of the authors and does not necessarily represent the official views of the National Institutes of Health.