Opportunities to Reduce Children's Exposures to Pesticides Through Organic Food and Farming

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Prelude

- A cross-sectional OP pesticide exposure assessment study in children using urinary biomarkers (*Lu et al., 2001, EHP*)
  - Residential (garden) pesticide uses associated with elevated OP urinary metabolite levels,
  - The background OP metabolite levels are most likely resulting from dietary exposure,
  - All 110 children ages 2-5 had measurable OP metabolite levels in urine,
  - Except for one child.

Prelude

- How special is this child whose urine samples contained non-detectable OP pesticide metabolite levels?
  - According to the parents, they only provided organic food items to their children.

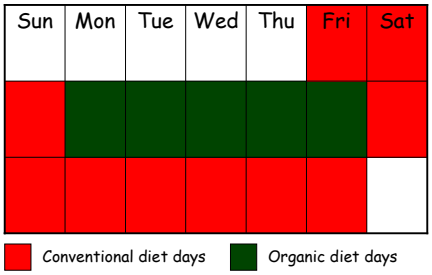
Study Hypothesis

Does dietary intake contribute the majority of OP pesticide exposure in children living in urban/suburban homes?

Study Design

- 23 children ages 3-11 ONLY consuming conventional diets,
- Two spot urine and salvia samples collected daily, first morning and before bedtime voids, for 15 consecutive days,
- 24-hour duplicate food collected twice during conventional diet days,

Sampling Calendar



Study Design

- From Day 4-8 (total 5 days), children's conventional diets were replaced with organic items;
  - Mostly fresh and processed fruits and vegetables, juices, wheat- or corn-based items,
  - Do not intend to change the consumption pattern,
  - Organic food items were previously analyzed to confirm "free of pesticides".

Study Calendar

Summer, 2003	Fall, 2003	Winter, 2004	Spring, 2004
15-day with 5-day organic diet intervention	12-day with 5-day organic diet intervention	7-day without organic diet intervention	7-day without organic diet intervention

Study Design

- Daily dietary consumption for the entire study period was also collected.

Sample Analysis

- Specific metabolites for OP pesticides
  - Malathion, Chlorpyrifos, Diazinon, Coumaphos
- Metabolites for pyrethroids
  - Permethrin, Cypermethrin, Cyfluthrin, Deltamethrin
- Metabolites for herbicides
  - 2,4-D, Atrazine

Data Management

Daily Volume-Weighted
Average Concentration (DVWA, μg/L) =

$$\sum [C_i\ (\mu g/L) \times V_i\ (mL)] / \sum [V_i\ (mL)]$$

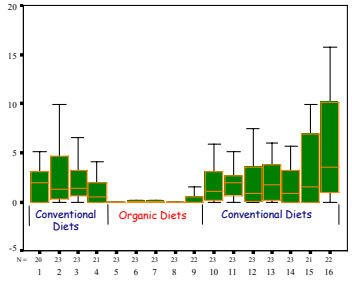
Results

- Study protocol did not change children's dietary consumption patterns
  - Overall, each child consumed 2 more items of fresh fruits and wheat-base food items in the organic diet period than in the conventional diet period.

Results

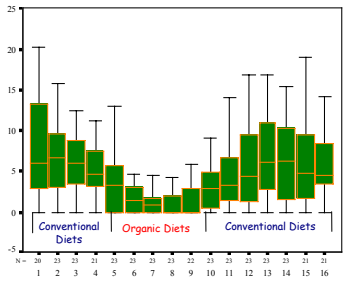
- Study protocol did not bias the findings
  - None of the organic food items that were purchased before and during the study period contained detectable OP or other pesticides.

Box plots of DVWA of malathion dicarboxylic acid (MDA) concentrations



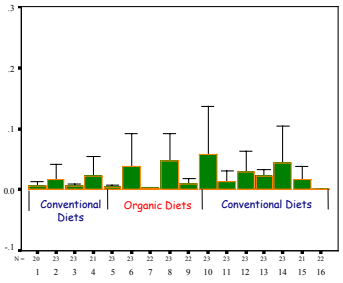
Sequential day

Box plots of DVWA of 3,5,6-trichloro-2-pyridinol (TCPY) concentrations



Sequential day

Box plots of DVWA of 3-chloro-4-methyl-7-hydroxycoumarin (CMHC) concentrations



Sequential day

Conclusions

- Organic diets provide a protective mechanism against OP pesticide exposure in children,
  - probably true for other OPs such as acephate, azinphosmethyl, and dimethoate that are registered solely for agricultural use.

Conclusions

- Most likely that dietary intake of OP pesticides is the only route of exposure for urban/suburban children in this study,
  - Due to the lack of residential uses.

Conclusions

- Variabilty associated with OP urinary metabolite levels is rather large, highlighting the complex scenario of dietary pesticide exposure,
  - This issue should be addressed in the future study design, such as the frequency and the timing of urine collection.

Conclusions

- The recent registration changes effectively removed the use of many OP pesticides from residential environment,
  - However, the use of OP in agriculture might be increasing,
  - Need more PDP data to assure such trend.

Limitations

- Study cohort does not mirror general population.

Finale

"Dietary intake of pesticides represents the major source of exposure for infant and children, and …… that the differences in dietary exposure to pesticide residues account for most of the differences in pesticide-related health risks that were found to exist between children and adults."

Pesticides in the Diets of Infants and Children, National Research Council, *1993.*

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