Cynthia L. Curl, CL , RA Fenske and K Elgethun. 2003.
**Organophosphorus pesticide exposure of urban and suburban pre-school children with organic and conventional diets**.
*Environmental Health Perspectives* doi:10.1289/ehp.5754

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While it might seem obvious that eating organic food reduces exposure to pesticides, it's rarely been tested directly, particularly in looking not just what's on the food but **what gets into a child's body because of what they eat**.

This new study from Seattle reports that school children eating conventionally-grown fruits and vegetables are **more likely to exceed EPA safety thresholds for organophosphate pesticides** than children eating organic produce. Simple choices by parents can have **a big impact on pesticide exposures**.

Experts debate the adequacy of those standards—some saying they are too lax, others (usually from industry) saying they are too strong. Whoever is right, this study shows that **choosing organic lowers the chance that thresholds will be exceeded**, therefore making some of the plausible health impacts of exposure to organophosphates less likely.

**What did they do?** Curl *et al*. recruited children for participation in the studies by interviewing parents entering one of two grocery stories in the Seattle area, one specializing in organic, the other not. The scientists then visited the homes of recruited children twice, on the first visit to interview the parents about a range of variables including frequency of household pesticide use, to instruct them in the creation of a "food diary" so that records would be available to assess the amounts of produce of different types consumed; and on the second visit to obtain urine samples.

Urine samples were analyzed for the dialkylphosphate metabolites of organophosphate pesticides.

What did they find? After analysis of the food diaries, Curl et al. determined that 18 of the recruited children ate organic diets, while 21 ate conventional. Preliminary analysis revealed that the organic and conventional groups did not differ in gender or age composition (mean ages were 46 (organic) and 47 (conventional) months. Variables such as home ownership status and income also did not differ, nor measurements of the children's activities.

While there were overall differences between the conventional vs. organic families in likelihood of pesticide use around the home (conventional families more likely), there was no significant difference in frequency of organophosphate pesticide use.

Of five dialkylphosphate metabolites measured, dimethylthiophosphate (DMTP), one was by far dominant over others. DMTP was found in the urine of 87% of children measured.

The heart of the analysis shows that DMTP levels in children eating organic foods were significantly lower than those eating conventional foods:


Comparing the traces of a organophosphate metabolite in the urine of children eating organic vs. conventional produce.

DMTP values averaged 9 times higher in children eating a conventional

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diet.

Using a nonparametric statistical test this difference is highly significant ($p < 0.003$).

Curly *et al*. were interested in determining which organophosphate pesticides were likely to be contributing to these differences: which ones are used on fruits and vegetables and, when metabolized, yield DMTP. Through an analysis of EPA records they found that most OPs are used in ways that would not result in contamination of produce. Of those used on produce that yield DMTP, oxydemeton-methyl, azinphosmethyl, phosmet and malathion have the highest annual use on fresh fruits and vegetables, making them the most likely sources for the contamination seen.

In an ideal world, Curly *et al*. would have been able to collect precise duplicates of the diets of the children as they were eating, and analyze those samples to find out what the actual exposures were that lead to the observed levels of DMTP in urine. This wasn't possible. They used a clever set of calculations to take a stab at answering that question.

They calculated how much of the four OP pesticides they identified above would each child have had to have consumed to yield the DMTP levels they observed. They then looked how often that consumption would have created exposures exceeding EPA standards.

These standards are based on exposure levels (concentrations on food), not amounts measured in urine. This calculation requires a series simplifying assumption and also that each compound be treated one-by-one. In other words, if (for example) malathion is a child's only source of OP, how much malathion would the child need to be exposed to to produce that much urinary DMTP? And looking across all the children they studied, what percentage of those malathion exposures would violate EPA standards.

**They found that children eating conventional foods are much more likely to be exposed to OP levels above the EPA standards.** The results depended upon the compound. The largest difference was seen for azinphosmethyl: only one child with an organic diet (6%) compared to eleven children with conventional diets (52%) would exceed the standard. If all exposure were from oxydemeton-methyl, 88% of the children with organic diets and 100% of the children with conventional diets would exceed the EPA standard. For malathion, none would exceed.

**What does this mean?** According to the authors:

> "This study demonstrates that dietary choice can have a significant effect on children's pesticide exposure. To our knowledge, no other studies have tested this hypothesis. Our finding that children who consume primarily organic produce exhibit lower pesticide metabolite levels in their urine than children who consume conventional produce is consistent with known agricultural practice, since organic foods are grown without pesticides. Consumption of organic produce represents a relatively simple means for parents to reduce their children's pesticide exposure."