YOU ARE WHAT YOU ATE!

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Chicago Tribune

PESTICIDES IN YOUR PEACHES
– MONICA ENG, TRIBUNE REPORTER

- Chicago Tribune and USDA studies found pesticides, some in excess of US EPA rules, in the fragrant fruits, like peaches
  - More than 60 chemicals were found in the recent USDA PDP survey for peaches,
  - For the top 50 chemicals found in the CONVENTIONAL peaches,
  - They found 3 chemicals in peaches purchased from local FARMERS' MARKETS,
  - They found 1 chemical in ORGANIC peaches grown in California.

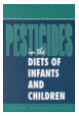
"As we munch into the peach season, shoppers face an array of choices for the same fuzzy fruit but little guidance on which type to pick ....." August 12, 2009

http://www.chicagotribune.com/health/chi-0812-peaches-pesticides_mainaug12,0,2494206.story

DIETARY PESTICIDE EXPOSURE GUIDELINE

- Unlike nutrient guideline, there are no explicit policies for minimizing dietary pesticide intakes,
- Two landmark events occurred in the 1990's intended to provide guidance of pesticide policy in US;
  - *Pesticides in the Diets of Infants and Children* – National Academy of Science/National Research Council 1993,
  - The Food Quality Protection Act- 1996.

PESTICIDES IN THE DIETS OF INFANTS AND CHILDREN



Executive Summary;

Dietary intake represents the major source of pesticide exposure for infants and children, and the dietary exposure may account for the increased pesticide-related health risks in children compared to adults

THE FOOD QUALITY PROTECTION ACT- 1996

- Fundamental change of US pesticide regulation,
- Mandate US EPA to assure that there is a "reasonable certainty of no harm" from pesticide exposures for pregnant women, infants, children, and other vulnerable groups.

ENVIRONMENTAL WORKING GROUP – SHOPPER'S GUIDE TO PESTICIDES

- Reported annually http://www.foodnews.org/fulllist.php ,
- Taken into account frequency of consumption for each food commodity[1], the frequency of pesticide residue detection and the levels[2], and the toxicity of the pesticides[3]
- The philosophy behind the *Guide* is to
  - *reflect the overall load of pesticides found on commonly eaten fruits and vegetables*
  - *best capture the uncertainty of the risks of pesticide exposure and the value judgments involved in the choice to buy food with less pesticide*
  - *give consumers the information they need to make choices to reduce pesticides in their diets.*

1. US FDA Total Diet Study; 2. USDA Pesticide Data Program; 3. US EPA

CHILDREN'S PESTICIDE EXPOSURE STUDY (CPES)

- Study hypothesis - "*does dietary intake attribute to the majority of total pesticide exposure in urban/suburban children?*"
- A longitudinal study using biomarker approach to assessing dietary pesticide exposures among elementary school-age children,
  - Variability of daily dietary pesticide exposures;
  - Seasonal, geographical and demographical differences;
  - Identifying high-pesticide risk food commodities and its relationship to pesticide urinary biomarkers

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CPES STUDY DESIGN

- Eligibility for participation
  - 3-11 years old,
  - Children only consumed conventional diets,
  - Committed to 12 calendar months.
- Sampling taking place in multiple consecutive days in each of the 4 seasons
- Sample/data collection included
  - Two daily concurrent spot urine and saliva samples,
  - 24-hour duplicate food samples*,
  - Daily dietary consumption information.

CPES STUDY DESIGN

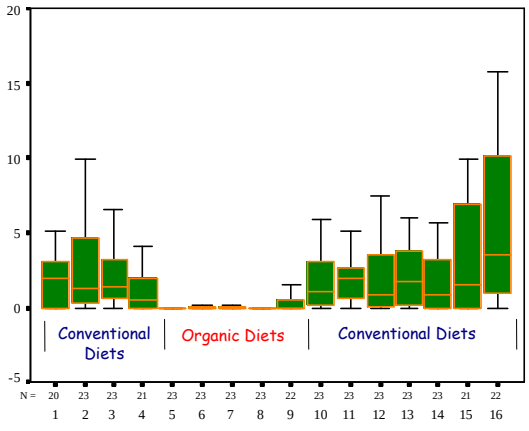
- Organic Diet Intervention
  - Children's conventional diets were replaced with organic food items for 5 consecutive days during summer and fall sampling seasons,
  - We replaced mostly fresh fruits and vegetables, juices, wheat- or corn-based items,
  - Do not intend to change the consumption pattern,
  - Selected organic food items were analyzed to confirm "free of pesticides".
- CPES was conducted in
  - Seattle WA, USA (CPES-WA) in 2003-2004
  - Atlanta GA, USA (CPES-GA) in 2006-2007

CPES SAMPLING DAYS

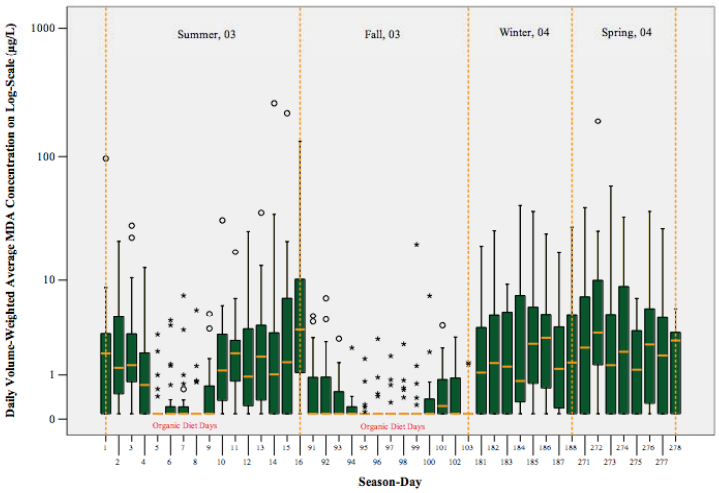
Sun	Mon	Tue	Wed	Thu	Fri	Sat

Conventional diet days Organic diet days

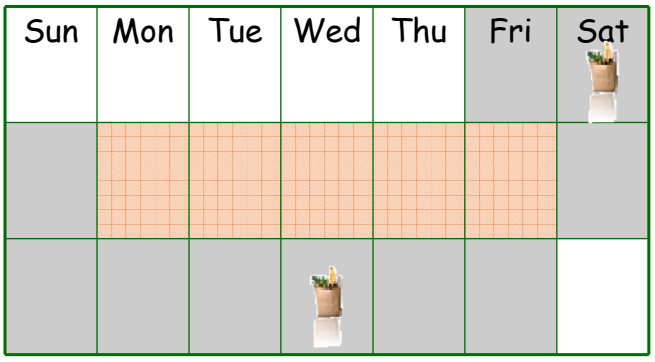
THE EXPOSURE PROFILE OF MALATHION FOR CPES-WA CHILDREN IN THE SUMMER '03 SEASON AS MEASURED BY THE DVWA OF URINARY MDA CONCENTRATIONS



ONE-YEAR EXPOSURE PROFILE OF MALATHION FOR CPES-WA CHILDREN AS MEASURED BY THE DVWA OF URINARY MDA CONCENTRATIONS



CPES SAMPLING DAYS



Conventional diet days Organic diet days

24-HOUR DUPLICATE FOOD SAMPLING

- Parents/caregivers prepared two sets of meals, one for the participating child and one for CPES,
- Individual food item of the meal was frozen and processed (weighed and homogenized),
- Composite food samples were made, if individual food item is less than 50 grams,
  - Same type of foods (fruits, vegetables, or juices) from the same meal were composited first; if still < 50g
  - All foods from the same meal were composited.
- Food samples analyzed in US FDA labs for 109 organophosphate pesticides and 17 pyrethroid insecticides.

COMMON FRESH PRODUCE CONSUMPTION BY CPES CHILDREN

Rank	Food item	Number of consumption	Food item	Number of consumption
	CPES-WA		*CPES-GA*	
1	Orange juice	16	Banana	14
2	Blueberries	8	**Strawberries**	13
3	Watermelon	7	**Apple**	10
4	**Apple**	7	Orange juice	9
5	**Peach**	6	Peanut butter	7
6	Lemonade	6	Tomato	6
7	**Grape**	6	Watermelon	5
8	Corn	6	**Pear**	5
9	Banana	6	**Carrots**	5
10	Apple juice	6	Apple juice	5
11	**Carrots**	5	**Spinach**	3
12	**Lettuce**	4	**Peach**	3
13	Broccoli	4	Onion	3
14	Apple sauce	4	Mushrooms	3
15	**Strawberries**	3	**Lettuce**	3
16	Raspberries	3	Grape juice	3
17	**Peas**	2	Broccoli	3
18	Potato	2	**Peas**	2
19	Pineapple	2	Olives	2
20	**Nectarine**	2	Lemonade	2
21	Mushrooms	2	**Grape**	2
22	Honeydew	2	Fruit punch	2
23	Grape juice	2	Corn	2
24	**Cherries**	2	Blueberries	2
25	**Spinach**	1	Apple sauce	2
26	Onion	1	Potato	2
27	Mango	1	Raspberries	1
28	**Green pepper**	1	Plum	1
29	Green beans	1	Mango	1
30	Grapefruit	1	**Green pepper**	1
31	Fruit punch	1	Green beans	1
32	**Celery**	1	**Celery**	1
33	Cauliflower	1	Cantaloupe	1
34	Cantaloupe	1	Cabbage	1
35	Asian pear	1		

COMMON FRESH PRODUCE CONSUMPTION IN CHILDREN AND THE RISKS

Rank	Food item	Number of consumption	Food item	Number of consumption	Food item
	-WA			*GA*	*EWG*
1	Orange juice	16	Banana	14	Peach
2	Blueberr	8	Strawberries	13	Ap
3	Waterm	7	Apple	10	Bell
4	Apple	7	Orange juice	9	Celer
5	Peach	6	Peanut butter	7	Nectar
6	Lemonade	6	Tomato	6	Straw
7	Grape	6	Watermelon	5	Ch
8	Corn	6	Pear	5	
9	Banana	6	Carrots	5	
10	Apple juice	6	Apple juice	5	
11	Carrots	5	Spinach	3	
12	Lettuce	4	Peach	3	
13	Broccoli	4	Onion	3	
14	Apple sauce	4	Mushrooms	3	
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EWG "Dirty Dozen List" is NOT targeted at common fruits and vegetables consumed by children.

THE FREQUENCY OF PESTICIDE RESIDUE DETECTIONS IN THE CPES'S 24-HR DUPLICATE FOOD SAMPLES

Study	Total food samples collected	Numbers of samples contained at least 1 pesticide residue (%)	Numbers of food samples contained (%)			
			At least 1 OP	At least 1 pyrethroids	More than 1 pesticide	More than 2 pesticides
CPES-WA	110	25 (22.7)	23 (21)	3 (3)	6 (5)	3 (3)
CPES-GA	129	19 (14.7)	11 (9)	10 (8)	6 (5)	1 (<1)
MBA[1]	40	11 (27.5)	9 (23)	2 (5)	1 (3)	0 (0)

24-HR DUPLICATE FOOD SAMPLES CONTAINING OPS AND PYRETHORID INSECTICIDE RESIDUES

CPES-WA	Duplicate food item(s)	Pesticide Residue (µg/g)	
		OP	Pyrethroids
Summer 03	**Strawberries**, green beans, dried raspberries, blueberries	Malathion (8),	Bifenthrin (149)
	Strawberries	Malathion (4)	
	Cantaloupe	Malathion (11)	
	Apple sauce	Phosmet (23)	
	Apple sauce	Azinphosmethyl (13)	
	Peach, pineapple, apple sauce, sugar pea pod, corn	Omethoate (12) Dimethoate (10) Ethion (4)	
	Red grape, watermelon	Phosmet (18)	
	Cherries, nectarine, apple	Phosmet (387) Chlorpyrifos (1)	
	Watermelon, **apple**	Azinphosmethyl (14)	
	Nectarine	Phosmet (252)	
	Raspberries, blueberries, blackberries, **baby carrot**, **peach**	Malathion (4) Phosmet (7) Azinphosmethyl (45)	
	Cranberry juice	Acephate (2)	
	Cranberry juice	Acephate (1)	
Fall 03	**Apple**	*Azinphosmethyl (111)*	
	Lettuce, broccoli, mushrooms		*Cypermethrin I (411)* *Cypermethrin II (382)* *Cypermethrin III & IV (340)*
	Apple	Phosmet (9) Azinphosmethyl (8)	
	Spinach, cauliflower		Permethrin (90)
	Asian pear	Phosmet (36)	
	Apple juice	Azinphosmethyl (10)	
	Orange juice	Chlorpyrifos (1)	
	Peas, corn	Dimethoate (6)	
	Juice box	Methamidophos (1)	
	Celery, onion, canned corn	Acephate (18)	
	Orange juice	Ethion (24)	
	Cranberries-apple juice	Acephate (3)	

24-HR DUPLICATE FOOD SAMPLES CONTAINING OPS AND PYRETHORID INSECTICIDE RESIDUES

CPES-GA	Food Content	Pesticide Residue (µg/g)	
		OP	Pyrethroids
Summer 05	**Strawberries**, blueberries, grape juice		Bifenthrin (28)
	Potato	Phosalone (55)	
	Frozen berries (blue, black, raspberries), **baby carrots**, **apple**, banana	Phosmet (3) Chlorpyrifos (2)	
	Broccoli (cooked)		Permethrin (82)
	Peach	Phosmet (86) Phosalone (29)	
	Green beans	Methamidophos (11) Acephate (39)	
	Watermelon, **grape**, cantaloupe	Phosalone (69)	
	Strawberries		Bifenthrin (7)
	Strawberries		Bifenthrin (2)
	Watermelon	Phosalone (83)	
	Carrots, baby green **lettuce**	Phosalone (84)	Permethrin (58)
Winter 06	**Strawberries,** spinach		*Permethrin (921)*
	Topping olives, mushroom, spinach		Permethrin (98)
	Orange	Phosmet (25) Chlorpyrifos (3)	
	Apple		Permethrin (4)
	Apple, green salad	Phosmet (30)	
	Potato, **bell pepper**, broccoli, ketchup	*Chlorpyrifos (10)* *Methamidophos (9)* *Acephate (90)*	Cypermethrin (26)
	Celery	*Methamidophos (78)* *Acephate (350)*	
	Spinach, tomato, spaghetti sauce		Cypermethrin (53)

MARKET BASKET ANALYSIS FOOD SAMPLES CONTAINING OPS AND PYRETHORID INSECTICIDE RESIDUES

MBA	Food Content	Pesticide Residue (µg/g)	
		OP	Pyrethroids
Summer 03	**Cherries**		Esfenvalerate (71)
	Honeydew melon	Methamidophos (3)	
	Grape	Methamidophos (1)	
	Nectarine	Chlorpyrifos (1) Methamidophos (2)	
	Strawberries	*Chlorpyrifos (363)*	
	Lemonade	Methamidophos (trace)	
	Strawberries		*Bifenthrin (93)*
Winter 04	Orange	Ethion (1)	
	Strawberries	Chlorpyrifos (3)	
	Peach	Methamidophos (12)	
	Grape	Chlorpyrifos (22)	

STUDY LIMITATIONS

- Composite food samples
  - Not possible linking pesticide residue(s) to the specific food items;
  - May dilute residue concentrations.
- Long storage time
- 24-hr duplicate food samples as the surrogates for dietary pesticide exposure
- Small sample size

CONCLUSIONS

- CPES is among the first to
  - target elementary school-ages children's dietary exposures
  - Report 20% of daily food consumption contained at least one pesticide residue using duplicate diet sampling methodology
- CPES children's daily diets are overlapping with the food commodities that are frequently contaminated by pesticides
- None of the pesticide residues exceeds US EPA tolerance levels, and the levels in general are within the ranges reported by the USDA PDP[1]

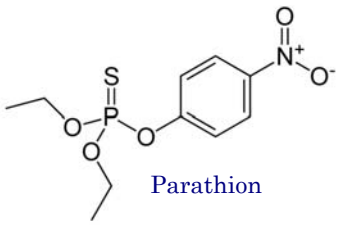
1. www.ams.usda.gov/science/pdp

CONCLUSIONS

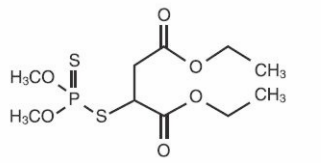
- The combination of frequently consuming fresh produces that contain multiple pesticide residues that are known of causing developmental and neurological effects in children should required further action,
- The vulnerable sub-populations to pesticide toxicities, such as infants, young children, and pregnant women, should seek for alternative sources to those high pesticide risk food commodities.

DOES PESTICIDE EXPOSURE MATTER IN ENVIRONMENTAL PUBLIC HEALTH?

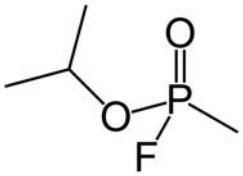
ORGANOPHOSPHATE (OP) PESTICIDES



Parathion



Malathion



Sarin (nerve gas)

DOES PESTICIDE EXPOSURE MATTER IN CHILDREN'S ENVIRONMENTAL HEALTH?

- The combination of frequent fresh produce consumption that contain multiple pesticide residues that are known of causing developmental and neurological effects in children should required further action,
- The vulnerable sub-populations of infants, young children, and pregnant women to pesticide toxicities should seek for alternative sources to those high pesticide risk food commodities.

DOES PESTICIDE EXPOSURE MATTER IN CHILDREN'S ENVIRONMENTAL HEALTH?

- The gene-environment interaction
  - Environmental exposures trigger gene-expression resulting in the onset of many diseases, such as cancer, neurodevelopmental, and neurodegenerative diseases.
- The epigenetic changes
  - Reversible heritable changes in gene function or other cell phenotype that occur without a change in DNA sequence,
  - Epigenetic changes may be induced spontaneously or in response to environmental factors,
  - Hypotheses suggested that maternal exposure history is critical to epigenetic changes in fetuses, and to their future health.

THE RECENT GOVERNMENTAL ACTIONS ON REGULATING PESTICIDE USES

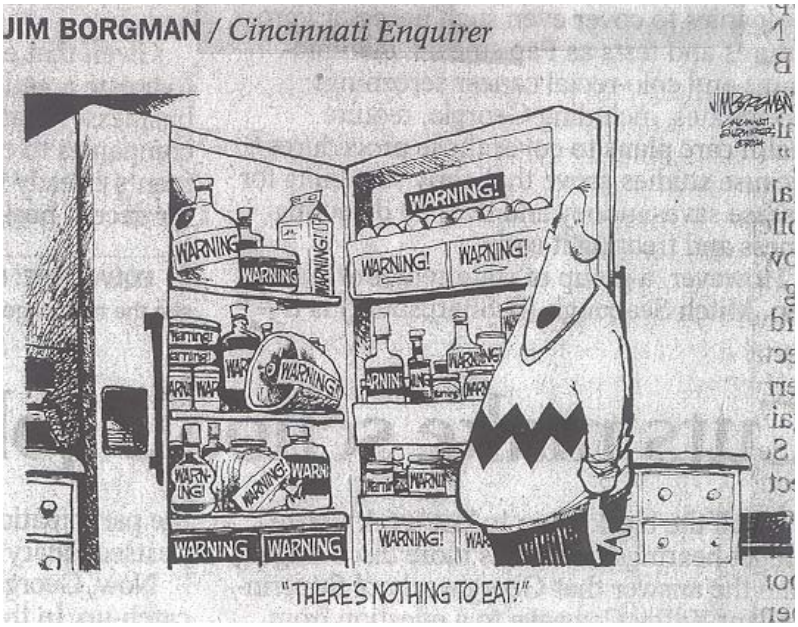
- In 2001, US banned residential use of OP pesticides, citing the neurodevelopmental toxicities,
- Germany and France banned the use of neonicotinoides in May 2008, citing the possible link to global honeybee colony collapse disorder (CCD),
- Ontario Canada banned the cosmetic uses of pesticides in April 2009 citing the possible link to increasing cancer incidence.

DOES MODERN AGRICULTURE MATTER IN CHILDREN'S ENVIRONMENTAL HEALTH?

- Chemicals
- Nutrients

REDUCING RISK OF MYOCARDIAL INFARCTION BY INCREASING CONSUMPTION OF DAIRY PRODUCTS

- The conjugated linoleic acid, a member of Omega-6 fatty acid family, found abundantly in dairy products made from milk taking from grass-fed cattle,
- Linoleic acid is essentially absent in the milk of corn-fed cattle,
- More than 95% of cattle in US are corn-fed.



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