TRANSFER EFFICIENCIES OF HOUSEHOLD PESTICIDES FROM A CERAMIC TILE SURFACE TO FOODS

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HUMAN EXPOSURE ISSUE

- The Food Quality Protection Act (1996) requires the US EPA to evaluate aggregate human exposure of pesticides from dietary and non-dietary pathways to reduce the levels of uncertainty in exposures to children and infants.
- Post-application exposure may occur to pesticide residues deposited on surfaces during spraying.
- Children and infants may be exposed to surface residues through indirect dietary exposure from either direct contact between foods and contaminated surfaces (surface-to-food transfer) and/or through an intermediate, such as hands (surface-to-hands-to-food transfer) (Akland et al., 2000 and Melnyk et al., 2000).
- Generating accurate measurements of exposure through indirect dietary route requires developing transfer efficiency data for food items from household surfaces.

SCIENTIFIC APPROACH

OBJECTIVE

The objectives of this study were to determine the transfer efficiency (%) of three classes of pesticides from a household surface (ceramic tile) to three different food items (bologna, apple, and Fruit Roll-Ups) and to compare foil coupons to wipe measurements of surfaces.

Surface Treatment:
A customized spray chamber was used to spray a Pesticide Spray Solution (PSS) onto the ceramic tiles.

Food Items:
Pesticide transfer efficiencies were measured for three different foods, with standardized surface contact area. The foods were Fruit Roll-Ups Blastin' Berry Hot Colors® (Betty Crocker®), Thin Slice Bologna (made with chicken & pork), and Red Delicious Apple slices.

Surface Drying:
Following spraying, each ceramic tile was transferred to a glove box where it was air dried for an hour at constant temperature and humidity.

Surface Wipes:
Pesticide transfer to foods were compared to the pesticides removed using surface wipes (isopropanol moistened gauze pads), which were wiped across the ceramic tile in both the horizontal and vertical direction.

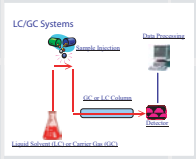
Foil Coupons:
Foil coupons were also sprayed with PSS in order to assess the concentration of each pesticide applied to the surfaces.

Sample Extraction, and Preparation:
Bologna and apples were extracted using an ASE 300. The Fruit Roll-Ups were dissolved in water:acetonitrile, then liquid-liquid extraction was performed using ethyl acetate:hexane.

Sample Analysis:
All samples were analyzed for pesticide concentration with an HP 6890 GC with µECD.

Transfer Efficiency (TE):
TE is defined as the amount of pesticide recovered from the food item divided by the pesticide concentration or loading level.

TE = TA/CS X 100
TA: Pesticide Recovered from food (ng/cm^2) wipe.
CS: Pesticide surface concentration (ng/cm2) or loading level determined either by extraction of surface wipes with gauze pads, total surface sample extraction, or foil deposition coupons.



PESTICIDE TRANSFER TO FOODS

Figure 1. Surface Pesticide Concentration

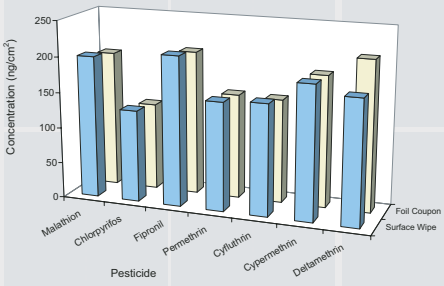


Figure 2. Pesticide Transfer Efficiencies (%) from Ceramic Tile to Foods

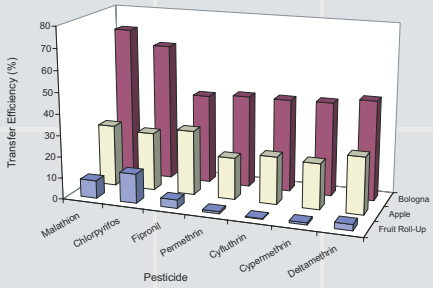
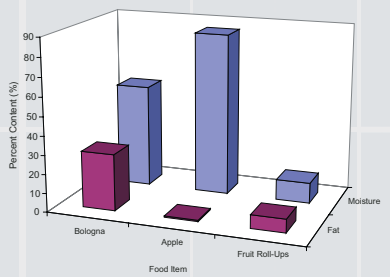


Figure 3. Fat and Moisture Content of Bologna, Apple and Fruit Roll-Ups



RELEVANCE

I. The amount of each pesticide removed from ceramic tile using surface wipes was similar to the concentration of each pesticide captured on foil coupons (Figure 1). Either measurement could be used to determine surface concentration.

II. The extent of pesticide transfer to the foods was less than the total availability of residues on the ceramic tiles (Figure 2).

III. Among the foods tested, bologna had the highest transfer efficiencies for all seven pesticides tested followed by apple and Fruit Roll-Up, respectively (Figure 2).

IV. The highest transfer efficiencies among the seven pesticides tested were observed for organophosphates (malathion and chlorpyrifos), followed by pyrethroids and pyrazole (Figure 2).

V. Within each class of pesticides, transfer was fairly uniform to each food (Figure 2). It may be possible that transfer is pesticide class dependent.

VI. A combination of fat and moisture content (i.e. >30% each) may be used to predict transfer capabilities of foods. (Figure 3).

PRODUCTS AND OUTCOMES

- Foods containing high fat and moisture have a higher potential for contamination when contacting sprayed surfaces.
- Ultimately, these results suggest the extent of transfer is affected by the food type and chemical properties of the pesticide itself.
- Findings from this study in conjunction with models under development will be used to generate more accurate estimates of excess dietary exposure to infants and children in homes where pesticides are used.

REFERENCES

Akland, G., Pellizzari, E.D., Hu, Y., Roberds, J.M., Rohrer, C.A., Leckie, J.O., and Berry, M.R. (2000). Factors Influencing Total Dietary Exposures of Young Children. Journal of Exposure Analysis and Environmental Epidemiology, 10: 710-722.

Melnyk, L.J., Berry, M.R., Sheldon, L.S., Freeman, N.C.F., Pellizzari, E.D., and Kinman, R.N. (2000). Dietary Exposure of Children Living in Lead-Laden Environments. Journal of Exposure Analysis and Environmental Epidemiology, 10: 723-731.