WORKING FOR A HEALTHY FUTURE

Pesticide biomonitoring in residents Use of a mathematical model

Laura MacCalman, Karen Galea, Martie van Tongeren, John Cherrie, Anne Sleeuwenhoek

Centre for Human Exposure Science

Institute of Occupational Medicine

Background

- Exposure to pesticides from agricultural use among bystanders and residents is difficult to estimate
- Regulatory risk assessment procedures in place
  - However, not comprehensively evaluated for pesticide exposure of residents living near agricultural land and bystanders
- To determine if regulatory risk assessment procedures in UK are appropriate

Challenges

- Difficult to plan as pesticide spraying depends on a lot of factors (eg presence of pests, weather)
- Methods for monitoring metabolites are not available for all pesticides
- Not feasible to collect 24 hrs samples for this duration

Methods

- Recruit farmers
  - Apply likely to apply certain pesticides (chlorpyrifos, cypermethrin, mancozeb)
  - Residents living <100 m from field
- Recruit residents living near farms
  - Provide urine samples
  - Weekly samples during a spraying season on an allocated day
  - Reactive samples if we receive sufficient notice from the farmer
  - Background samples during and outside spray season
- Use of physio-kinetic model by Rigas et al (2001)
  - To determine the most appropriate time of sample collection
  - To compare urinary metabolites with predicted internal exposure

Aims

- To determine the most appropriate sampling time
- To provide estimates of urinary levels of metabolites using ADI levels of exposure
- Study is currently still underway (no results of the measurements will be presented)

PK - Model

- Based on model used by Rigas *et al.* (2001)
- to describe the concentration of the metabolite in the absorption reservoir
- to describe the excretion

Required information

- Active Ingredient and metabolite specific info e.g.
  - Molecular weight, absorption rate, biological half-life
- Exposure specific information
  - Time of day of exposure, duration of exposure
- Person-specific information
  - Body weight

Optimal sampling time

- Chlorpyrifos, cypermethrin, mancozeb
- Run for each
  - Average male, female, 4 and 12 year old
  - 1 hour exposure at 8am, 12pm and 4pm
- Determine average concentration in urine at
    - Evening: 10pm (assuming last void between 4 and 9pm)
    - Morning: 7am (assuming last void at 10pm)

Optimal sampling time

- Ratio of concentration in urine for a morning void as compared to a night void
  - From 1.03 (half-life 13 hours)
  - to 2.61 (half-life 100 hours)

- Morning void always had higher concentration regardless of half-life, body weight, time of exposure

Estimate urinary level given exposure

- Test run using ADI
  - Chlormequat (0.7 mg/kg bw)
  - Captan (0.1 mg/kg bw)
  - Chlorpyrifos (0.003 mg/kg bw)
  - Penconazole (0.007 mg/kg bw)
- Assuming
  - exposure at 12pm
  - previous void 10pm
  - Sample taken at 7am
  - Average male

Estimate urinary level given exposure

- Chlormequat (0.7 mg/kg bw)
  - 0.09 mg/l
- Captan (0.1 mg/kg bw)
  - 0.004 mg/l
- Chlorpyrifos (0.003 mg/kg bw)
  - 0.00007 mg/l
- Penconazole (0.007 mg/kg bw)
  - Not determined as yet

Conclusions

- Using the model the optimal time to collect sample is the next morning
- Using the ADI to test, making some crude assumptions, the urine levels can be calculated.
- With more detailed exposure information this modelled concentration will be more reliable

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