World Health Organization

Evaluation of the IESTI equations using probabilistic modelling of consumer exposure

Objectives

In order to compare the various options for the IESTI equations it is necessary to establish a baseline:

- Selection of pesticides with an ARfD evaluated since 2011 (Work done prior to the IESTI worshop 2015)
  - 47 pesticides
- For foods for which Codex established MRLs
  - 214 food categories
  - 1251 couples (pest.food)

Methodology

Dietary Exposure = consumption x concentration levels

National individual food consumption surveys

National monitoring programs

Probabilistic exposure assessment

Daily consumed quantity of food *a* for an individual *i*

Concentration of pesticide s in food *a*

Exposure of an individual *i* to a pesticide *s*

$$E_{s,i} = \frac{\sum_{a=1}^{A_s} Q_{i,a} C_{s,a}}{bw_i}$$

Body weight

Create 2 000 individuals

$$Risk_s = \frac{Nb(E_{s,i} > ARfD_s)}{10\,000}$$

Repeat 100 times to account for uncertainty: *Risk[LB,UP]*

Populations and scenarios

- Two populations
  - Adults (>= 16 years old)
  - Children (≤ 6 years old)
- Censored data
  - 10% or 100% of usages
  - Set to limit of quantification
- Raw commodities/processed foods
  - Scenario 1: Only raw commodities as defined in Codex
  - Scenario 2: Include processed foods (juice, oil, dried, syrup, flour, bran, sauce, butter, sugar) without diet conversion factors (DCFs)
  - Scenario 3: Include processed foods with DCFs for dried products (IESTI practices)
- Residue level variability for positives
  - Scenario 1: None (observed level)
  - Scenario 2: Beta (mean=observed level, 97.5^{th}=3*mean)
  - Scenario 3: Lognormal (mean=observed level, 97.5^{th}=3*mean)

Description of food consumption data

Country	National Food consumption data			
	Years	Name of the survey	Population	Number of subjects
Czech Republic	2003-2004	SISP04	Adults	1,666
Italy	2005-2006	INRAN_SCAI	Adults	2,313
France	2007	INCA2	Children 3-9 yo	482
Netherlands	2006-2007	VPC_kids	Children 3-6 yo	957
USA	2009-2010	FCID	Adults and children	9,754
Canada	2004	Canadian Community Health Survey	Adults and children	35,000
Brazil	2008-2009	Brazilian National Dietary Survey	Adults	34,003
Australia	To be submitted			

Description of residues data after matching with MRL database

Country	National concentration survey after matching with the MRLs database								
	Years	Number of pesticides	Number of foods	Number of couples (pest.food)	Number of measurements	Percent of measurements ≥ LOD in total measurements	Percent of measurements ≥ LOQ in total measurements	Percent of measurements ≥ MRL in total measurements	Percent of measurements ≥ MRL in non censored measurements
Europe (30 countries)	2013-2015	39	163	1643	1 842 292		2.28%	0.02%	0.86%
USA	2010-2015	34	48	513	430 273	3.68%	3.35%	0.03%	0.85%
Canada	2008-2017	38	162	1698	590 550	2.79%	2.33%	0.02%	0.66%
Brazil	2010-2015	20	23	190	150 154	3.08%	3.08%	0.14%	4.54%
Australia	To be analysed								

Description of US residues data per pesticide

Pesticides	Number of measurements	Percent of measurements ≥ LOD in total measurements	Percent of measurements ≥ LOQ in total measurements	Percent of measurements ≥ MRL in total measurements
Buprofezin	20538	0.13	0.11	0
Carbofuran	2154	0	0	0
Chlorpyrifos-methyl	685	0	0	0
Clothianidin	36205	0.13	0.13	0.0037
Cyfluthrin/beta-cyfluthrin	10246	0.0074	0.0058	0
Cypermethrins	35016	0.15	0.13	0.025
Cyproconazole	628	0	0	0
Cyromazine	4993	0.051	0.05	0
Dichlorvos	1428	0	0	0
Difenoconazole	29464	0.17	0.14	0
Dimethomorph	14233	0.079	0.069	0
Emamectinbenzoate	5112	0	0	0
Etofenprox	3190	0	0	0
Fenbuconazole	12893	0.12	0.12	0
Fenpropathrin	7996	0.046	0.046	0
Fenpyroximate	11561	0.091	0.086	0.00023
Fluopyram	2478	0.0049	0.0046	0
Flutriafol	7608	0.0012	0.0012	0
Fluxapyroxad	9581	0.053	0.045	0
Imidacloprid	35952	0.75	0.63	0.00023
Indoxacarb	17744	0.088	0.087	0.00023
Malathion	13838	0.037	0.036	0.00023
Methoxyfenozide	31123	0.33	0.3	0
Phorate	4096	0	0	0
Phosmet	8287	0.067	0.058	0
Profenofos	1628	0	0	0
Prothioconazole	532	0	0	0
Pyraclostrobin	28808	0.63	0.6	0.0014
Sedaxane	328	0	0	0
Sulfoxaflor	4028	0.018	0.018	0
Tebuconazole	19682	0.38	0.36	0.0021
Thiamethoxam	37611	0.27	0.26	0.0012
Triadimenol	7575	0.00046	0.00046	0
Triflumizole	3032	0.077	0.071	0

Scenario comparisons for US data

- Censored data
  - 10% or 100% of usages → significant differences ~x10
- Raw commodities/processed foods
  - Only raw commodities as defined in Codex

    ↓ significant differences (for 17 pesticides)
  - Include processed foods (juice, oil, dried, syrup, flour, bran, sauce, butter, sugar) without diet conversion factors (DCF

    ↓ no significant difference
  - Include processed foods with DCFs for dried products (IESTI practices)