



Pesticide regulation

- **Pesticides are deadly. Invisible exposure – over time, in small (tiny) doses – leads to chronic health effects.**
- **Immunosuppressive effect – triggers diseases like cancer or asthma.**
- **Persistent build up in our bodies – lindane for instance is a potent carcinogen.**
- **Chlorpyrifos –pregnant women exposed to tiny amounts gave birth to babies with reduced weight and head circumference.**
- **TINY EXPOSURE IS ENOUGH.**



“The right dose differentiates the poison and remedy”

- **Regulation across the world defines the acceptable daily intake (ADI) of pesticide –**
 - **what is safe to take daily,**
 - **over a lifetime,**
 - **for what age/bodyweight.**
- **ADI is the touchstone of pesticide risk management. Cannot exceed ADI, otherwise deadly.**



Step 1: The acceptable limit

- **Toxicological studies, both chronic and acute on animals – mostly rats and dogs – to determine the level at which no adverse effects on experimental animals.**
- **Lowest observed or No observed adverse levels (LOAEL or NOAEL).**
- **Safety factor used – factor 10 for inter-species (between animals-humans). Factor 10 for intra-species = **ADI** (based on body weight).**
- **Growing debate in US for having extra safety factor of 10 (total 1000) for kids, especially for organophosphates**



ADI : For Indian pesticides – double zero and lower most toxic

Name of pesticide	Production 2000-01 (tonnes)	JMPR-ADI (mg/kg bw)	YEAR OF REVIEW	US-EPA CRfd (mg/kg bw)	US-EPA Arfd (mg/kg bw)	YEAR OF REVIEW
D.D.T.	3766	0.005 (Conditional)	1983	0.0005		1994
MALATHION	5103	0.3	1997	0.024	0.5	2000
METHYL PARATHION	1979	0.003	1995	0.00002	0.00011	1999
Dichlorovos--D.D.V.P.	2648	0.004	1993	0.00017	0.01666	1998
MONOCROTOPHOS	8118	0.0006	1995	0.00005		1986
PHORATE	6044	0.0005	1996	0.00017	0.00083	1999
ETHION	3456	0.002	1990	0.0005	0.0017	1999
ENDOSULPHAN	7462	0.006	1998	0.006		1993
CYPERMETHRIN	3388	0.05	1996	0.01		1996
ACEPHATE	3347	0.01	2002	0.0012	0.005	2000
CHLORPYRIPHOS	7000	0.01	1999	0.0001	0.0017	1999
LINDANE	473	0.005	2002	0.0047		1993
ENDRIN		0.0002 (PTDI)	1994	0.0003		1988
DIELDRIN		0.0001(PTDI)	1994	0.00005		1987
CARBARYL		0.008	2001	0.014		1993



Calculate what you can eat...

- Your malathion diet...

As per JMPR (WHO/ FAO)

$0.3 \times 60 \text{ kg} = 18 \text{ mg/day for you}$ or

$0.3 \times 10 \text{ kg} = 3 \text{ mg/day for your child}$

or take USEPA ADI

$0.024 \times 60 \text{ kg} = 1.44 \text{ mg/day for you}$ or

$0.024 \times 10 \text{ kg} = 0.24 \text{ mg/day for your child}$

ADD ALL PESTICIDES LIKE THIS.....



2: calculate limit of residue

- **Supervised crop trials. Determine what is the best-possible residue level on crops.**
- **What is least amount of residue that is **feasible**.**
- **Used to determine the **Maximum Residue Level** (MRL) for each crop for pesticide used on them.**
- **The MRL is not the safety standard. It is legal limit that is allowed on the crop/food. **SAFETY IS DEFINED BY ADI. MRL MUST BE WITHIN ADI.****



Step 3: Determining exposure

- **Critical step: have to determine what we will eat and how much. Our diet.**
- **WHO/FAO compiles diet charts from governments.**
- **Most governments collect their own data.**
- **Daily pesticide intake arrived:**
 - Average diet **(theoretical intake)**
 - Accurate diet **(Estimated intake)**
 - Or total diet **(Measured intake)** on cooked food.



Diets of the world: WHO/FAO regional diets

(in grams per person per day)

Commodity	Middle eastern	Far eastern	African	Latin American	European
Cereals	430.8	452.3	318.4	252.2	226.3
Root and tubers	61.8	108.5	321.3	159.3	242.0
Pulses	24.6	19.8	17.8	23.1	12.1
Total sugars and honey	95.8	50.5	42.7	104.3	107.3
Total nuts and oilseeds	12.8	50.0	34.2	57.5	29.9
Total vegetable oils and fats	40.3	14.2	23.3	21.8	38.6
Total stimulants	8.2	1.7	0.6	5.5	14.4
Total spices	2.5	3.0	1.8	0.5	0.5
Total vegetables	233.1	179.0	77.1	150.5	371.8
Total fish and seafood	13	34.7	36.5	45	46.3
Eggs	14.6	13.1	3.7	11.9	37.6
Total fruits	204.4	85.4	94.7	271.3	212.4
Milk and milk products	132.3	32.7	42.2	167.8	340.8
Meat and offals	71.3	47.0	30.4	78.0	217.3
Total animal oils and fats	1	1.9	0.7	5.5	10.7
Total diet in grams per person per day	1346.1	1093.8	1045.3	1354.1	1907.6

Source: World Health Organization



What We Eat:

Daily per capita intake of food commodities in India as per 2001 food balance sheet of FAO

Product	Per capita supply (kg/year)	Per capita supply (gm/day)	Percentage of total diet
Total cereals	162	445	37.1
Total pulses	11	29	2.4
Total vegetables	87.32	239	19.9
Total spices	1.97	5.4	0.4
Total fruits	40.66	111	9.3
Total meat	5.2	14.2	1.2
Eggs	1.54	4	0.4
Fish	4.43	12	1.0
Milk, excluding butter	65.49	179	15.0
Total sugar and honey	38.3	105.0	8.7
Animal Fats (ghee, butter)	2.25	6	0.5
Vegetable Oils	9.49	26	2.2
Oil Crops	7.1	19	1.6
Treenuts	0.68	2	0.2
Total stimulants	0.74	2	0.2
Approximate average per capita daily diet		1200.0	

Source: FAO 2001, Food balance sheet.



Average daily intake of food commodities by a 10 kg child in India (data in grams/day)

Age and sex groups	Cereals	Pulses	Leafy vegt.	Roots and tubers	Other vegt.	Fruits	Condiments & spices	Meat, fish and egg	Milk products	Fats/oils	Sugar	Total
1-3 yrs male	126	21	8	41	16	18	4	9	163	8	21	434
1-3 yrs female	113	19	5	35	16	23	5	10	165	7	18	417
Average for 10 kg child (1-3 years child)	119	20	7	38	16	20	4	10	164	7	19	425

Source: GOI 1998, India Nutrition Profile, Ministry of Human Resource Development.



Regulating toxins

Determine ADI (acceptable daily intake)

- Tests on rats for toxicity (NOAEL/LOAEL)
- Safety factor: 100 times more for humans

Set MRL (maximum residues limit)

- Based on field tests on crops
- Best-possible residue
- Compare with other countries' MRL

**Multiplied by
diet (exposure)**

**DIETARY INTAKE (TMDI-Theoretical
Maximum Daily Intake)** The sum of what
we eat: diet by section of population

Cross check

**— Ensure
exposure is
lower than
ADI**