



Chemical Body Burden

Can we keep a check?



All are exposed!

We are exposed to chemicals from various sources, which find various routes to our bodies.

- Chemicals in products
- Chemicals food and water
- Chemicals from industrial and vehicular pollution

We cannot avoid being exposed!

But can we reduce the exposure?



What is body burden?

- Body burden is levels of chemicals that actually are in people's bodies
- Body burden assessment is done through Biomonitoring.
- Biomonitoring is now recognised as the most health-relevant assessments of exposure because they measure the amount of the chemical that actually gets into people, not the amount that may get into people from measured environmental concentrations like in food and water or air.



Body burden studies in India

- Number of studies done in the past on body burden of pesticides
- Almost all the studies tested for organochlorine chemicals
- But most studies done in 1980s and 1990s. Little work done after that.



Body burden in India

Levels of DDT and HCH content in human blood samples in general population in India

City	Year	No. of Samples	Total DDT (ppm)	Total HCH (ppm)
Lucknow	1980	25	0.02	0.022
Delhi	1982	340	0.71	0.49
Lucknow	1983	48	0.028	0.075
Delhi	1985	50	0.301	-
Ahmedabad (rural)	1992	31	0.048	0.148
Ahmedabad (urban)	1997	14	0.032	0.039



Body burden in India

Levels of DDT and HCH residues in human milk samples in general population in India

City	No. of Samples	Whole milk basis (ppm)	
		Total DDT	Total HCH
Lucknow	25	0.127	0.107
Ludhiana	75	0.51	0.195
Bangalore	6	0.053	0.014
Kolkata	6	0.114	0.031
Mumbai	6	0.224	0.053
Delhi	60	0.344	-
Delhi	60	-	0.38
Ahmadabad	50	0.305	0.224



PML's studies

- 1. Endosulfan residues in biological samples in Kasaragod, Kerala, 2001**
- 2. Pesticide residues in blood of Punjab farmers, 2004**
- 3. Mercury in human bodies in Singrauli, UP, 2012**



PMLs Punjab study in 2004

- Selected two districts – Bhatinda and Ropar – based on high pesticide use and media reports on cancer patients.
- A team of scientists from the PML visited four villages - MahiNangal, Jajjal and Balloh in Bhatinda and Dher in the district of Ropar.
- Collected 20 blood samples from randomly selected people



PMLs Punjab study in 2004

- Blood sample tested based on widely- recognised US Environmental Protection Agency methodology using chromatography techniques
- Blood samples tested for 14 Organochlorine (OCs) and 14 Organophosphorous (OPs) pesticides.



Results

- **Found 15 different kinds of pesticides in the 20 blood samples.**
- **Each blood sample contained a cocktail of 6-13 different pesticides**

And we found it in very high amounts



Results



How much of which pesticides in blood?

	Organochlorine pesticides						Organophosphorous pesticides				Total pesticides
	HCH	Heptachlor	Aldrin	Chlordane	DDT	Endosulfan	Monocrotophos	Phosphamidon	Chlorpyrifos	Malathion	
Average pesticides in Punjab blood samples (mg/l)	0.057	0.0006	0.0062	0.009	0.065	0.0046	0.095	0.037	0.066	0.030	0.370



But how high?

- Levels of certain organochlorine pesticides were found to be 15-605 times higher than those found in the blood samples of the US population as established by the biomonitoring studies by the US Centre for Disease Control and Prevention



Organochlorines in blood

Horrific

Pesticide residues we found in Punjab are much higher than in the US

	β -HCH	Lindane	Heptachlor	DDE	DDT
Punjab blood samples					
Percentage of sample with pesticides (%)	35	100	5	95	50
Mean concentration of pesticide (ng/g of lipids)	1,254	4537	110	8,996	1,990
Pesticides found in blood by CDC study on US population					
Percentage of sample with pesticides (%)	62	1.7	27	99	26
Mean concentration of pesticide (ng/g of lipids)	9.68	<7.5	<7.5	260	<10.6
Number of times the Punjab samples exceed the pesticides concentration when compared to US samples	129	605	15	35	188

Note: Organochlorine pesticides are lipophilic and concentrate in the body's lipid stores including the lipid in the blood serum. For comparison, levels for these compounds are expressed as per gram of total lipid in the blood serum.



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That is not all

- We also found residues of so-called “non-persistent” pesticides –Organophosphates
- We found monocrotophos in 75% of the blood samples
- Chlorpyrifos in 85% of samples
- 70% of the samples also contained two more Organophosphates: phosphamidon and malathion



And in high amount

Example: Monocrotophos

- The short-term exposure limit for the humans set by WHO/FAO for this pesticide is 0.002 mg/kg body weight/day.
- An adult weighing 60 kg therefore cannot be safely exposed to more than 0.12 mg/day of monocrotophos
- We found the average levels of monocrotophos in Punjab blood samples as 0.095 mg/l.
- Considering that average adult has about 5 litres blood, the total amount of monocrotophos in blood alone was 0.475 mg.
- **This was four times higher than the short-term exposure limit for the whole body.**



Organophosphates

- **Organophosphates** constituted **more than 60%** of the total pesticide residues in the blood samples from Punjab
- This finding is disturbing because.....
- Organophosphates are now getting added in body to the earlier contamination of Organochlorines
- **Organophosphates** have **far higher toxicity** than the older Organochlorines



What are the health implications?

- We cannot say for certain.
- The effects of specific chemicals can vary among individuals.
- The science of pesticide in body and its linkage with human health is still developing.
- Moreover, we don't carry only one pesticide in our bodies. We carry a cocktail.
- And, virtually nothing is known about the combined health impacts of dozens of these chemicals in the body at the same time.



What do we do then?

- Slowly, world is moving beyond finding linkages between chemicals and disease they cause. It is no more important.
- It is understood that these toxins will have implications, even if we cannot prove it by scientific means.
- What is more important is to know how much and how many of these chemicals are trespassing human bodies.
- The bottom line is simple: Chemicals can be allowed to trespass our bodies, indiscriminately.



US National Biomonitoring Program

- Centre for Disease Control and Prevention in the US has been running National Biomonitoring Program to determine the level of chemicals in the US populations since late 1980s
- NBP currently measures more than 450 environmental chemicals and nutritional indicators in people.
- The Fourth National Report on Human Exposure to Environmental Chemicals was published in 2009
- Results used for regulating chemicals



Way ahead: Regulate these toxins

- The UK's Royal Commission on Environmental Pollution in 2003 stated "where chemicals are found in elevated concentrations in biological fluids such as breast milk, they should be removed from the market immediately"
- Many researchers, scientists and NGOs now believe that body burden studies may hold the key to a full-proof system of regulating the use of pesticide and other chemicals
- It is no more about testing pesticides in food and then regulating pesticide use.
- It is now about testing pesticides in human bodies and then regulating and controlling their use.



Monitoring and regulation

- Enact chemical Trespass law - a law to prevent trespassing of human bodies by chemicals and to hold manufacturers accountable.
- We must have a system in place for regular monitoring of chemicals in human bodies for the whole country.
- The data generated from these studies must be used for regulating chemicals
- Phase out chemicals that are found in large number of people or in higher quantities
- This is the only way we can reduce chemical exposure