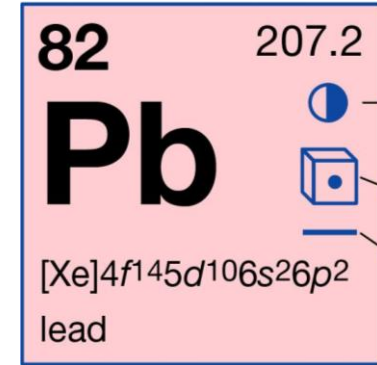




Is the presence of lead in certain imported spices a public health issue ?

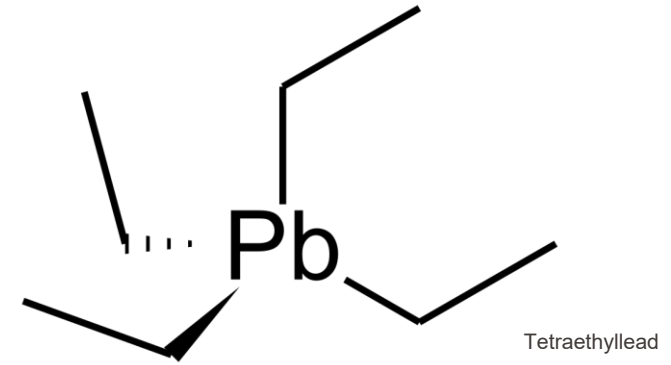
Lead

- Lead is a heavy metal, omnipresent in the environment
- A metal used for thousands of years, from fishing «leads» to Roman canalizations
- Toxicity known for thousands of years



Lead Plaque of Magliano, Italy, bears an Etruscan inscription from mid-5th century BC.

Lead poisoning in the past



Lead poisoning, also known as plumbism or saturnism

- Lead poisoning can cause aggressive, hostile, and destructive behavioural changes, as well as learning disabilities, seizures, severe and permanent brain damage, and even death.
- Blood levels of 10 to 15 ug/dL are associated with reduced intelligence and detrimental effects on growth and development of children [...] (Thomas, 1995;U.S. PHS, 1991)
- As lead was phased out of gasoline in the United States, the average concentration of lead in blood dropped from 16 to 3 ug/dL

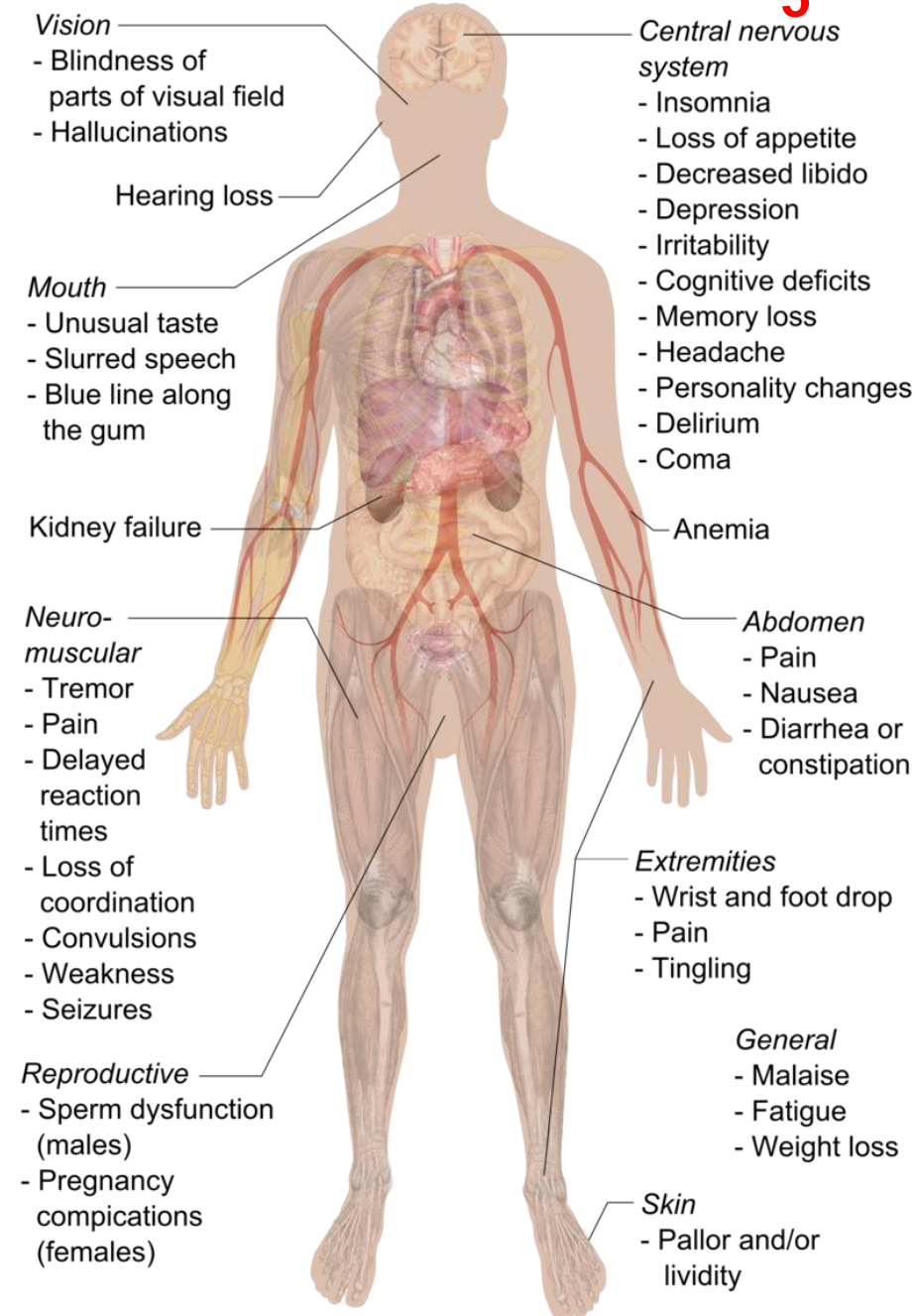
Lead poisoning

- Very different symptoms based on the molecule (organic / inorganic) and individuals
- Symptoms can occur from 1 ug Pb/dL of blood, deposition in the bones can keep elevated concentrations in the body for years
- Pregnant or childbearing age women should avoid eating hunting meal
- WHO recommends to take measures above 5 ug Pb/dL blood.



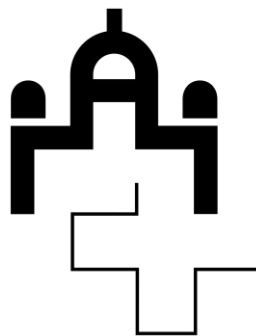
Symptoms of Lead poisoning

5



Regulations on foodstuffs

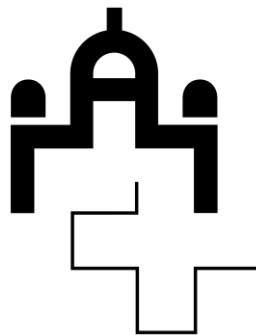
- Swiss regulations are based on European regulations
- Limits on foodstuffs start at 0,02 mg Pb / kg wet weight for baby food



	Foodstuffs ⁽¹⁾	Maximum level (mg/kg wet weight)
3.1	Lead	
3.1.1	Raw milk ⁽⁶⁾ , heat-treated milk and milk for the manufacture of milk-based products	0,020
3.1.2	Infant formulae, follow-on formulae and young child formulae ⁽⁵⁷⁾	
	marketed as powder ^{(3) (29)}	0,020
	marketed as liquid ^{(3) (29)}	0,010
3.1.3	Processed cereal-based foods and baby foods for infants and young children ^{(3) (29)} other than those listed under point 3.1.5.	0,020
3.1.4	Foods for special medical purposes intended for infants and young children	
	marketed as powder ^{(3) (29)}	0,020
	marketed as liquid ^{(3) (29)}	0,010
3.1.5	Drinks for infants and young children labelled and sold as such, other than those mentioned under points 3.1.2 and 3.1.4	
	marketed as liquids or to be reconstituted following instructions of the manufacturer including fruit juices ⁽⁴⁾	0,020
	to be prepared by infusion or decoction ⁽²⁹⁾	0,50
3.1.6	Meat (excluding offal) of bovine animals, sheep, pig and poultry ⁽⁶⁾	0,10
3.1.7	Offal ⁽⁶⁾	
	of bovine animals and sheep	0,20
	of pig	0,15
	of poultry	0,10
3.1.8	Muscle meat of fish ^{(24) (25)}	0,30
3.1.9	Cephalopods ⁽⁵²⁾	0,30
3.1.10	Crustaceans ^{(26) (44)}	0,50
3.1.11	Bivalve molluscs ⁽²⁶⁾	1,50
3.1.12	Cereals and pulses	0,20
3.1.13	Root and tuber vegetables (excluding salsifies, fresh ginger and fresh turmeric), bulb vegetables, flowering brassica, head brassica, kohlrabies, legume vegetables and stem vegetables ^{(27) (33)}	0,10
3.1.14	Leafy brassica, salsify, the following fungi <i>Agaricus bisporus</i> (common mushroom),	0,30

Regulations on foodstuffs

- Swiss regulations are based on European regulations
- Limits on foodstuffs start at 0,02 mg Pb / kg wet weight for baby food
- Spices have a limit of 0.6 ~ 2 mg / kg
- VBT : 40 ug Pb/dL (10 ug/dL for women < 45yrs)
(5 ug/dL considered a limit for WHO)



3.1.26	Dried spices ⁽²⁹⁾	
	Fruit spices	0,60
	Root and rhizome spices	1,50
	Bark spices	2,0
	Bud spices and flower pistil spices	1,0

A problem ...
... of the past ?

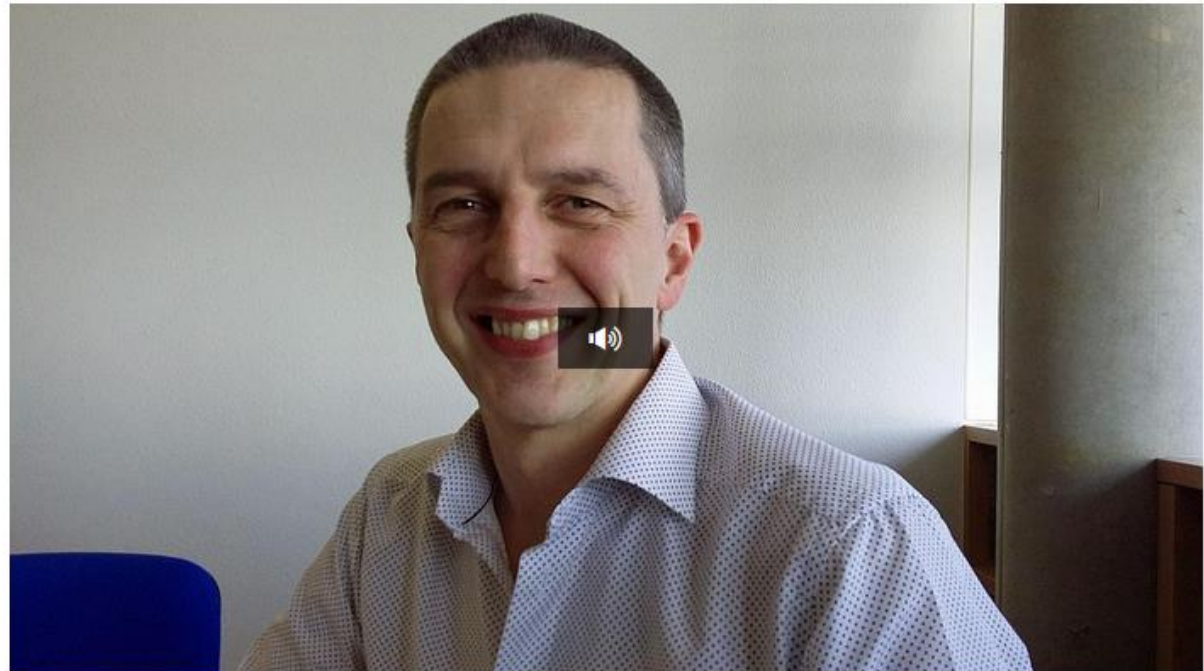
Gare à l'abus de chocolat, riche en cadmium, un métal lourd nocif pour la santé

Santé

Modifié le 23 août 2025 à 20:18

[Résumé de l'article](#) ▾

[Partager](#)



Faut-il s'inquiéter de la présence d'un métal lourd dans le chocolat? Interview de David Vernez / Forum / 5 min. / le 23 août 2025

Why is there lead in spices?

- Soil contamination
- Irrigation water or fertilizers
- Cross-contamination : processing, transport, storage
- Adulteration: adding lead compounds



Case Study: “A Spoonful of Lead”

- 1,496 spice samples, covering over 50 spice types from 41 countries
- Locals, abroad and lead-poisoned people
- 31 % of all samples > 2 ppm lead
- Georgian spice : 48,000 ppm lead
- North Carolina (USA): 28.8 % of spice / herbal remedy samples : ≥ 1 mg/kg lead
- Elevated lead spices : Tumeric, hot pepper, paprika, soup spices mixes

TABLE 2
Lead Concentration in Spices by Country of Purchase^a

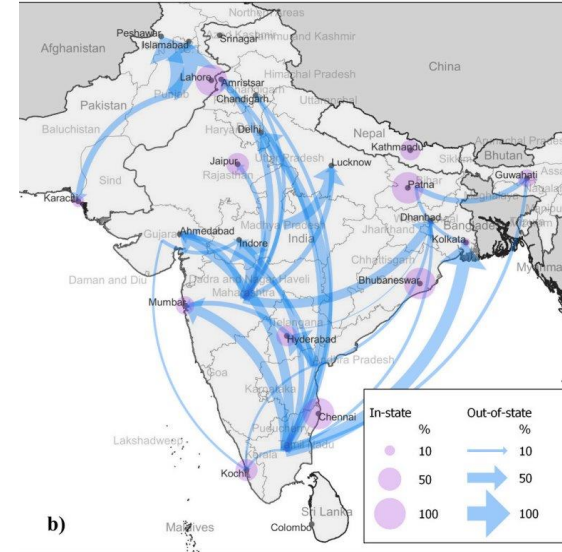
	Number of Samples	%	Lead Concentration Percentiles, ppm				Geometric Mean (GSD) of Samples With Detectable Lead	Percentage ^b of Samples With Lead Concentration Above a Reference	
			Median, All Samples	75th	90th	Maximum		Above Detection Limit, %	Above 2 ppm, %
<i>Grand total</i>	1 496	100	0.4	4.0	330	48 000	9.5 (20.2)	53	31
<i>Country of purchase</i>									
Unknown	185	12 ^c	ND	1.0	4.4	4 400	4.1 (12.6)	36	16
United States	519	35 ^c	ND	0.8	3.2	21 000	1.9 (6.4)	40	13
Store survey	102	20 ^d	ND	0.6	4.0	21	1.0 (3.9)	49	13
Case investigation	417	80 ^d	ND	0.8	3.0	21 000	2.3 (7.1)	38	14
Foreign country	792	53 ^c	1.3	35.8	920	48 000	20.2 (23.3)	66	45
South Asia	412	52 ^e	1.1	12.8	596	7 100	14.1 (15.4)	62	42
Bangladesh	275	35 ^e	2.5	69.0	700	2 000	16.8 (14.4)	73	54
India	76	10 ^e	ND	ND	3.3	690	3.3 (7.5)	24	13
Pakistan	51	6 ^e	0.5	2.4	940	7 100	10 (25.7)	55	25
Nepal	10	1 ^e	1.0	205.8	2 510	2 700	16.6 (35.8)	60	30
Georgia	210	27 ^e	13.5	925	10 860	48 000	58.6 (31.1)	90	70
Mexico	39	5 ^e	ND	0.7	6.4	17.0	2.4 (4.1)	31	18
Morocco	21	3 ^e	1.4	6.6	56.6	120	5.2 (5.5)	67	48
Jamaica	12	2 ^e	ND	ND	0.4	0.4	0.4 (1.2)	17	0
Other countries (N = 32)	98	12 ^e	0.1	1.7	230	33 000	6.6 (30.4)	51	23

TABLE 1
Lead Concentration by Type of Spice^a

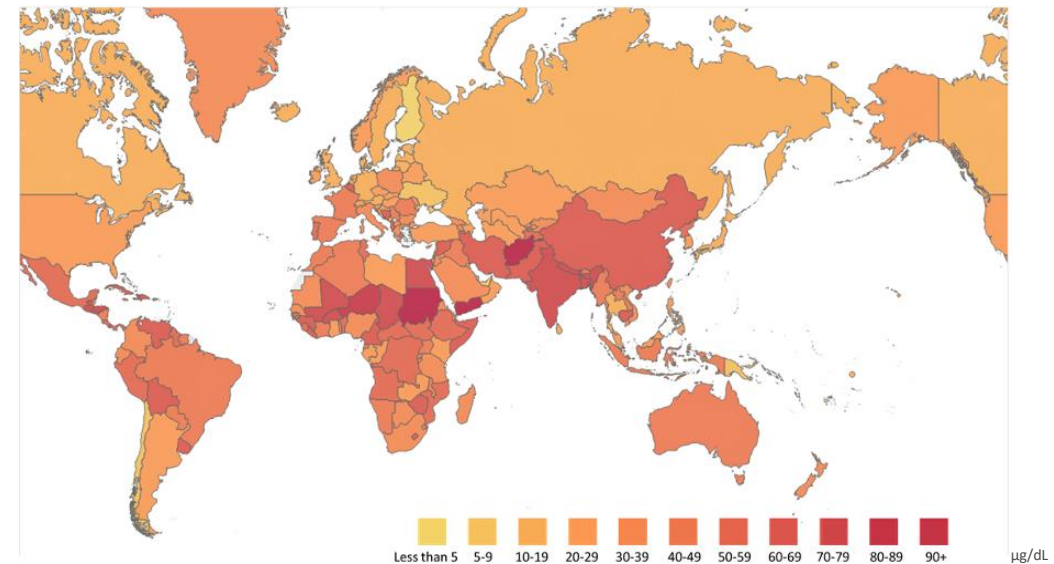
Spice	Number of Samples	Lead Concentration Percentiles, ppm				Geometric Mean (GSD) of Samples With Detectable Lead	Percentage ^b of Samples With Lead Concentration Above a Reference	
		Median, all Samples	75th	90th	Maximum		Above Detection Limit, %	Above 2 ppm, %
Total all spices	1 496	0.4	0.4	4.0	48 000	9.5 (20.2)	53	31
<i>Kviteli kvavili</i> /yellow flower/Georgian saffron	32	227.5	17 750	25 500	48 000	240.1 (63.1)	100	84
Curry	67	0.3	1.2	6.0	21 000	2.4 (13.2)	51	18
<i>Khmeli suneli</i> /kharcho suneli	41	1.7	175	6 340	17 000	21.6 (36.1)	85	49
Bouillon/broth/soup spice	17	ND	ND	1 921	9 600	8.6 (109.6)	24	6
<i>Svanuri maril</i> /svaneti salt	32	525	1 900	4 310	7 100	291.4 (16.7)	88	78
<i>Utskho suneli</i> or fenugreek	38	3.1	77.0	455	3 500	11.8 (14.6)	84	58
<i>Adjika</i>	10	58.0	1 062.5	3 290	3 400	78.3 (28.8)	80	60
Masala	40	ND	1.3	21.9	2 700	2.8 (10.6)	50	13
Turmeric	252	0.7	230	770	2 700	32.3 (22.0)	56	39
Hot pepper, chili powder, paprika	284	ND	3.3	27.0	2 400	4.9 (7.5)	48	30
<i>Kvliavi dziral</i> /caraway	9	4.8	14.5	...	1 400	8.9 (9.7)	89	78
Cumin	127	ND	1.0	4.4	1 200	2.3 (6.2)	46	19
Cinnamon	19	2.0	4.8	9.6	880	3.8 (6.1)	74	53
Salt	11	ND	0.6	364	410	35.6 (34.6)	27	18
Tamarind	2	114.5	...	...	230	230 (0.0)	50	50
Spice mix	7	0.6	1.3	...	170	2.1 (12.1)	71	14
Coriander	102	0.6	2.5	17.4	79	3.0 (4.4)	55	26
Thyme	11	2.4	6.6	18.0	19	2.9 (3.0)	91	55
Mole	6	ND	9.1	...	17	10.4 (2.0)	33	33
<i>Epazote</i>	5	ND	11.5	...	13	11.4 (1.2)	40	40
Ginger	7	1.2	4.3	...	9.6	2.9 (2.7)	57	29
<i>Berberis</i> berries	2	5.1	...	...	9.4	2.8 (5.4)	100	50
Onion	4	ND	5.4	...	6.9	2.4 (4.4)	50	25
Okra	4	ND	3.9	...	5.5	5.5 (0.0)	25	25
Cilantro	3	1.3	...	...	4.6	2.4 (2.4)	67	33
Asafetida/hing	4	0.4	3.1	...	3.6	2.5 (1.7)	50	25
Tikka	3	1.8	...	...	2.5	2.1 (1.3)	67	33

Populations at risk

- High-spice consumers / ethnic diets
- Low-income regions
- Individuals with existing lead burden (water, paint..)
- **484,504 deaths** from lead in 2021
- Weak regulatory enforcing regions (India, Pakistan, Georgia..)
- Cumulative exposure in high-risk regions



Map indicating dominant sourcing patterns. Arrows represent turmeric sourced from another state



Average blood lead level (<20y.o) Source: Institute of Health Metrics and Evaluation (IHME)

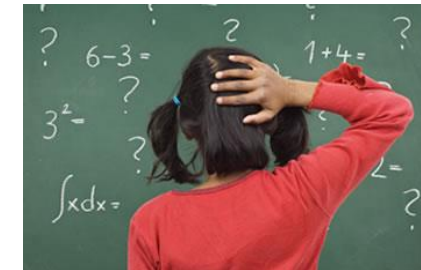
Pediatric Lead Exposure

- Study from 2010-2019
- Indian spices and cultural powders
- **4 pediatric poisoning cases** confirmed
- Child BLL \uparrow from 3.2 \rightarrow **4.1 $\mu\text{g}/\text{dL}$** (5 $\mu\text{g}/\text{day}$ lead)
- **% of children exceeding 10 $\mu\text{g}/\text{dL}$ tripled (2.8%)**
- **26% of spices** > 1 mg/kg lead (up to **7.6 mg/kg**)
- **65% cultural powders** > 1 mg/kg lead (up to **41 mg/kg**)
- Tradeoff between spice quality/lead quantity

Table 3

Estimates of the theoretical maximum blood lead level (BLL) increase for children 24–36 months old from turmeric in locations with turmeric lead levels above the LOD.

Country	Region	City	State	Maximum turmeric lead concentration ($\mu\text{g}/\text{g}$)	Turmeric consumption per household per month (g) ¹	Average household size (n)	Estimated lead intake from turmeric $\mu\text{g}/\text{day}$	Estimated child BLL increase - basic assumptions ($\mu\text{g}/\text{L}$)	Estimated child BLL increase - AALM ($\mu\text{g}/\text{L}$)
India	North	Lucknow	Uttar Pradesh	5	204	5.3	1	1	2
		Chandigarh	Chandigarh	7	204	4.5	2	1	2
		Amritsar	Punjab	10	204	4.7	3	2	4
	Northeast	Guwahati	Assam	127	183	4.4	38	20	45
		Patna	Bihar	2274	206	5.0	663	345	790
	East	Bhubaneswar	Odisha	5	206	4.1	2	1	2
		Chennai	Tamil Nadu	11	80	3.5	2	1	2
Pakistan	South	Islamabad	Islamabad Capital Territory	22	139	7.1	3	2	4
		Karachi	Sindh	2935	139	8.6	333	173	396
	Peshawar	Khyber Pakhtunkhwa	1051	139	9.7	105	55	125	
	Nepal	Kathmandu	Bagmati	82	139	3.9	21	11	25



Neurological, behavioral & learning problems. Long-term issues.

Spices, a public health issue ?

- Predominant sources of lead (fuel, dishware..) have been removed from the environment
- Spices from certain regions have lead concentration well above the legal limits
- The small quantity of spices used in occidental cooking mostly constraints the risk to young children and some population groups
- Quality control and enforcement of legal limits should be taken and continued



EPFL

Thank you
for your
attention!

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Léo & Ahmed

Visual sources

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