


Heavy Metal Poisoning

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Heavy Metal Poisoning


- ◆ Metal:
 - Characterized by luster, ductility, malleability, high electric and thermal conductivity; chemically form bases which can react with acids



Heavy Metal Poisoning

- ◆ Heavy Metal – Metal of High Specific Gravity:

– Cadmium	112	
– Lead	207	
– Mercury	200	
– Zinc	65	Not so heavy
– Aluminum	27	Light
– Arsenic	75	Metalloid?
– Selenium	79	Metalloid?




Heavy Metal Poisoning

- ◆ Metals Classified by Human Requirements:
 - Large requirements, wide tolerance – Sodium, Iron
 - Micro-requirements, narrow tolerance – copper, zinc, selenium
 - No known biological roles – toxic at low levels, Cadmium, Lead, Mercury
 - i.e. “Heavy Metals” – Major concerns for food




Heavy Metals - Sources

- ◆ In general: Worldwide – associated with mining, industry
- ◆ Sources for food:
 - Environmental pollution*
 - Accidental inclusion in processing
 - Contamination from containers
- * Entry into environment:
 - Natural weathering – low levels, local
 - Extraction and concentration – high levels
 - Discarding of products after use




Lead (Pb) Poisoning

- ◆ Mining, smelting, and refining, Manufacture of Pb – containing products (Batteries)
- ◆ Insecticides, leaded gas
- ◆ Soil
- ◆ Plants
- ◆ Food:
 - Containers of soldered tins and ceramic glaze




Lead (Pb) Poisoning

- ◆ Lead levels in canned goods substantially higher than in un-canned
- ◆ United States:
 - About 60% of lead intake via food
 - 6.6% from animal products
- ◆ Half-life: 20-30 days




Lead (Pb) Poisoning

- ◆ Risk Groups:
 - Children:
 - In infants and young children – 53% of ingested Pb* is absorbed
 - In adults – 5-10%
 - CNS and metabolic defences still developing – therefore lower thresholds for adverse effects
 - Physiological stress – rapid growth, unstable eating habits
 - Normal hand-to-mouth activity – higher exposure in children
- * Pb crosses placenta – enters milk




Clinical Lead Poisoning (Plumbism)

- ◆ Children:
 - Anemia, recurrent emesis, vague abdominal pain, constipation, clumsiness, ataxia, mental retardation, muscular weakness, lack of concentration, seizures, coma
- ◆ Adults:
 - Headaches, colic, emesis, anorexia, generalized pain, fatigue, anemia, neuritis, palsy
- ◆ Pregnant women:
 - Stillbirths, abortions
 - Renal Dysfunction and Neurological Impairment




Methylmercury

- ◆ Sources:
 - Chloralkali plants
 - Pulp and paper
 - Antiseptics, fungicides
- ◆ The Agent:
 - Absorbed from GIT 100%
 - Passes blood-brain barrier
 - Crosses placenta
 - Biological Half-life: 70-80 days




Methylmercury

- ◆ Biomagnification in water systems is N.B.!
- ◆ Don't eat the big fish
- ◆ Acute Toxicity:
 - Severe gastroenteritis, nephritis
 - Usually exposure to inorganic Hg




Methylmercury

- ◆ Clinical signs of Methylmercury Toxicity:
 - Sensory disturbance
 - Incoordination
 - Dysarthria
 - Auditory disturbance
 - Constriction of visual field
 - Congenital




Methylmercury

- ◆ Clinical Signs of Methylmercury Toxicity (Continued):
- ◆ C.P. – like syndrome:
 - Minimata – 6.9% versus 0.3% elsewhere
- ◆ Serious mental retardation
- ◆ Growth Disturbances
- ◆ Nervous system Disorders




Cadmium

- ◆ Sources:
 - Industrial processes
 - Batteries, electroplating
 - Contaminant of zinc in metal alloys
- ◆ The Agent:
 - 5% absorbed GIT (40% from lungs)
 - Binds to intestinal cells, metallothionein
 - Biological Half-life: ≤ 30 years




Cadmium

- ◆ Vehicle:
 - Most dietary exposure is through cereals and vegetables, particularly root vegetables




Cadmium Toxicity/Hazard

- ◆ Acute:
 - Severe gastroenteritis
 - Acid foods in Cd-plated utensils
- ◆ Chronic:
 - ITAI – ITAI (Ouch-Ouch) Disease (Japan)
 - Progressive osteoporosis, osteomalacia
 - Renal dysfunction
 - Severe bone pain and brittleness (multiple fractures)



Cadmium Toxicity/Hazard

- ◆ Source:
 - Zn + Pb mine
 - Cd as contaminant in effluent
 - Water for drinking, rice irrigation
 - Most cases occurred in older women after prolonged exposure



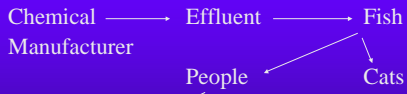
Chronic Toxicity

- ◆ 1970s - Canada:
 - Grassy Narrows Indians
- ◆ 1971-1972 – Iraq:
 - 6500 cases, 459 deaths
 - Treated wheat, barley seed made into flour and bread



Chronic Toxicity

- ◆ 1953 ff Japan:
- ◆ Minimata Disease = Dancing Cat Disease



Congenital

Concentrates in fetus 784 official cases, 103 deaths,
3000 suspect cases