

The Important Nutrients



The Known 51 Essential Nutrients for Sustaining Human Life*

Air, Water & Energy (3)	Protein (amino acids) (9)	Lipids-Fat (fatty acids) (2)	Macro-Minerals (7)	Trace Elements (17)	Vitamins (13)
Oxygen Water Carbohydrates	Histidine Isoleucine Leucine Lysine Methionine Phenylalanine Threonine Tryptophan Valine	Linoleic acid Linolenic acid	Na K Ca Mg S P Cl	Fe Zn Cu Mn I F Se Mo Co (in B ₁₂) B Ni Cr V Si As Li Sn	A D E K C (Ascorbic acid) B ₁ (Thiamin) B ₂ (Riboflavin) B ₃ (Niacin) B ₅ (Pantothenic acid) B ₆ (Pyroxidine) B ₇ /H (Biotin) B ₉ (Folic acid, folacin) B ₁₂ (Cobalamin)

*Numerous other beneficial substances in foods are also known to contribute to good health.

Classes of Nutrients: Micronutrients



- **Vitamins:** fat and water soluble
 - Fat Soluble - A, D, E and K
 - Water Soluble - C, B family (thiamin, niacin, riboflavin, B6, B12), folate
- **Minerals:**
 - Zinc, iron, copper, calcium, potassium, magnesium, phosphorus

Micronutrient Malnutrition Causes

- More severe illness
- More infant and maternal deaths
- Lower cognitive development
- Stunted growth
- Lower work productivity

The Big Four of Micronutrient Deficiencies: Hidden Hunger

- **Vitamin A** - An estimated 140 mil children are afflicted
- **Iron** - 2 bil people suffer from anemia, mainly pregnant and lactating women and young children
- **Folate** - Maternal folate deficiency leads to a quarter of a million severe birth defects each year
- **Iodine** – 32% of the developing world population lives at risk of iodine deficiency, and disorders with iodine deficiency during pregnancy cause 18 million babies to be born mentally impaired every year

Biological Importance of Iron

- Iron is essential for almost all living organisms
- Participates in oxidative and reductive processes as part of redox enzymes and thus plays an essential role in oxidative energy production
- Carrier of oxygen to the tissues from the lungs in the form of hemoglobin

Iron Deficiency

The WHO has defined cut offs for the presence of anemia based on the measurement of hemoglobin concentration in the blood.

Clinical signs of deficiency

- Pallor of nail beds and mucosal membranes is an indicator of anaemia, but there is no specific clinical sign commonly used for diagnosis.
- Fatigue(sinti kolen) and weakness
- Irritability

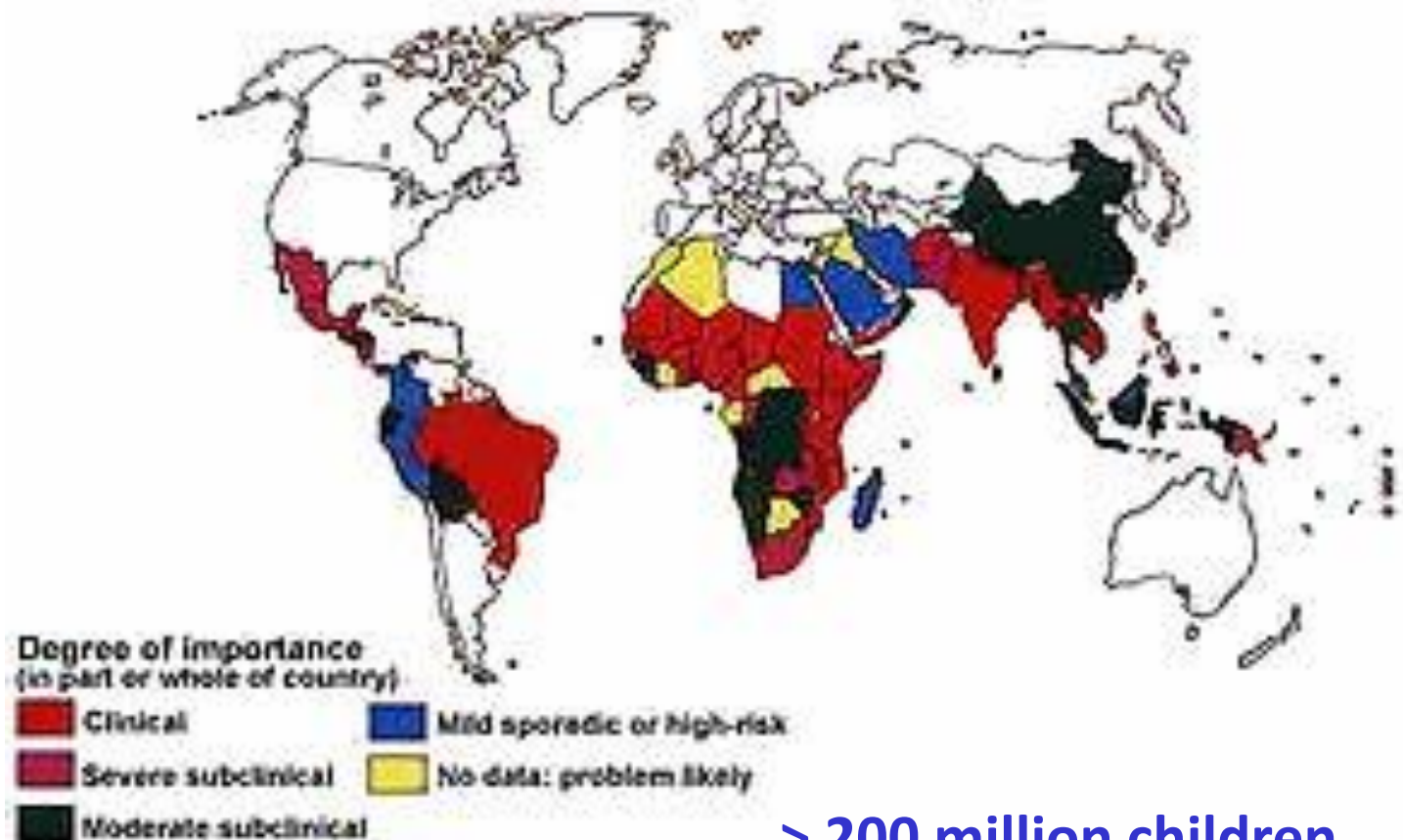
Causes of anemia



- Major causes
 - **Iron deficiency (1300-2200 m)**
 - Hookworm (876 m)
 - Vitamin A deficiency (300 m)
 - Malaria infection (300 m)
- Other causes
 - Chronic infections: TB, HIV
 - Other vitamins
 - Genetic defects

Prevalence of Vitamin A Deficiency

Countries categorized by degree of public health importance of vitamin A deficiency



> 200 million children
affected

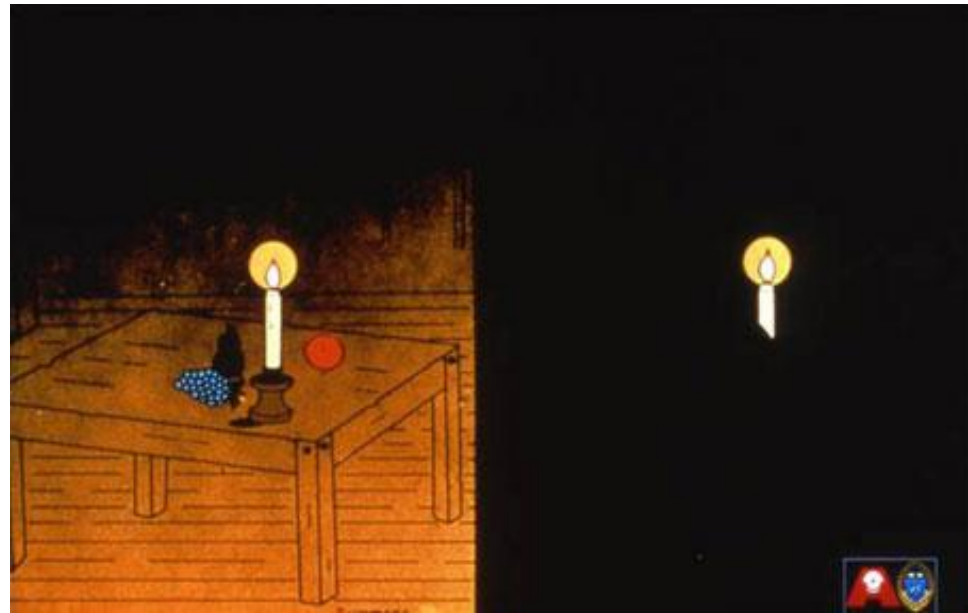
Vitamin A Deficiency

- 250,000 - 500,000 vitamin A deficient children become blind every year, 1/2 dying within 12 months of losing their sight
- 600,000 women die from childbirth-related causes each year, the vast majority of them from complications which could be reduced through better nutrition, including provision of vitamin A. (WHO)
- Xerophthalmia and corneal blindness, anemia, stunted growth, impaired immunity, increased severity of infection (measles, diarrhea or malaria), mortality

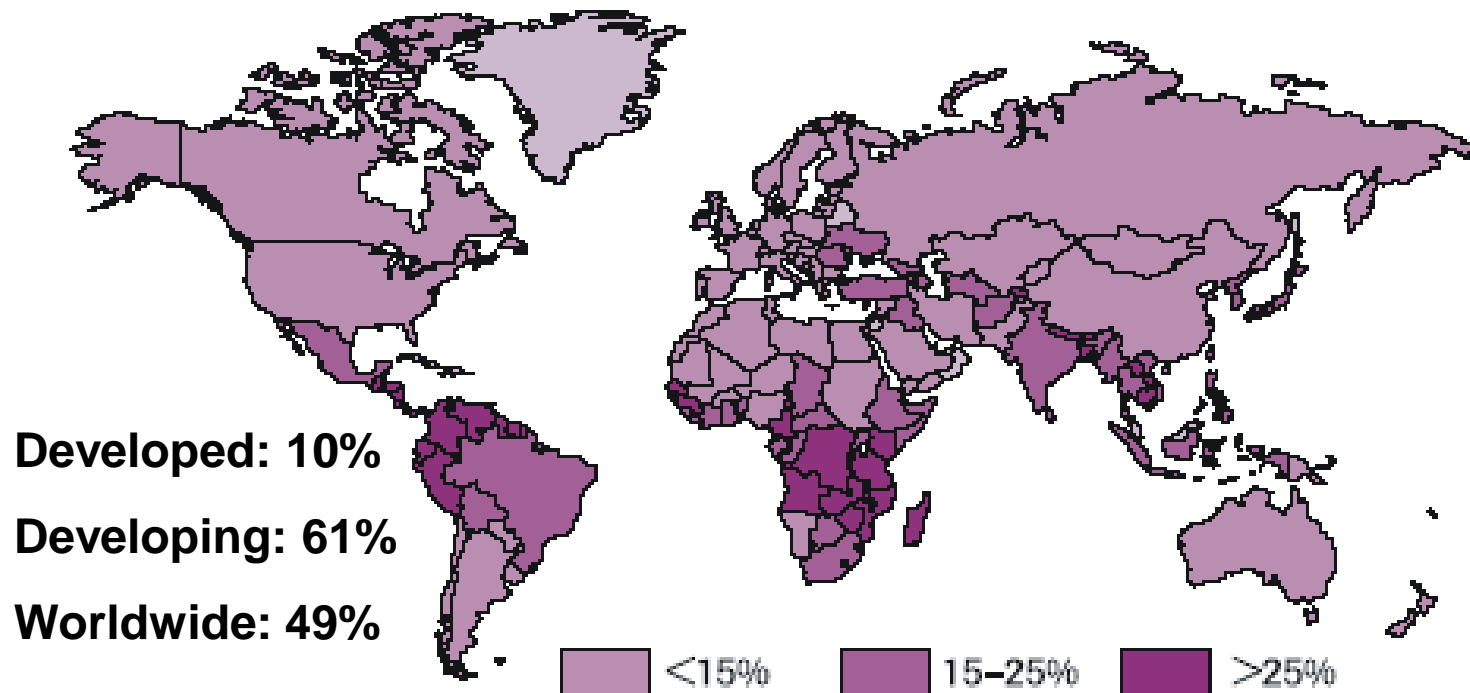


Vitamin A and Eye Health

- Causes blindness in children. Severe vitamin A deficiency causes corneal ulceration, necrosis of the eye and ultimately xerophthalmia.
- Milder vitamin A deficiency is nightblindness and Bitot's spots.
- Night blindness in pregnant women or children: where the eyes become less efficient at adjusting to dim light.



Estimated Population at Risk of Zinc Deficiency



Over 20% of the World's Population is Zinc Deficient

Brown and Wuehler (2000): Zinc and human health

Zinc Deficiency Symptoms

- **Signs**

- Growth retardation
- Delayed sexual maturation & impotence
 - Impaired testicular development
- Hypogonadism & hypospermia
- Alopecia
- Acroorifical skin lesions
 - Other, glossitis, alopecia & nail dystrophy
- Immune deficiencies
- Behavioral changes

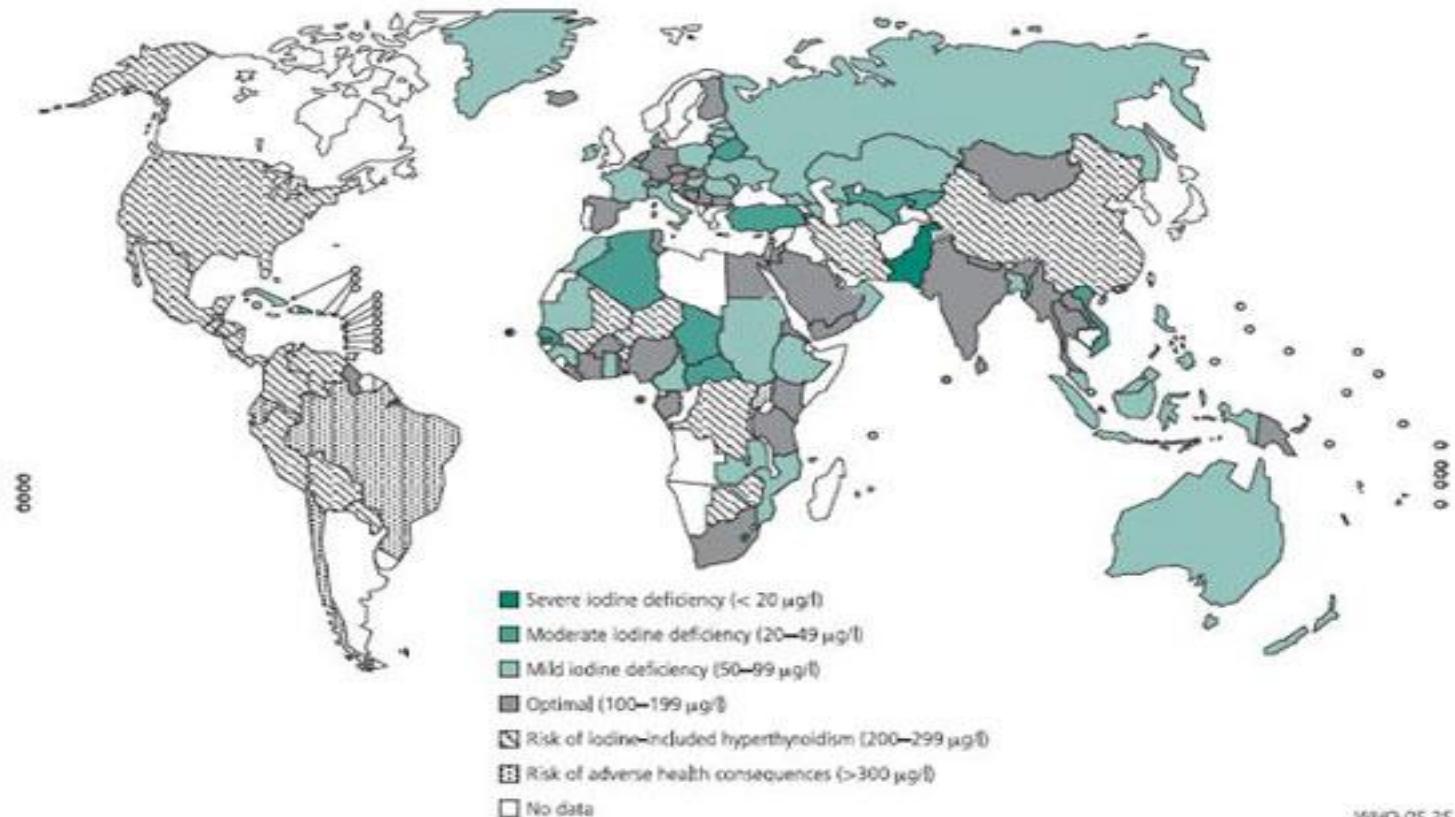
- **More signs**

- Night blindness
- Impaired taste (hypoguesia)
- Delayed healing of wounds, burns, decubitus ulcers
- Impaired appetite & food intake
- Eye lesions including photophobia & lack of dark adaptation

Iodine Deficiency

- Required to produce thyroid hormones that control cell metabolism, neuromuscular tissue growth and development, especially the fetal perinatal brain

Fig. 1. Degree of public health significance of iodine nutrition based on median urinary iodine



Iodine deficiency Symptoms

- Goitre - An increase in thyroid size is usually the first clinical sign of impaired iodine nutrition and indicates an adaptation to the reduction of thyroid hormone available.
- Cretinism - Irreversible condition resulting from iodine deficiency in a pregnant woman that causes severe mental deficiency, Deaf **mutism** and short stature in children

Other Malnutrition Problems

Se deficiencies

Scurvy (vitamin C)

Beriberi (thiamine/B₁)

Rickets (both vitamin D & Ca deficiencies)

Pernicious Anemia (cobalamine/B₁₂)

Folic acid

How to get the intake for Vitamin A?

Amounts of different foods that contain approximately 500 RE vitamin A (roughly the recommended daily intake of vitamin A for an adult)

1 spoon (10 ml)



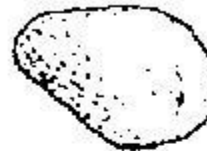
Fresh red palm oil

1 small



Carrot

1 small



Mango

Egg-sized piece



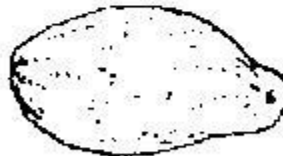
Liver

1.5 cups chopped



Dark green leaves

1 small



Pawpaw

Medium-sized piece



Yellow sweet potato



Milk

Retinal – animal foods e.g. liver, eggs, fatty fish, fortified milk

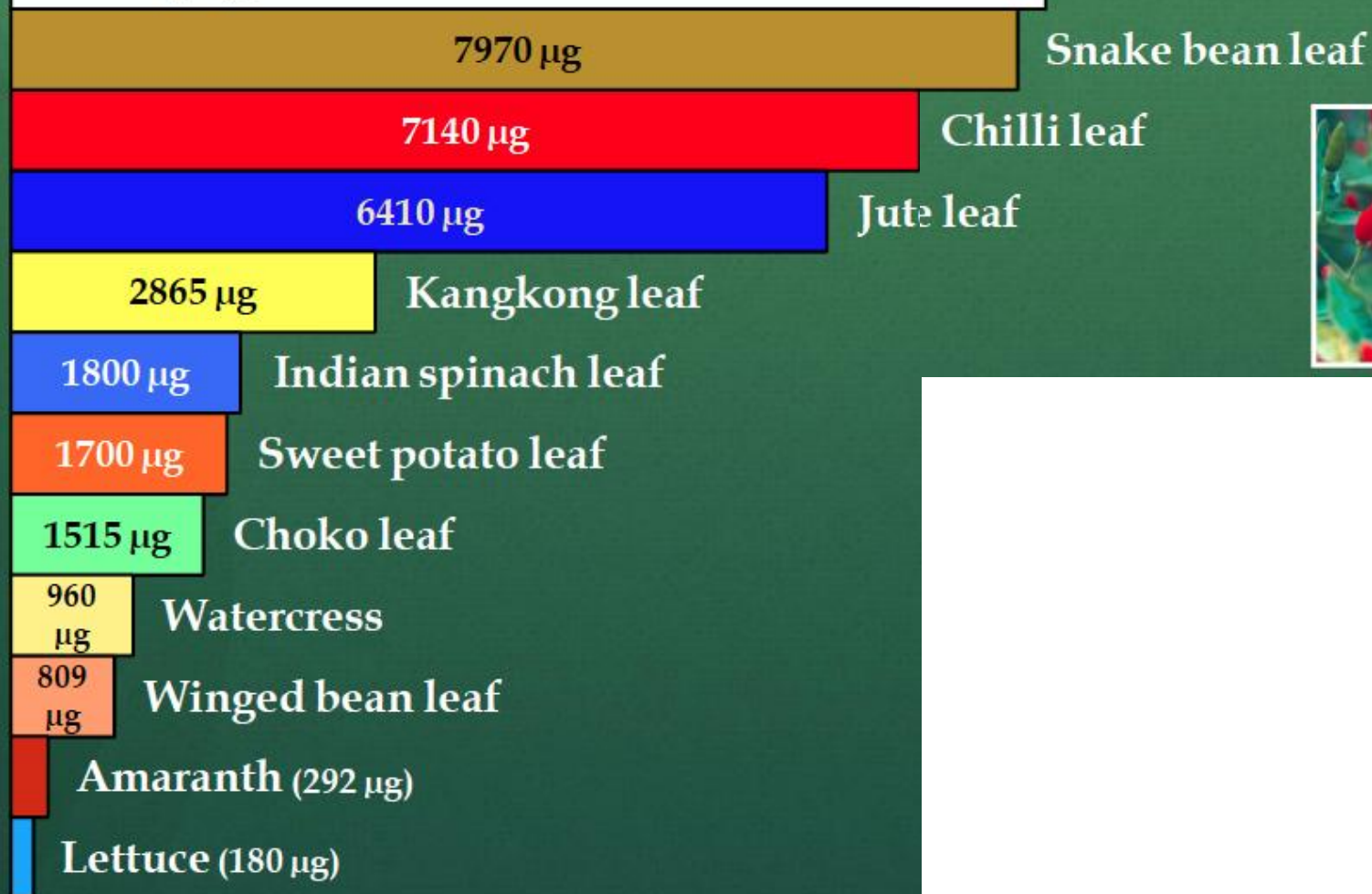


- **β -carotene** – orange plant pigment found only in plant foods
- Precursor to retinal
- In green leafy vegetables β - carotene is usually present but masked by chlorophyll





Leafy greens – Vitamin A content



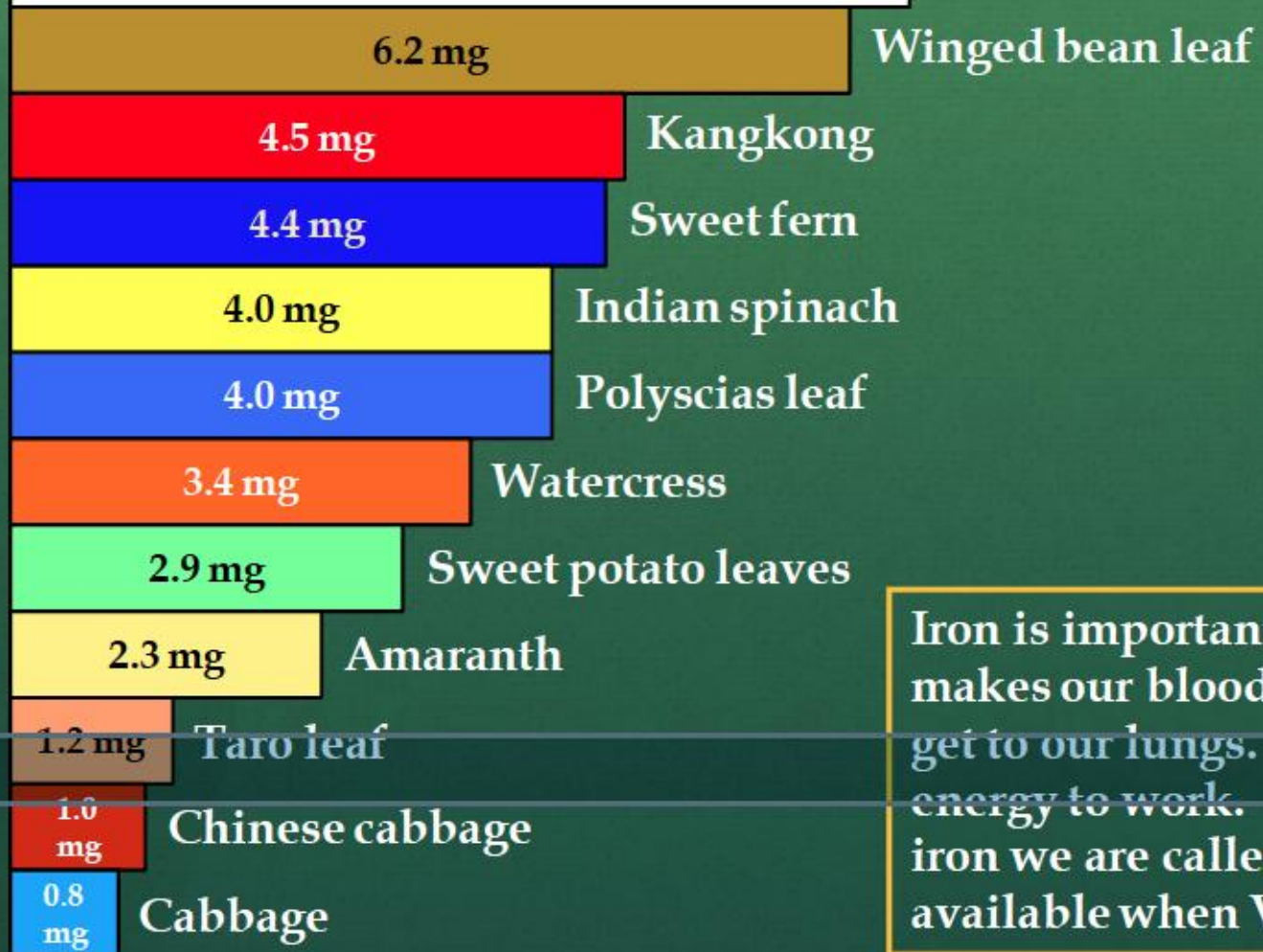


Dietary Iron



- Two types of iron
 - Heme iron (animal sources)
 - Non-heme iron (plant sources)
- Absorption of heme iron is 20-30%
- Absorption of non-heme iron varies between 1-10% and is much more affected by iron status

Leafy greens - Iron content



Iron is important
makes our blood
get to our lungs.
energy to work.
iron we are called
available when V

Sources of Zinc

- Relatively abundant mineral
 - Good sources: shellfish, beef and other red meats
 - Slightly less good: Whole-grains
 - most in bran and germ portions
 - 80% lost to milling
 - phytates, hexa & penta phosphates depress absorption
 - P/Zn ratios of 10 or more
 - Relatively good sources: nuts and legumes
- Eggs, milk, poultry & fish diets lower than pork, beef, lamb diets
 - High meat diets enhance absorption
 - 280g or 10 oz fits right into food pyramid guide
 - cys & met form stable chelate complexes

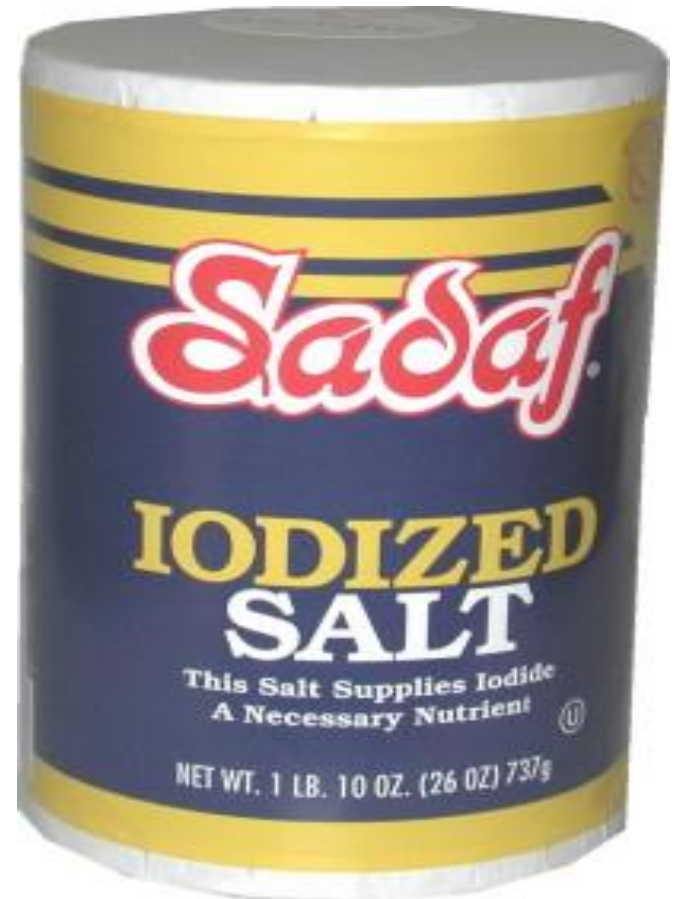
Sources of Folate

- Beans and peanuts
- Dark leafy greens
- Pumpkin
- Papaya
- Avocado
- Strawberries



Sources of Iodine

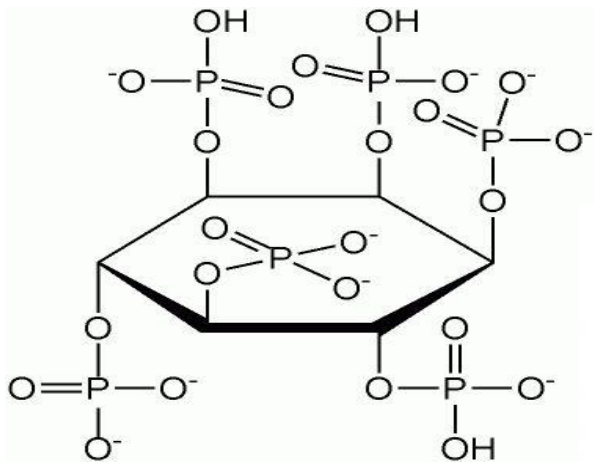
- Seafood
- Fish!



The Importance of Bioavailability

- Most staple plant foods (cereal grains and legume seeds) fed alone contain very low levels of bioavailable iron (e.g., about 5%) or zinc because of the **antinutrients** they contain (phytate, polyphenols, etc.)
- Increasing the bioavailability of Iron from 5% to 30% would have the same effect as increasing total amounts of Iron in staples by 6 fold

- **Phytates** – small organic compounds found in whole grains, legumes and nuts, bind iron and form an insoluble complex



- **Oxalates** – same as above but found in green leafy vegetables



- **Tannins** – compounds found in tea and coffee



Examples of foods that contain goitrogens

Cruciferous vegetables including:

- Broccoli
- Brussel sprouts
- Cabbage
- Cauliflower
- Kale
- Kohlrabi
- Mustard
- Rutabaga
- Turnips

Millet

Peaches

Peanuts

Radishes

Soybean and soy products, including tofu

Spinach

Strawberries

