
In the name of God

Selenium (Se)

Presented by:

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Introduction to Se

- Esential element for human
- There is in many selenoproteins
- Closely associated with vitamin E in it's function

Chemistry

- Non metal
- Several chemical forms
- Ingested selenium compounds:

selenate, selenite, selenocyctein and selenomethionine

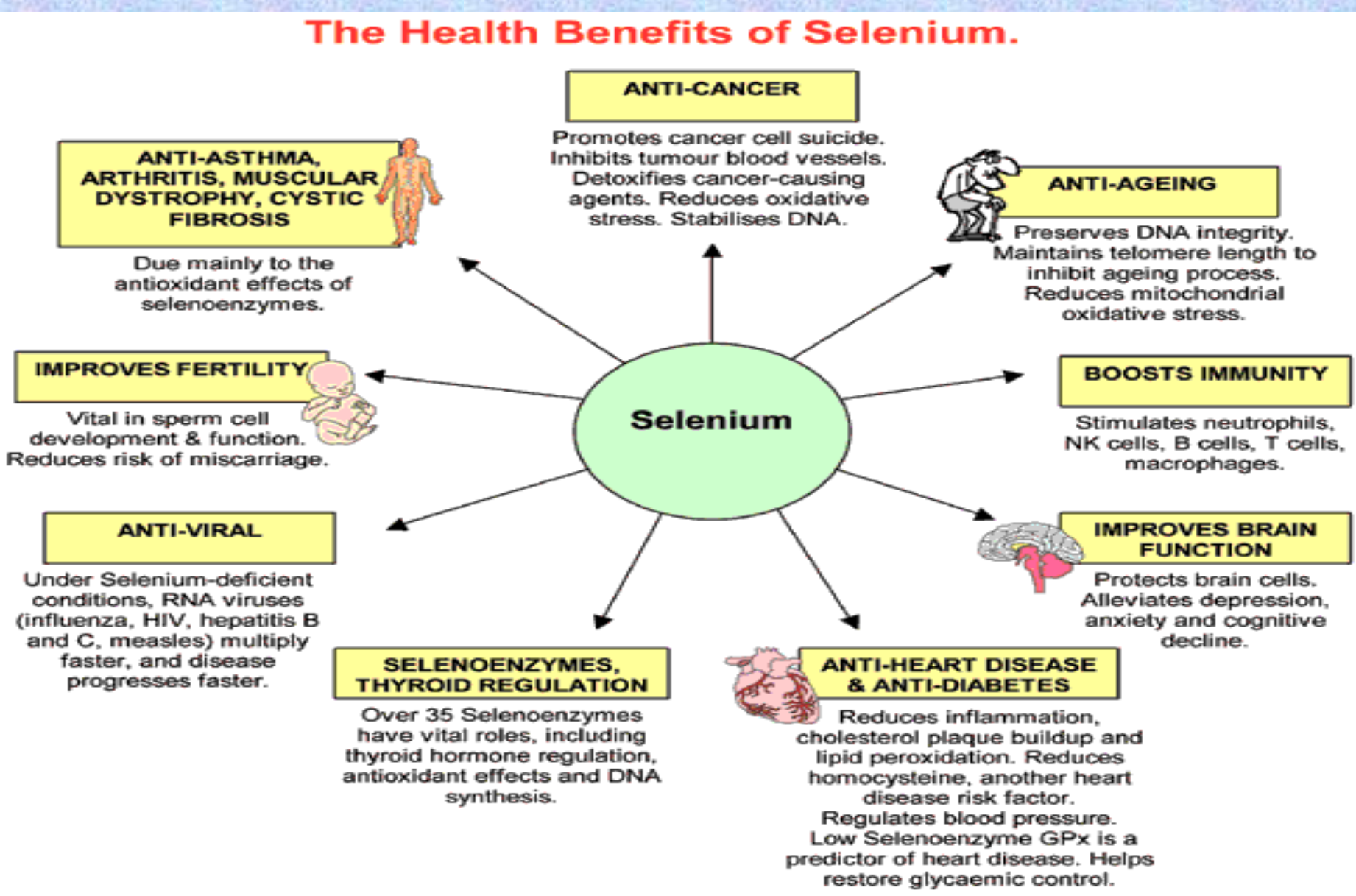
Dietary sources

- mainly as selenomethionine from plants
- wheat and other cereal products are a good source

Absorption, Transport, Metabolism and Excretion

- Absorption is not regulated
- Accumulate in liver, kidney and lungs
- Much of them rapidly excreted in urine

Function of Se



Function of Se

- **More than 30 biological activity**
- **Glutathione peroxidase (GSHPx): has 4 isoforms (GSHPx-1 in RBC, GSHPx-2 in gastrointestinal mucosa, GSHPx-3 in blood plasma and GSHPx-4 in cell membrane)**
- **Iodothyronine deiodinase: has 3 isoforms and convert T4 to T3.(type I in liver, kidney and muscle and Type II, III in brain, brown adipose tissue)**

Function of Se

- **Thioredoxin redoctase: has 3 isoforms (NADPH dependent)**
- **Selenophosphat synthetase (used of selenophosphat as a intermediate)**
- **Selenoprotein P: major selenoprotein in plasma, element transporter and an antioxidant**
- **Selenoprotein W: is in skeletal muscles**
- **Plays a role as a glutathione (GSH)-dependent antioxidant**
- **Its concentration decreases during selenium deficiency**

Se and Pancreas

- **There is evidence that patients with chronic pancreatitis have enhanced levels of free radical production, cytochrome P450 induction and antioxidant deficiencies, in particular selenium.**

- **Adequate concentrations of selenium play a key role in the secretion and action of insulin**

- **Two selenoproteins (glutathione peroxidase and selenoprotein P) are known to be involved in the insulin signaling pathway.**

Requirements and reference nutrient intakes for Se

- Daily need is 55μg for adult
- Intravenous supply: less than 40μg/day

Se deficiency

- liver necrosis
- White muscle disease in animals
- Myopathy of cardiac
- Skeletal muscle
- Increased oxidative stress

Sever deficiency

- **Keshan disease (KD) : low soil selenium**
- **Keshan disease as an endemic, highly lethal congestive cardiomyopathy.**
- **Caused by a combination of dietary deficiency of selenium and the presence of a mutated strain of Coxsackievirus B.**
- **Lack of selenium results in a more virulent strain of the coxsackievirus becoming the dominant viral species.**
- **But the mechanism of this selection event is unclear**

Sever deficiency

- **Kashin disease (KBD) : sever arthritis because low soil selenium**
- **The highest incidence rate of KBD in China, Southeast Siberia and North Korea.**

- **is a chronic, endemic type of osteochondropathy (disease of the bone)**
- **KBD is multifactorial, selenium deficiency being the underlying factor that predisposes the target cells (chondrocytes) to oxidative stress from free-radical carriers**

- **Nutritional depletion in hospital paitient (patients accept no trace element supplementation)**

- **Symptoms: muscle weakness, cardiomyopathy, macrocytosis and pseudoalbinism**

Kashin–Beck disease

Se deficiency

- Reproductive disorders:
- Necessary for Male fertility,
- Testostrone synthesis
- Sperm viability.

Important roles of Se

- Thyroid function:
- Thyroid deiodinase enzymes are selenoprotein

Important roles of Se

- Immune function:
- Se is important for immunocomptence, defense against AIDS

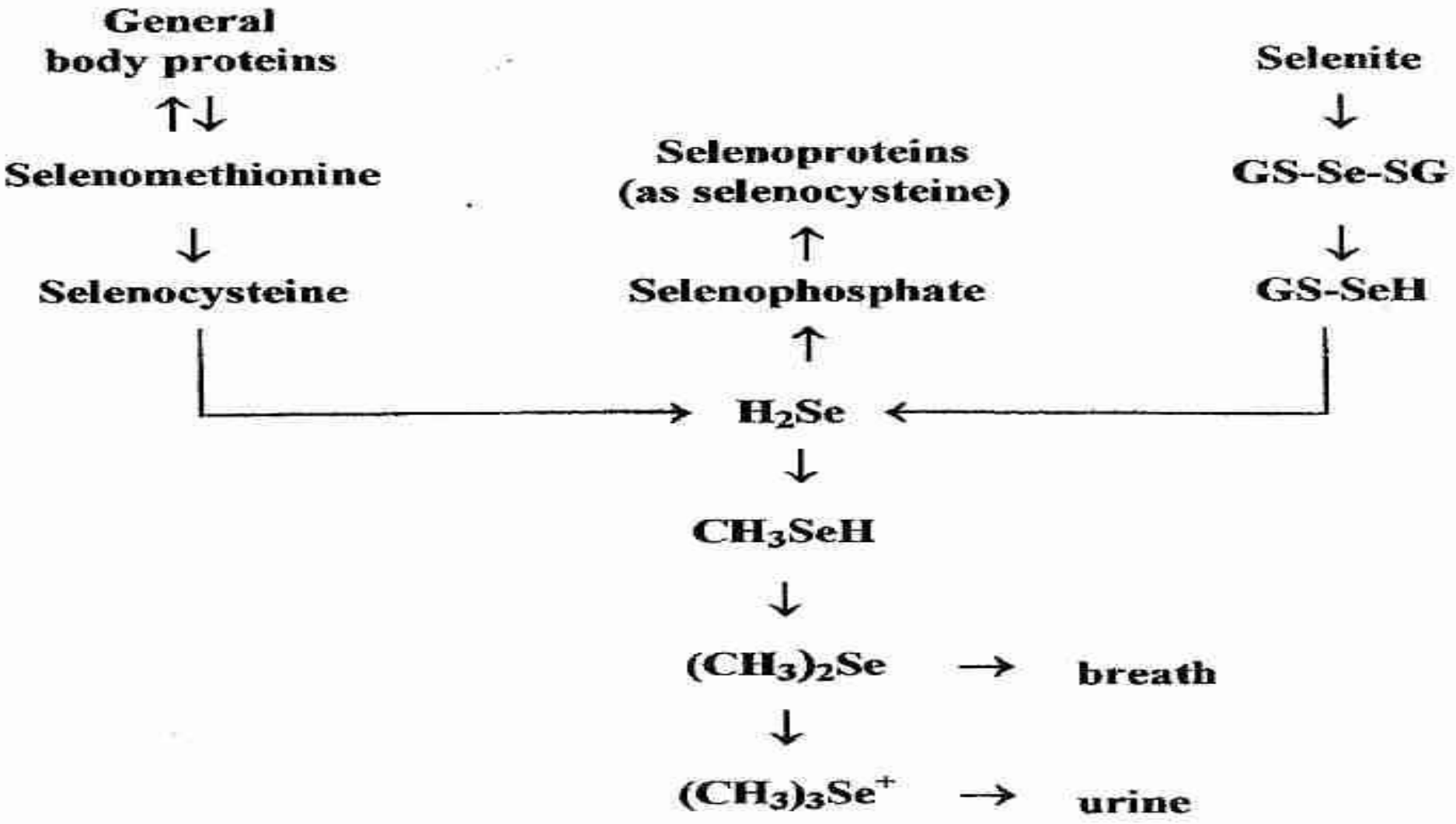
Important roles of Se

- Inflammatory condition:
- It's supplementation has positive effect in arthritis, pancreatities and asthma
- Cardiovascular disease
- Viral virulance (virulent strain of the coxsakie virus)
- Cancer chemoprevention:
- Such as liver cancer with hepatitis B, prostate cancer

Toxicity of Se

- Upper selenium called selenosis
- **characteristics:**
- Garlic odor in the breath (by dimethyl selenide), hair loss, nail damage, diarrhea
- **Note:**
- Halogenated aromatic hydrocarbons is useful in cure (caused faster methylation of selenid)

Metabolism of Se



Laboratory assessment of status

- Whole blood as a main indicator of selenium status
- Determined after acid digestion using a fluorometric method, atomic absorption spectroscopy.
- Red cell GSHPx-1 and plasma GSHPx-3 are assayed by enzymatic methods
- Selenoprotein P in plasma determined by immunological methods or monoclonal antibodies by affinity chromatography
- Hair and nail selenium are useful as a measure of long-term dietary selenium intake

Reference intervals

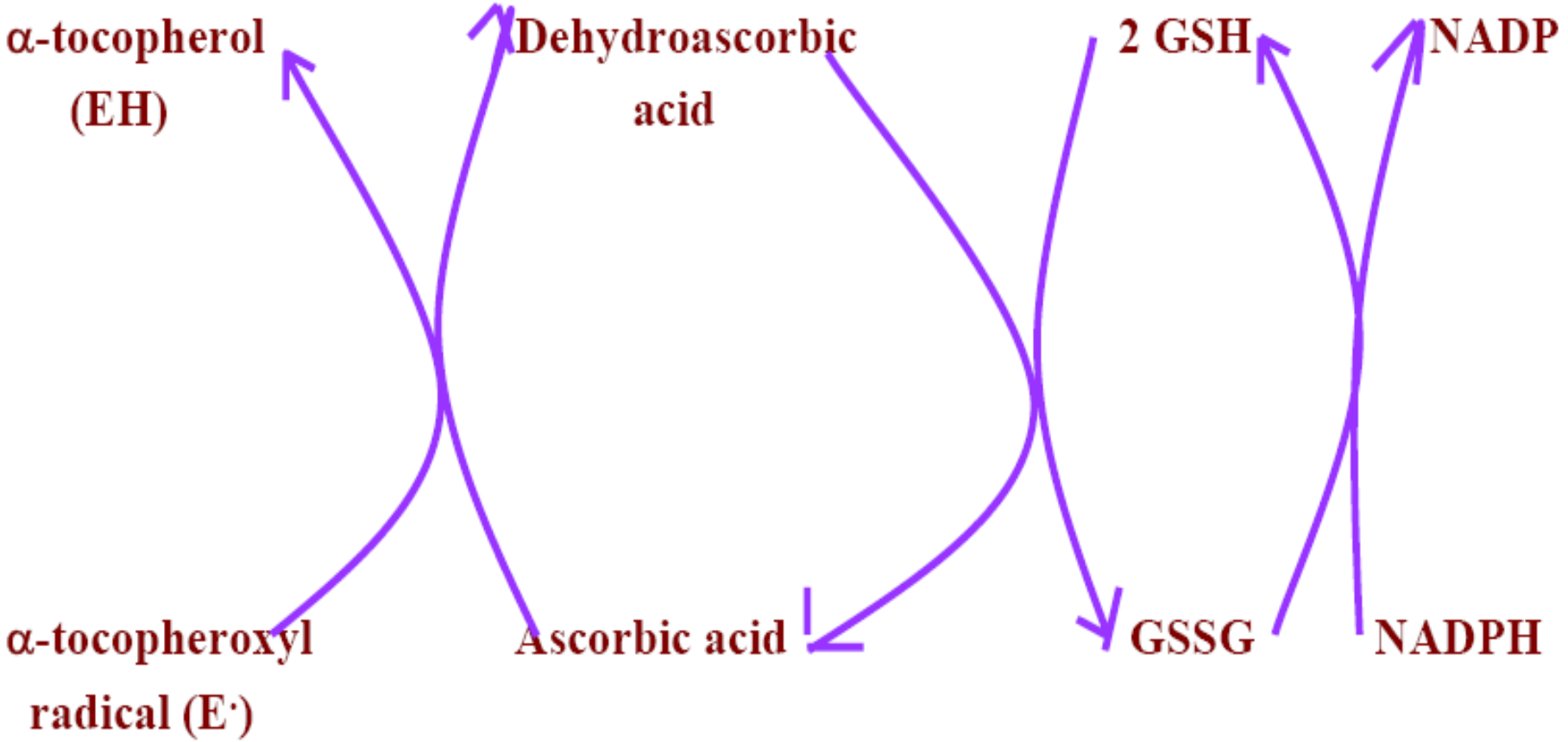
- **Note:** all reference intervals for selenium should be established locally because these are affected by dietary intake

- Plasma: 63 – 160 µg/L (0.8 – 2 µmol/L)
- Children <2 years: 16 – 71 µg/L (0.2 – 0.9 µmol/L)
- Children 2 – 4 years: 40 – 103 µg/L (0.5 – 1.3 µmol/L)
- Children 4 – 16 years: 55 – 134 µg/L (0.7 – 1.7 µmol/L)
- Cu-off values are 8 µg/L (0.1 µmol/L)

vitamin E & Selenium

- They have a synergically effect
- Se is necessary for pancreas action that is important for lipid and vitamin E absorptin
- Vitamin E decreased needs to Se because inhibit excretion of Se and cause stability of active form of Se

The Regeneration of Vitamin E



- The enzyme glutathione peroxidase which is involved with glutathione oxidation (2 GSH -------> GSSG) is a selenium containing enzyme, which explains the interrelationship between α-tocopherol and Se.

The End