Lecture 56:

Vitamins

Part 3

Copyright Protection:

Vitamins To Be Discussed:

- Vitamin B12
- Vitamin B17
- Vitamin B18

Vitamin B12 (Cobalamin):

- **Vitamin B12 is a water soluble vitamin that has a key role in the formation of red blood cells, the metabolism of carbohydrates, fats and proteins, and protecting the myelin sheath of the nerves.**

- **Being famous as the "red vitamin", cobalamin has a cobalt atom in the center of corrin ring.**

Functions of Vitamin B12:

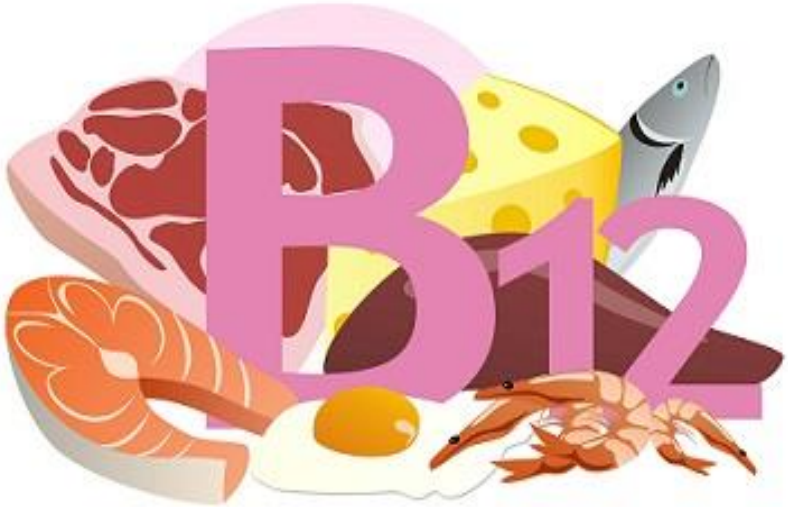
- **a) It is required for generating energy.**
- **b) In the form of 2-deoxyadenosyl, it is important for the production of energy within mitochondria.**
- **c) It is required for the production of red blood cells.**
- **d) It is necessary for the metabolism of the nerves especially their myelin sheaths.**

- **e) It is needed for DNA and RNA.**
- **f) It has a key role in the production of SAMe (S – adenosylmethionine), a mood – elevating compound in the body.**
- **g) It promotes the utilization of macronutrients (carbohydrates, fats, and proteins).**
- **h) It lowers homocysteine levels.**
- **i) It is important for the production of choline.**

Food Sources of Vitamin B12:

- **The best food sources are red meats and organ meats such as liver, kidney, and heart.**

- **Other foods rich in vitamin B12 are fish (especially mackerel and herring), dairy products, egg yolks, and seafood.**



- **Spirulina and fermented food such as miso and tempeh may contain small amounts of vitamin B12.**

- **There is no vitamin B12 in vegetables and fruits unless they are contaminated by vitamin B12 – producing bacteria.**

- **A very small amount of vitamin B12 is produced by bacteria in the small intestine as well.**

Absorption of Vitamin B12:

- **Vitamin B12 has two mechanisms of absorption:**

- **1) The first mechanism is passive absorption. It occurs in the mouth, and upper and lower parts of the small intestine.**

- **This type of absorption is rapid but extremely insufficient, with less than 1% of an oral dose being absorbed by this process.**

- **2) The second mechanism is active absorption, which occurs through the terminal part of the small intestine (ileum). It is mediated by the intrinsic factor (IF) released by the stomach.**

- **The body of an average person stores 2 – 3 mg of vitamin B12, which is sufficient for 3 – 4 years if supplies are completely cut off.**

- **Adults lose up to 3 mcg of vitamin B12 daily in the urine and stools.**

- **Also approximately 1 – 5 mcg of cobalamin is excreted from the liver into the upper part of the small intestine through bile daily. This cobalamin binds to IF, and most of it is usually reabsorbed.**

Athletic Benefits of Vitamin B12:

- **a) May delay fatigue and exhaustion by involving in the production of energy.**
- **b) Helps with protein synthesis.**
- **c) May assist building muscles.**
- **d) Acts as a cofactor in the conversion of creatine into creatine phosphate.**
- **e) May promote mental alertness.**

Non – Athletic Benefits of Vitamin B12:

- a) Anemia.
- b) Chronic fatigue syndrome.
- c) Fibromyalgia.
- d) Depression.
- e) Age – related macular degeneration (AMD).
- f) Alzheimer's disease and other dementias.
- g) Bell`s palsy.
- h) Male infertility.
- i) Canker sore.

- **j) Asthma.**
- **k) Cystic fibrosis.**
- **l) Crohn`s disease.**
- **m) Migraine.**
- **n) Trigeminal neuralgia.**
- **o) Diabetic neuropathy.**
- **p) Dermatitis.**
- **q) Eczema.**
- **r) Sickle cell anemia.**
- **s) High homocysteine levels.**

- **t) Diabetic retinopathy.**
- **u) Multiple sclerosis.**
- **v) Shingles (Zona).**
- **w) Bursitis.**
- **x) Bipolar disorder.**
- **y) Tinnitus.**
- **z) Atherosclerosis.**

Deficiency of Vitamin B12:

- **When the store of vitamin B12 is used up and daily dietary intake of vitamin B12 is less than 1 mcg, symptoms of vitamin B12 deficiency appear.**

- **They include anemia, fatigue, tiredness, numbness and tingling in the hands and feet, loss of vibratory and position sense, red and inflamed tongue, and cracks at the corners of the mouth.**

- **Abnormal gait, dementia, impotence, and loss of bladder and bowel control may occur in advance and untreated cases.**

Potential risk factors for developing vitamin B12 deficiency are:

- **a) Vegetarians and vegans.**
- **b) Disease of the terminal section of the small intestine, such as Crohn`s disease.**
- **c) Gastric atrophy.**
- **d) H2 blocking – medications.**

- e) Deficiencies of vitamins B2 and B3.
- f) Malabsorption (pernicious anemia).
- g) Total or partial gastrectomy.
- h) Tropical sprue.
- i) Celiac disease.
- j) Insufficiency of the pancreas.
- k) Trancobalamin II deficiency.
- l) Infestation with fish tapeworm (Diphyllobothrium latum).
- m) Alcoholism.
- n) Bacterial overgrowth in the intestine.

Dosage and Side Effects:

- **The RDA for vitamin B12 in adults is 2.4 mcg.**
- **The performance daily intake (PDI) for athletes and physically active adults is 20 – 200 mcg.**
- **The higher doses of vitamin B12 are considered safe. It is usually taken 500 – 1000 mcg per day without any side effects. However, allergic reactions may occur rarely.**

Interactions:

- a) **Potassium supplements**: they may decrease the absorption of vitamin B12.
- b) **Chloramphenicol**: this antibiotic may decrease the effectiveness of vitamin B12.
- c) **H2 blockers** (cimetidine, ranitidine, and famotidine): they reduce the absorption of vitamin B12.

- **d) Metformin: it may reduce the blood levels of vitamin B12.**
- **e) Para aminosalicylic acid: it may reduce the absorption of vitamin B12.**
- **f) Colchicine: it may decrease the absorption of vitamin B12.**
- **g) Cholesterol – lowering medications (such as cholestyramine and colestipol): they may decrease the absorption of vitamin B12.**

- **h) Neomycin: it may reduce the absorption of vitamin B12.**

- **i) Proton pump inhibitors (such as omeprazole, lansoprazole and esomeprazole): they lower the absorption of vitamin B12.**

- **j) Zidovudine (AZT): it may reduce the blood levels of vitamin B12.**

- **k) Anti – seizure medications (such as phenobarbital, phenytoin, and primidone): they decrease the absorption of vitamin B12.**

Vitamin B17 (Laetrile; Amygdalin):

- **Vitamin B17 is a controversial vitamin.**
- **Being famous as the "anti – cancer vitamin", it is also known as laetrile and amygdalin. In terms of chemical structures, laetrile and amygdalin are somewhat different.**
- **In fact, laetrile is a modified form of amygdalin. However, both laetrile and amygdalin are considered as vitamin B17, and they are chemically nitrilosides.**

Functions of Vitamin B17:

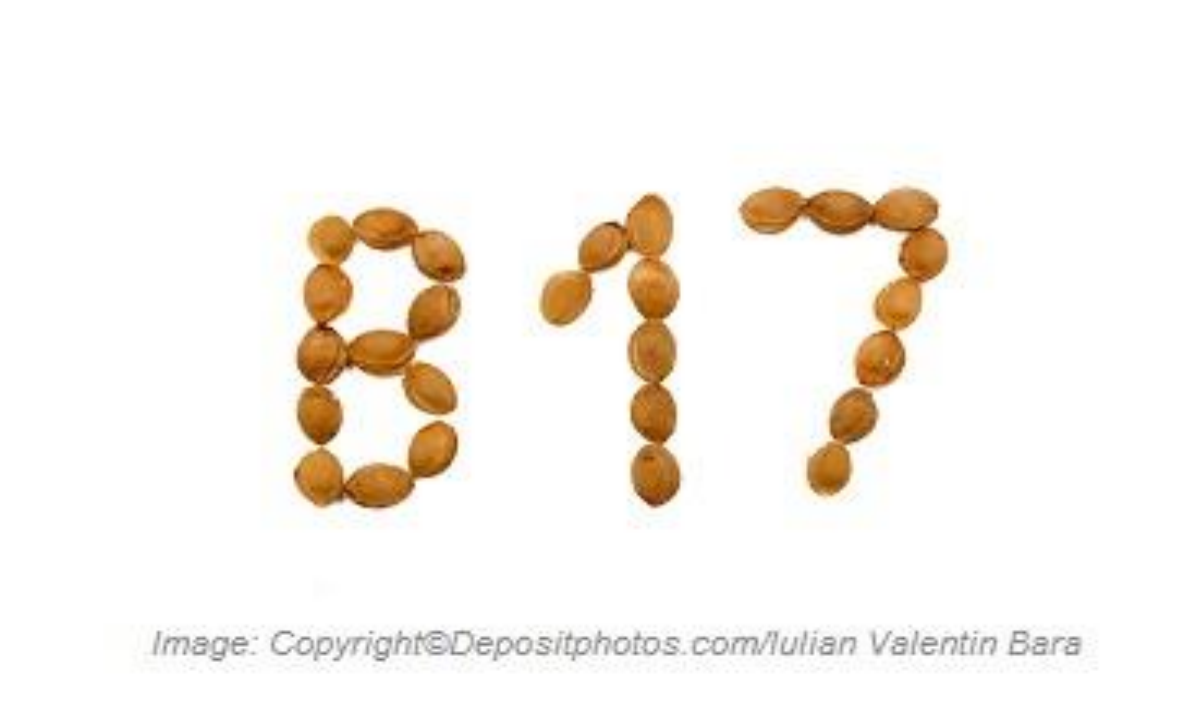
- **Vitamin B17 has an anti – cancer activity. The metabolism of laetrile produces cyanide.**

- **It is claimed that cyanide is inactivated in normal cells by the enzyme rhodanese. But cancer cells do not have this enzyme, which leads to buildup of cyanide within the cancer cells followed by poisoning them to death.**

- **There are many controversial clinical trials to support the claim.**

Food Sources and Absorption:

- **Apricot kernels and apple seeds are excellent sources of vitamin B17.**



- **Other food sources include bitter almonds, nectarine seeds, peach seeds, pear seeds, plum seeds, prune seeds, fava beans (sprouted), mung beans (sprouted), blackberry, choke berry, elderberry, and alfalfa leaves.**

- **Small amounts of vitamin B17 are also found in flaxseeds, chia seeds, sesame seeds, millets, buckwheat, and lentils (sprouted).**

- **It is absorbed from the small intestine into the blood stream.**

Benefits of Vitamin B17:

Vitamin B17 might be beneficial in the following conditions.

- **a) Cancers.**
- **b) High blood pressure.**
- **c) Arthritis.**

Dosage:

- **No RDA has been established for this vitamin. It is available as tablets, capsules, and powders.**

- **Vitamin B17 is usually taken 250 – 1000 mg per day. It is toxic in larger amounts.**

- **One apricot kernel provides about 14 mg of vitamin B17.**

- **It is claimed that any of the following options may provide enough vitamin B17 to prevent developing cancers:**
- **a) 10 – 20 apricot kernels per day.**
- **b) 1 – 2 cups of fresh mung bean sprouts.**
- **c) One apricot kernel per 10 Ibs of body weight per day. For instance, if your weight is 150 Ibs, you could take 15 apricot kernels per day.**
- **d) 3 – 4 whole apples (with seeds) per day.**

Homework:

- 1) Describe the athletic benefits of vitamin B12.
- 2) Describe the anti-cancer activity of vitamin B17.