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VITAMINS AND MINERAL SUPPLEMENTS

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Vitamins and minerals to know

Vitamin C

Iron

Calcium

Vitamins can be divided into two classes one is water soluble (B and C) the other is fat soluble (A D E K). Most of the fat soluble vitamins are also water soluble when the preparation is made. These vit are taken according to the Recommended Daily Allowance or Recommended Daily Intake which varies from country to country and person to person since the amount of the vit required by the human body has not yet been identified. The fat soluble vitamins require bile for their absorption hence any malfunctioning of bile will lead to them being poorly absorbed and as a result their deficiency. Megadoses of vit can lead to vit toxicity.

Vit A:

Belongs to a group of chemicals known as retinoids and are used in many drugs. Retinoid should not be mistaken for vit A. these drugs are used in the treatment of psoriasis and acne. Vit A chemical name is retinol and is an alcohol which is needed for the normal functioning of the retina. Retinol is converted into its aldehyde form called retinal in the eye where it combines with proteins called opsins to give the pigments in the eye. Of the four pigments mainly in the formation of visual purple which is found in the rods of the eye. This pigment is light sensitive and is activated by low light intensity and this leads to various

degree of the pigment by a series of chemical reactions. These stimulate the neurotransmitters release and the message is recorded by the optic nerve leading to formation of the picture in the visual centers of the brain. If rhodopsin is lacking then this wont occur and as a result nightblindness will occur. Another form of vit A found in plants is carotenoids which are the pro drug and can be converted by the intestine and liver to the active form. Mainly present as beta – carotene found in carrots. Vit A is also needed for the normal growth and differentiation of the epithelial tissue , also involved in the normal functioning of the mucus secreting cells. In the absence of vit a these cells become keratinized. These cells in the respiratory system and in the gi tract are involved with the bodies immune system and hence can lead to increased infection. In the cornea when the mucus cells are keratinized it will lead to dry eyes called xerophthalmia and can lead to blindness. When b – carotene is consumed in excess it leads to a condition called caritonemea in which the person turns orange. Excess of vit a can lead to peeling of the skin, hyperlipidemia, hypercalcemia and hepatotoxicity. Food rich in vit a are all dairy products, liver, fatty fish and egg yolk and also some veg like carrots and spinach.

Vit B group : all act as coenzymes.

Vit B1 (Thiamine)

It has a distinct smell as all sulphur compounds do. Thiamine is converted to pyrophosphate which functions as a coenzyme in some imp carbohydrate metabolism. Metabolism of alcohol also depends on thiamine pyrophosphate. A deficiency in this leads to a disease called beri – beri which mainly means weakness. Two types wet and chronic. In chronic beri beri there is peripheral motor loss and in wet type there is cardiac enlargement and eventually leads to a cardiac failure. Another condition is encephalopathy which leads to loss of memory, apathy and eye disturbances. Thiamine is found in liver, pork, unrefined grains and nuts basically brazil nuts. It can lead to hepatotoxicity when taken in

large doses and when administered IV care should be taken since anaphylactic shocks have been reported.

Vit B2 (Riboflavin)

It contains a ribose molecule as a part of its structure. It is converted into many co enzymes of which the imp are Flavin mononucleotide and flavin adenine dinucleotide. Both of these are used in the metabolism of fat, carbohydrate and proteins and as major hydrogen carriers from various metabolites to the respiratory chain. Found in liver, dairy products and yeast products. Almonds are a good source. Cause the yellow coloration of the urine. Deficiency can lead to cracking of the lips, lesions in the cheek, inflammation of the tongue, increased risk of infection and seborrhoeic dermatitis of the skin and scrotum. This should be kept out of reach of the light since it is sensitive to light.

Vit B3 (Nicotinamide) and nicotinic acid:

Are two forms of the same vit. Are also called niacinamide and niacin respectively. No relation to nicotine. Mainly used in the production of Nicotinamide adenine dinucleotide and nicotinamide adenine dinucleotide phosphate both act as hydrogen carriers and the latter one is more useful in the biosynthetic pathways. This vit is used in the treatment of hyperlipidaemias. It is mainly found in liver, yeast products, peanuts wholegrain cereals and fish. These can also be made in the body from the aa tryptophan but not in the quantity that is required. Deficiency can lead to pellagra or rough skin and has the three D's dementia, diarrhea, and dermatitis associated with it. When taken in excess it can lead to cardiac dysrhythmias, peptic ulcers, diabetes mellitus (Nicotinic acid) whereas nicotinamide has none of the above symptoms.

Vit B5 (pantothenic acid)

It occurs everywhere and deficiency are unknown. It is used in the formation of coenzyme A which is required for many biochemical processes.

Vit B6 (pyridoxine)

Occur in different forms and can be converted from one form to the other. Pyridoxal and pyridoxamine are the two forms. It is widely distributed hence deficiency is rare and it leads to neuritis, dermatitis, anaemia and weight loss. It has several therapeutic use. Used in the treatment of isoniazid treatment. Haemoglobin formation and sideroblastic anaemia. These vit are converted to pyridoxal phosphate an imp coenzyme used in the metabolism of aa for e.g conversion of tryptophan to nicotinic acid.

Biotin:

Widely distributed in the food we eat. Made by the natural flora of the intestine. Acts as a coenzyme in metabolic pathways involving carboxylation reactions. Deficiency leads to anorexia, dermatitis and vomiting.

Folic Acid:

Also called folacin. Found in all plant products, liver and crab meat. Alleviates symptoms of anaemia in patients who are pregnant. Deficiency leads to megaloblastic anaemia. And some malformations like spina bifida.

Vit B12 (hydroxocobalamin)

Was found in the form of cyanocobalamin and both the forms have the same function. Found in dairy products and egg. Deficiency is rare since very small quantities are required. It is stored in the liver for long periods of time. It is also associated with megaloblastic anaemia, in this case is the irreversible damage of the myelin sheath of peripheral nerves and in spinal tracts. This deficiency is not rare since there is a problem with the absorption of this vit. Vit are absorbed in the ileum with the help of the intrinsic factor , if this factor is absent then absorption does not take place and deficiency results.

Vit C (Ascorbic acid)

Deficiency of this vit leads to a disease called scurvy which is the degeneration of the bodies connective tissue before death. This has an antioxidant property and hence helps protect the unsaturated fatty acids. It also helps in iron absorption by keeping the iron in the ferrous state which can get easily converted into the ferric state. It is required in the biosynthesis of catecholamines and adrenal steroid hormones. It is essential in the production of the protein collagen. Two best sources are capsicum and guava. It is also present in fresh fruits and vegs. If taken in large doses then lot of water should be taken to avoid the formation of kidney stones. If a person takes a large dose of vit c for a long time and then stops rebound scurvy can take place.

Vit D.

It is not obtained from the diet and acts as a prohormone. As long as the UV light irradiates the skin sufficient vit D can be made. The precursors in the presence of UV light are converted into the vit D which is used in the regulation of calcium. This occurs mainly in the liver and in the kidney. It is three forms calcitriol, calciferol and cholecalciferol. Its proper functioning also depends on the parathyroid hormone. When there is hypocalcaemia it causes the demineralization of the bones and increased calcium absorption by the intestine. With vit D control on calcium metabolism bone mineralization is decreased. Its deficiency leads to rickets in children and can be used to treat osteomalacia in adults. If taken in excess then this vit can lead to death. It leads to hypercalcaemia which leads to excessive deposition of calcium in soft tissue and kidney damage.

Vit E (the tocopherols)

Mainly present as alpha – tocopherol. Has antioxidant properties and hence prevents the oxidation of unsaturated fatty acids. These oxidative agents can lead to degeneration and hence vit E helps in clearing of these agents. It is also

necessary in the formation of haemoglobin. Found in plant food. Deficiency can lead to anaemia in children. Non toxic. Also helps in reducing wrinkles on the skin.

Vit K

Three forms:

Phylloquinone : in plants

Menaquinone : is made by the gut bacteria and found in animal tissue

Menadione or phytomenadione : synthetic form.

Used for the purpose of coagulation of blood. In our case it is made by the intestinal bacteria. Major cause of deficiency is the use of broad spectrum antibiotics which kills the bacteria in the intestine. Needed for the formation of number of biologically imp proteins including osteocalcin needed for calcium metabolism. Prothrombin being the most imp. Is involved in blood clotting after it is converted to thrombin.

Minerals:

Minerals can be divided into two types depending on the amount that is needed by the body they are macromolecules (Ca , Na, k, P, Cl, Mg) and micromolecules (Fe, Zn, Cu, Co, I, Mn, Mo).

Calcium: is the most plentiful element in the body with it being stored in the inorganic part of the bone and is involved in many biochemical functions like coagulation of blood, muscular contraction, neural transmission. The metabolism of ca is mainly controlled by vit D and PTH. It is imp to keep the levels of ca constant in the body since hypo can lead to tetany and severe muscular contractions and hyper can lead to deposition of the bone in the soft tissue

leading to renal damage. Women suffer from osteoporosis after menopause. This can also happen if there is lack of ca in the diet. Only few foods provide large amount of ca and some foods inhibit the absorption of ca from the diet e.g. unrefined cereals and spinach which combine with the ca and make it in a form which cannot be absorbed. The best way to give ca is ca citrate to be taken orally and ca in the chloride form is used to inject intravenously.. ca is also incorporated as a carbonate in some antacids.

Phosphorous: it is also widespread in the diet and its deficiency is rare. In case there is deficiency it leads to the blood cell dyscrasias, muscular weakness and bone pains. It is not only present as the inorganic part of the bone but also has its function in many biochemical reactions when combined with vit and purines and pyrimidines. There can be a def of p due an excessive use of antacids containing Al since it has a tendency to combine with p to form its salt and rendering it useless. Excessive amounts of p can lead to ca def by preventing the incorporation of ca into the bone and increasing renal excretion.

Mg:

It takes part in many biochemical reactions and act as a coenzyme and considerable amts are stored in the bone. Def of mg can lead to nausea and apathy and occurs in alcoholics. Serever def can lead to a cardiac failure and death. If large amounts are ingested it appears to be harmless but if the kidneys are not functioning properly then it will lead to hypermagnesameia which will lead to slurred speech unsteadiness and lethargy and if spasmodic contraction of the cardiac muscle occurs it will lead to death. Oral mg is used with al to counterindicate its constipating effect. It also appears to increase the solubility of the ca salts in the urine.

Na, K and Cl:

These are the main electrolytes of the body and na is mainly found in the extracellular fluids and k in intracellular fluids mainly associated with the Cl ion.

These help in maintaining the osmotic pressure as well as the electrolyte balance. This difference is necessary for material to move in and out of the cell and also for neural conduction. Cl is also needed for the production of HCl in the stomach.

Normally a def in Na does not occur but there are always a chance that there is excess of it. This can lead to hypertension. Kidney needs water to excrete the Na out and hence thirst is inevitable. NaCl tablets can irritate the stomach.

The role of K is to maintain the balance. A def in K can lead to cardiac dysrhythmias, severe diarrhea and hypokalaemia. KCl also irritates the stomach and hence the tablets are enteric coated. It is best to suggest food rich in K to treat def.. foods like banana, juice, wholegrain cereal and nuts are rich in K.

The Microminerals:

Iron: needed for the formation of hemoglobin and is used as an hematinic and agent used to inc the levels of hemoglobin in the blood. Also needed in the formation of cytochromes and myoglobin which have the similar heme group. It is present in two forms the ferrous and the ferric and it is the ferrous that is mostly absorbed. Ferrous can get oxidized into the ferric form very easily and hence is prevented by the antioxidant agents like vit C. iron is present in meat, legumes, shellfish and whole grains. It is also affected by phytic acid just like Ca. Best consumed on a empty stomach as this allows maximum absorption

Iodine: is mainly used by the thyroid gland for the production of thyroxine and triiodothyronine. Though the dietary source is an iodide it is converted into iodine when utilized by the body. Main source is sea food and water. Def results in hypothyroidism and goitre. Excessive amounts of iodine can also lead to a goitre.

Zinc: it is an imp part of the bodies enzyme system and hence is utilized in many physiological functions. All the functions of the immune system are affected by a def in Zn. It helps in maintaining epithelial and tissue integrity and promoting the

growth of cells and suppressing apoptosis. It is found in oysters, meat, egg. Def of zn can lead to stunted growth and underdeveloped sex organs.

Copper: Cu : like iron is imp in the synthesis of hemoglobin. It is part of the coenzyme that is required in the synthesis. It also an integral part of the electron transport chain. Cu is transported by a protein called caeruloplasim from liver to the tissues. Good source shell fish, nuts and bean and liver.

Fluorine: it is imp to strengthen the tooth enamel and it is also an coenzyme for many enzymes. It is obtained from water, fluoridated mouthwash and paste and also from tea.

Selenium: was thought to be poisonous but has now its def has proven to be the cause of some of the cancers. Its def can also lead to sudden infant death syndrome and muscular dystrophy. It is a key component of the glutathione peroxidase complex of the enzyme which are imp in protecting the tissue from oxidative damage. Best source is sea food , liver and kidney, but when taken more than the recommended dose can be fatal.