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VITAMIN D3 DEFICIENCY

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Abstract: Vitamin D deficiency is common and may contribute to osteopenia, osteoporosis and falls risk in the elderly. Screening for vitamin D deficiency is important in high-risk patients, especially for patients who suffered minimal trauma fractures. Vitamin D deficiency should be treated according to the severity of the deficiency. In high-risk adults, follow-up serum 25-hydroxyvitamin D concentration should be measured 3–4 months after initiating maintenance therapy to confirm that the target level has been achieved. All patients should maintain a calcium intake of at least 1,000 mg for women aged ≤ 50 years and men ≤ 70 years, and 1,300 mg for women > 50 years and men > 70 years.

Introduction:

Vitamin D generally refers to two fat soluble prohormones, ergocalciferol (vitamin D2) and cholecalciferol (vitamin D3). Vitamin D2 is produced by certain invertebrates and fungi whilst vitamin D3 is produced in the skin of vertebrates, both following exposure to ultraviolet (UV) radiation. Ingested vitamin D2 and endogenously produced D3 are converted to the biologically active form, 1,25-dihydroxyvitamin D [1,25(OH)2D] (calcitriol) in the human body.

Vitamin D plays an essential role in maintaining bone health through regulating calcium concentrations in the body. The development of vitamin D deficiency is associated with deteriorating bone health and in severe cases, hypocalcemia, rickets, and osteomalacia in children and adults.[25]Those at greatest risk of vitamin D deficiency include patients with chronic illnesses (e.g., chronic kidney disease [CKD], cystic fibrosis [CF], asthma, and sickle cell disease), dark-pigmented skin, poor nutrition, and infants who are exclusively breastfed.[21,34]The primary source of vitamin D is sunlight exposure, which has been limited or blocked extensively for many children over the past 20 years due to the association of skin cancer and ultraviolet rays. Chronic use of certain medications (e.g., glucocorticoids, cytochrome P450 3A4 inducers, anticonvulsants, and antiretroviral agents) has also been associated with compromised vitamin D concentrations. Given the high rate of bone development early in life, adequate serum concentrations of vitamin D are crucial for the developing child.[1] There has also been a piquing interest in vitamin D in pediatric patients due to the recent epidemiologic reports suggesting that vitamin D may protect against autoimmune disease and play a role in innate immunity.Vitamin D insufficiency is a common problem in pediatrics, especially those who have chronic illness, and who are malnourished, limited geographically to

the amount of sun exposure, as well as those with darker skin, and on chronic medications. The accelerated rate of bone development during a child's life suggests that adequate concentrations of vitamin D are an important issue in this population. Although more research is needed concerning the goals of vitamin D therapy and dosing in this population, there are helpful evidence-based guidelines to direct therapy for rickets, CKD, and CF.

Vitamin D deficiency:

There are certain groups of people that have an increased risk for vitamin D deficiency.[8] These groups include the following:

Solely breast-fed infants older than 2 months of age

Individuals older than 50 years of age

Persons living in residential care facilities

Persons with problems absorbing fat, which includes those with:

o Cystic Fibrosis

o Crohn's Disease

o Celiac Disease

o Some Liver Diseases

Persons with kidney disease, especially those requiring dialysis

Persons that have had gastric bypass surgery Darker-skinned individuals [4].

Persons using sunscreen (SPF8 or higher) Obese individuals

Persons treated with certain drugs that may interfere with absorption or activity of the vitamin [5]:

o Anti-Seizure Drugs Such As Phenytoin,phenobarbital,and carbamazepine

o Drugs used to treat tuberculosis such as isoniazidand rifampin

o other drugs including corticosteroids, theophylline (an asthma drug), and cimetidine which decreases acid production in the stomach.

The function of vitamin D3 in the body:

Vitamin D3 simply acts as a protein that binds to the calcium in the digestive system so that calcium becomes absorbable into the bloodstream, thus reaching the tissues that need calcium.

Vitamin D3 works to balance the level of calcium and phosphorus in the blood. [14]In addition to its role in enhancing one of the important functions of the kidneys, which is reabsorption of calcium and phosphorus into the blood as much as the body needs, which makes it an important role in the process of building bones and teeth[7].

Vitamin D3 also has an adverse effect on the gland known as the parathyroid, as it prevents calcium from leaving the bones and returning to the blood when the body does not need it.

In most references, we find that it also has many functions, the most important of which is its effect on muscle strength and strengthening the immune system, and thus it has an impact on the prevention of cancerous tumors, and scientists also confirm that it has an important relationship in what is known as insulin resistance, which is considered one of the most important causes of diabetes.

From these important functions we can deduce the diseases that can affect the body when this vitamin is lacking. [23] The most important of these are rickets in children, osteomalacia in adults, and osteoporosis in the elderly, which leads to the ease of bone fractures. Other potential effects of vitamin D3 that are still under study include depression, cardiovascular diseases, high cholesterol and immune diseases.

Vitamin D2 and D3 Bioavailability

Until relatively recently it was widely believed, based upon anti-rachitic findings, that vitamin D2 and D3 were equipotent and could be considered interchangeably. However, evidence is accumulating to suggest the two forms may vary in their bioefficacy and the importance of this must be considered when discussing potential food matrices. A number of recent studies addressing the potency of the two calciferols have found D3 to be more effective in raising serum 25(OH)D levels. In a group of vitamin D insufficient hip fracture patients, a daily capsule of 25 μg D3 was more effective than an equal dose of D2 in increasing total serum 25(OH)D [14]. Also in older populations, 15 μg daily or 1250 μg monthly of capsular vitamin D3 increased serum 25(OH)D more efficiently than an equal dose of D2 [6], as has also been shown with a single 7500 μg dose of oral or intramuscular D3. The increased ability of a weekly capsule of 1250 μg of D3 for 12 weeks to maintain serum 25(OH)D when compared with equimolar D2 has also been shown in healthy adults [16]. These findings support those of a number of earlier studies also addressing this topic.

The above findings were not replicated in a number of recent studies in which D2 and D3 were found to be equally effective in increasing serum 25(OH)D when administered to healthy adults as capsules [19] or in orange juice for 11 weeks, or in a high-dose liquid suspension to vitamin D deficient infants for 6 weeks. Despite this, the general consensus that is beginning to emerge is that vitamin D3 is the more potent form. However, it is difficult to directly compare the results of the discussed studies given the many confounding factors between them. Most notable in this regard are the different methods employed to analyze serum 25(OH)D, the differing baseline serum levels, the variance in age groups studied, the doses administered, and the duration of supplementation. Overall, more studies specifically designed to address this question are needed before the results can be translated into a public health message.

The signs and symptoms of vitamin D deficiency

Severe lack of vitamin D causes rickets, which shows up in children as incorrect growth patterns, weakness in muscles, pain in bones and deformities in joints. [15]. This is very rare. However, children who are deficient in vitamin D can also have muscle weakness or sore and painful muscles. Lack of vitamin D is not quite as obvious in adults. Signs and symptoms might include: Fatigue, Bone pain, Muscle weakness, muscle aches, or muscle cramps, Mood changes, like depression.

Consequences of vitamin D deficiency

Vitamin D deficiency results in abnormalities in calcium, phosphorus and bone metabolism. Specifically, it causes a decrease in the efficiency of intestinal calcium and the phosphorus absorption of dietary calcium and phosphorus, resulting in an increase in parathyroid levels. [20,21] In secondary hyperparathyroidism, serum calcium is maintained at the normal range at the expense of mobilising calcium from the skeleton and increasing phosphorus wasting in the kidneys. This process causes a generalised decrease in bone mineral density, resulting in osteopenia and osteoporosis. The secondary hypoparathyroidism also causes phosphaturia, which results in a low or low-normal serum phosphorus level. This leads to inadequate calcium- phosphorus levels and a mineralisation defect in the skeleton. In young children with little minerals in their skeleton, this defect results in rickets. In adults, the result is osteomalacia. Quantified by bone mineral density scores, osteomalacia presents symptomatically with isolated or generalised aches and pains in bones and muscles.[27] In the elderly, vitamin D de ciency causes increasing sway and frequent falls,[8] increasing the risk of fracture. In addition to improvements in bone density and the prevention of falls and

fracture, vitamin D may have several other putative benefits, including bene cial effects on the immune and cardiovascular systems. [17,3].

Vitamin D Toxicity:

Vitamin D deficiency can lead to many health problems, and excessive intake also causes toxicity. Vitamin D deficiency treatment is performed in two phases. In the first stage, the acute deficiency is treated in the patient, and the second phase is the lining of the body reserves. The upper limit for children younger than 1 year has been reported to be 1000 IU/day for long-term Vitamin D therapy, and 2000 IU/day for children over 1 year. [32–26] Paediatric toxic threshold doses are not clearly de ned and serum 25(OH) D concentration is up to 140 ng/it is considered harmful if it is low. Depending on the variations in the calcic response to Vitamin D in the treatments administered, there may be individual responses at specific doses. Failure to determine appropriate doses in long-term treatments, age inappropriate doses, and variable response to contraindication may result in toxicity. [21, 22]

Elevated levels of Vitamin D emphasize hyperglycaemic response. In vivo studies suggest that 25(OH)D is responsible for 1.25(OH)2D rather than toxic by binding competitively to Vitamin D receptors.[11]

Vitamin D increases calcium absorption from the gastroin- testinal tract. Vitamin intoxication is secondary to high dos- es of Vitamin D intake. Reported toxicity is associated with overdosage of prescribed Vitamin D in cases of exposure, or consumption of over-the-counter supplements contain- ing Vitamin D.[30] In our country, an excess of Vitamin D is generally reported to be associated with unnecessary or inappropriate doses of Vitamin D and long-term outpatient prescribing.

Vitamin D toxicity may indicate symptoms such as hypercalcemia, hypercalciuria, renal calculus, hyperphosphatemia, polyuria, polydipsia, ectopic calcification of soft tis- sues (kidney and lung), nausea, and vomiting. Loss of appetite, vomiting, constipation, growth retardation, poly- uria, dehydration and the indication of vitamin D poisoning such as fever develops as hypercarbia secondary. Vitamin D is characterized by hypercalciuria and hypercalcemia-as- sociated nephrocalcinosis and 25(OH)D vitamin (>150 ng/ mL) parathyroid hormone suppression.[33]

In the treatment of Vitamin D poisoning, external Vitamin D intake is discontinued and intravenous fluid therapy, loop diuretics, glucocorticoids, and calcium-restricted diet are administered. In addition to treatment, calcitonin and bisphosphonates (pamidronate) are used in severe cases.In the United States, it has been reported that Vitamin D.

Foods Provide Vitamin D

1. Vitamin D is key to health. Available in few food sources (primarily sh), vitamin D plays an important role in bone health, as well as in immune, nerve and muscle function. In addition, it may play a role in protecting against cancer, heart disease, stroke, diabetes, autoimmune diseases, and depression.[24]

2. Vegetarian D Sources. Vitamin D is available in dairy products (through fortification) and egg yolks. [2] Mushrooms exposed to light also can provide good sources of vitamin D.

3. Vegan D intake. Vegans may be at greater risk for low vitamin D intake, but they can obtain vitamin D from regular exposure to sun and fortified foods.

4. The sunshine vitamin. [9] Most people get some of their vitamin D intake through sun exposure, but this is dependent upon season, time of day, length of day, cloud cover, smog, skin colour, and sunscreen use.

Sources and Metabolism of Vitamin D

Humans get vitamin D from exposure to sunlight, from their diet, and from dietary supplements. [12-31] A diet high in oily fish prevents vitamin D deficiency.3 Solar ultraviolet B radiation (wavelength, 290 to 315

nm) penetrates the skin and converts 7-dehydrocholesterol to pre vitamin D3, which is rapidly converted to vitamin D3. Because any excess pre vitamin D3 or vitamin D3 is destroyed by sunlight), excessive exposure to sunlight does not cause vitamin D3 intoxication.

Few foods naturally contain or are fortified with vitamin D. The "D" represents D2 or D3. Vitamin D2 is manufactured through the ultraviolet irradiation of ergosterol from yeast, and vitamin D3 through the ultraviolet irradiation of 7-dehy- drocholesterol from lanolin. Both are used in over-the-counter vitamin D supplements. Vitamin D from the skin and diet is metabolized in the liver to 25-hydroxyvitamin D, which is used to determine a patient's vitamin D status 25-hydroxyvi- tamin D is metabolized in the kidneys by the enzyme 25-hydroxyvitamin D-1α- hydroxylase (CYP27B1) to its active form, 1,25-dihydroxyvitamin D.The renal pro- duction of 1,25-dihydroxyvitamin D is tightly regulated by plasma parathyroid hormone levels and serum calcium and phosphorus levels.Fibroblast growth fac- tor 23, secreted from the bone, causes the sodium–phosphate cotransporter to be internalized by the cells of the kidney and small intestine and also suppresses 1,25-dihydroxyvitamin D synthesis.5 The efficiency of the absorption of renal calcium and of intestinal calcium and phosphorus is increased in the presence of 1,25-dihy-droxyvitamin D.[18] It also induces the expression of the enzyme 25-hydroxyvitamin D-24-hydroxylase (CYP24), which catabolizes both 25-hydroxyvitamin D and 1,25-dihydroxyvita- min D into biologically inactive, water-soluble calcitroic acid.

There are a range of sources of vitamin D3, but the most important one is exposing your skin to ultraviolet rays from the sun to make the vitamin inside the body. The references agree that the best time to expose your body to sunlight is before ten in the morning or after three in the afternoon. Exposing the face, limbs, shoulders, and back to the sun for 10 to 30 minutes at a time for several days a week is sufficient to convert cholesterol in the skin into vitamin D3. Even on cloudy days, 50% of UV rays can reach the skin. [10,22] But sunblock creams prevent these rays from reaching the skin. Perhaps we should mention here that the glass does not allow ultraviolet rays to pass through it, and therefore exposure to sunlight from behind the glass. Does not help It is also known that people with dark skin do not benefit a lot from sunlight when exposed to it, as the pigment melanin present in the skin in higher quantities than others s does not allow the effective use of the rays.

As for foods rich in vitamin D3, they are generally fatty foods, as vitamin D3 is one of the fat-soluble vitamins. The most important of them are Whale liver oil, where a small spoon contains 1360 IU. Fatty fish such as salmon and tuna, which contain approximately 150-400 units per serving. [13] A cup of milk fortified with vitamins and which contains approximately 120 units. Liver and red meat contain approximately 40 units. One egg contains approximately 40 units. An orange juice cup contains approximately 130 units.

Most doctors in the Arab world, noting that the vast majority of those who were analysed for vitamin D3, the results were less than 30 ng / mg, and this was likely due to many reasons, the most important of which was insufficient exposure to sunlight.

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