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## Vitamin D and population health; a nephrology viewpoint

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Low levels of vitamin D may interfere with renin-angiotensin system, and aggravation of hypertension, poor control of diabetes and progression of diabetic kidney disease. Thus more attention to reaching to suitable levels of vitamin D in chronic kidney disease patients is suggested.

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Vitamin D is a fat-soluble vitamin that is naturally found in a variety of foods and can be supplemented with dietary supplementation (1,2). Sunlight plays a vital role in absorbing vitamin D in the body, then vitamin D should be converted to 25-hydroxyvitamin D, or calcidiol that is converted to calcitriol in the kidneys (3). Vitamin D helps calcium absorption in the intestine and provides sufficient concentration of calcium and phosphate for bone formation and prevention of tetanus due to hypocalcemia (4). Vitamin D is also essential to grow and regenerate bones by osteoblasts and osteoclasts (5). Vitamin D insufficiency leads to bone thinning and fragility and also to reduce sleep duration to less than 5 hours per night leading sleep quality below 70% while sleep quality should be 85% or more (6). Sufficient vitamin D can effectively prevent rickets in children and osteomalacia in adults (1). In addition to calcium regulation, vitamin D prevents osteoporosis too. Vitamin D plays a role in modulating cell growth and neuromuscular function as well as in inactivating inflammatory processes (3,7). Vitamin D can upregulate the genes that encode proteins for replication, differentiation and apoptosis. Most body cells contain vitamin D receptors that convert

25-hydroxyvitamin D to 1,25dihydroxyvitamin D. The best serum indicator for vitamin D is 25-hydroxyvitamin D with a half-life of 15 days (2,4,5). However, serum levels of 25-hydroxyvitamin D may not indicate the levels of vitamin D in body tissues. Unlike 25-hydroxyvitamin D, 1,25dihydroxyvitamin D is a good indicator for assessing vitamin D level due to its short half-life about 15 hours (3,7). Additionally, serum vitamin D concentrations are regulated by parathyroid hormone and also by calcium and phosphate. Normally, the reduction of 1,25dihydroxyvitamin D does not indicate a decrease in vitamin D unless the levels of vitamin D are greatly reduced. Reducing the level of 25-hydroxyvitamin D in black Americans is more frequent than in whites, but compared to black whites, the black people have higher bone density (3). Therefore, blacks are less likely to develop bone fractures. In addition, in black people, levels of parathyroid hormone are higher and are therefore prone to vitamin D deficiency. Among blacks and whites, the levels of parathyroid hormone and 25-hydroxyvitamin D are considerably different (3). Other factors that reduce vitamin D include the use of sunscreens, skin pigmentation, aging, skin grafts, malabsorption disorders, obesity via vitamin D accumulation in body

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fat, inherited disorders such as rickets due to vitamin D deficiency or resistance to vitamin D, autosomal dominant hypophosphatemic rickets (ADHR) and other acquired disturbances (8-10). Accordingly chronic kidney disease is associated with deficiency of vitamin D. Vitamin D plays a role in maintaining health, survival, fertility, and also in preventing cardiovascular disorders, malignancies, immune or infectious-related disorders, multiple sclerosis, rheumatoid arthritis, and type 2 diabetes mellitus (1,7,11,12). Reducing the serum levels of 25-hydroxy vitamin D to less than 50 nmol/L is a sign of vitamin D deficiency, while the serum level lower than 25 nmol/L indicates severe deficiency and the values between 25 to 75 nmol/L indicates moderate deficiency. Vitamin D deficiency is a major health problem throughout the world and can be easily prevented in a variety of groups, especially in high risk people (3,9). Osteoporosis is the reduction of bone mass based on body volume that is common in both genders, especially among women. Osteoporosis is a global problem that affects the quantity and quality of life and is gradually increasing (3,13). Today, bone fracture due to osteoporotic state is a health problem around the world that poses a risk to 40% of women and 13% of men over the age of 50 years. Vitamin D is essential for the absorption of calcium from the intestine (3,4,14). Calcium is one of the essential factors for homeostasis. Given that sunlight exposure plays a significant role in calcium absorption and while the elderly are less exposed to direct sunlight and whilst vitamin D synthesis through the skin decreases with age, therefore, calcium absorption decreases and ultimately causes osteoporosis in this age subgroup. The results of studies have shown that lowering the levels of calcium and vitamin D leads to pathologic fractures, but all studies do not show that the administration of calcium and vitamin D supplements can reduce fracture in the elderly population (11,15). According to the United States National Academy, men and women over the age of 50 years and the younger are recommended to receive 1200 mg and 1000 mg of calcium per day. However, it is less for Europeans, hence 800 mg/d of calcium is recommended for women aged 50 to 60 years (7). While active form of vitamin D is producing the kidney any damage to kidney particularly injury to interstitial area will accompany with vitamin D deficiency in the group of patients. Low levels of the vitamin may interfere with renin angiotensin system, and aggravation of hypertension, poor control of diabetes and progression of diabetic kidney disease. Thus more attention to reaching to suitable levels of vitamin D in chronic kidney disease patients suggests.

### Author's contribution

AHD is the single author of the paper.

### Conflicts of interest

None.

### Ethical considerations

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