JOURNAL OF MULTIDISCIPLINARY SCIENCES AND INNOVATIONS

VOLUME 04, ISSUE 11
MOPNTHLY JOURNALS

ISSN NUMBER: 2751-4390
IMPACT FACTOR: 9,08

TREND OF VITAMIN D DEFICIENCY IN SOUTH AND CENTRAL ASIA

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Abstract: Vitamin D is a vital nutrient and hormone that supports strong bones, a healthy immune system, and helps control inflammation. Yet, deficiency is widespread, especially among women, often due to limited sunlight, cultural practices, urban lifestyles, darker skin, air pollution, and diets low in vitamin D-rich foods. Low vitamin D levels can lead to bone weakness, muscle problems, increased falls, infections, chronic diseases, and complications during pregnancy. Combating this issue requires a combination of strategies, including targeted supplementation, fortifying commonly eaten foods, encouraging safe sun exposure, promoting active lifestyles, and culturally sensitive education. Tailored, region-specific approaches are essential to improve health outcomes across South and Central Asia.

Keywords: Vitamin D, Deficiency, Trend

Introduction

Vitamin D is a fat-soluble vitamin that functions both as a nutrient and as a hormone, playing a crucial role in calcium and phosphorus homeostasis essential for bone health (1,2). Beyond skeletal function, laboratory studies suggest that vitamin D may reduce cancer cell proliferation, modulate immune responses, and decrease inflammation (1). The primary natural source of vitamin D is endogenous synthesis in the skin via ultraviolet B (UVB) exposure, while dietary sources—including fatty fish, egg yolks, fortified milk, and cereals—serve as important supplements for individuals with limited sunlight exposure (1,3).

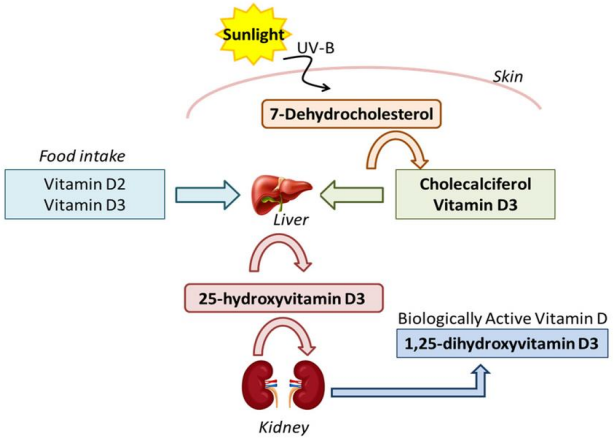

Fig 1; Pathway of Vitamin Production. The vitamin D production pathway involves the conversion of 7-dehydrocholesterol in the skin to vitamin D3 via UV-B. Vitamin D3 (and D2 from food) is hydroxylated in the liver to 25-hydroxyvitamin D3 and then in the kidneys to 1,25-dihydroxyvitamin D3,

Vitamin D deficiency is recognized globally as a public health concern, particularly in South Asian and Central Asian populations, due to geographic, cultural, dietary, and lifestyle factors. Deficiency is typically defined as serum 25(OH)D <20 ng/mL (50 nmol/L), while insufficiency ranges from 21–29 ng/mL (52–72 nmol/L) (3). Globally, around 1 billion people are affected by vitamin D deficiency, and approximately 50% of the population has insufficient levels. Deficiency has been associated with an increased risk of several diseases, including colon and

breast cancers, cardiovascular diseases, diabetes mellitus, multiple sclerosis, rheumatoid arthritis, Parkinson's disease, and tuberculosis (4).

Prevalence of Vitamin D Deficiency

Global Overview

Globally, vitamin D deficiency varies widely by region, affecting all age groups and ethnicities. In the United States, deficiency (<50 nmol/L) is observed in about 20% of White adults and 75% of Black adults (8). Despite food fortification, rickets has re-emerged in industrialized countries, and debate continues regarding optimal daily intake and serum thresholds for non-skeletal benefits (1,8).

South Asia

Vitamin D deficiency remains a major and persistent public health concern across South Asia, affecting all age groups with particularly high prevalence among women. Pooled data indicate that approximately 68% of adults in the region are deficient, with country-specific rates varying:

Country	Prevalence (%)	Key Affected Groups
India	40–99	Adults, children
Pakistan	70–90	Adults, adolescents, pregnant women
Bangladesh	50–80	Women, children
Nepal	~70	Urban adults, school-age children
Sri Lanka	40–70	Adults, females

Several factors contribute to this widespread deficiency. Women are disproportionately affected, with a 76% deficiency rate compared to 51% in men, largely due to cultural practices that limit sun exposure. Rapid urbanization and indoor lifestyles further reduce opportunities for sunlight, while air pollution diminishes ultraviolet B (UVB) radiation necessary for vitamin D synthesis. In addition, darker skin pigmentation common in the region naturally decreases the efficiency of cutaneous vitamin D production. Finally, diets are often low in vitamin D-rich foods, such as fatty fish, and comprehensive food fortification programs remain limited or inconsistently implemented.

Overall, these findings highlight the urgent need for culturally sensitive interventions, including targeted supplementation, improved dietary intake, and public health strategies that promote safe sun exposure to reduce the burden of vitamin D deficiency in South Asia. (7-14)

Central Asia

Data on vitamin D status in Central Asia—including Kazakhstan, Uzbekistan, Kyrgyzstan, Tajikistan, and Turkmenistan—remain limited, but available studies indicate a high prevalence of deficiency. In Kazakhstan, a meta-analysis reported that 57% of adults are vitamin D deficient. Similarly, Uzbekistan faces a significant public health challenge, with recent Ministry of Health estimates indicating that approximately 68% of adults have Vitamin D deficiency, despite the country's abundant sunlight of over 300 days per year.

Vitamin D deficiency is also prevalent among infants and children. In Samarkand, 78.7% of infants were deficient, and children with conditions such as celiac disease had deficiency rates up to 80%. Even during summer, only 18% of children had normal vitamin D levels, with deficiency being more pronounced in winter and spring. Factors contributing to this high prevalence include limited sun exposure due to lifestyle and cultural practices, long winters at high latitudes with minimal UVB radiation, and insufficient dietary intake of vitamin D-rich foods. These findings underscore the need for targeted public health interventions, including supplementation programs, dietary strategies and education on safe sun exposure (15,16,17).

Health Consequences

Vitamin D deficiency impacts multiple aspects of health. Skeletally, it can lead to rickets in children, osteomalacia in adults, reduced bone mineral density, osteoporosis, and an increased risk of fractures (1,5). Muscularly, deficiency is associated with decreased muscle strength and a higher likelihood of falls, especially among older adults (21,22). Beyond the musculoskeletal system, inadequate vitamin D levels have been linked to a greater susceptibility to infections, the development of autoimmune conditions, cardiovascular disease, diabetes, and adverse outcomes during pregnancy (5,6,23).

Public Health Strategies

Screening and Surveillance

Screening efforts should focus on populations at greatest risk of vitamin D deficiency, such as older adults, pregnant women, infants, people with limited sun exposure, and individuals with darker skin tones (18). The most reliable method for assessing vitamin D status is measuring serum 25-hydroxyvitamin D [25(OH)D] levels

Supplementation Programs

Recommended vitamin D supplementation varies by age and physiological status. Exclusively breastfed infants should receive 400 IU per day (20). Pregnant and lactating women are advised to take between 600 and 2,000 IU daily, depending on their baseline vitamin D levels (25). Older adults may benefit from 800 to 2,000 IU per day to maintain serum 25(OH)D levels of at least 30 ng/mL and to help reduce the risk of falls (21,22). High-dose annual or intermittent bolus supplementation is not recommended, as it has been associated with an increased risk of falls and fractures in older adults (22).

Fortification

Adding vitamin D to commonly consumed foods such as milk, flour, edible oils, and cereals is a cost-effective way to improve vitamin D levels across the population (19). Successful fortification programs require collaboration with local food producers and policymakers to ensure proper implementation, quality control, and ongoing monitoring.

Lifestyle Interventions

Promoting safe sun exposure and regular outdoor activity can help the body naturally produce vitamin D, especially in high-risk groups. Educational efforts should also consider cultural practices, such as clothing habits, to ensure guidance is practical and culturally sensitive

Conclusion

Vitamin D deficiency is a significant public health issue across South and Central Asia, affecting individuals of all ages, with women being particularly vulnerable. Addressing this widespread problem requires a combination of approaches, including supplementation, food fortification, lifestyle changes, and focused public health initiatives. Strategies should be tailored to the specific cultural, environmental, and dietary contexts of each region to effectively reduce deficiency-related health risks and enhance overall well-being.

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