

Mini Review

Vitamin D: A Boon to Respiratory Health in COVID-19

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Abstract

COVID-19 has erupted not only as a pandemic but as challenge to mankind. Life has come to a stand still. All spheres of life are affected not only in terms of jobs and economy but importantly health and well being. In Indian scenario this is of particular significance as autumn coincides with festivities, wedding season and mass gatherings. Outbreaks of respiratory viral infections, such as those caused by influenza A and Respiratory Syncytial Virus have long been associated with changing season reaching a peak in winter season and nadir in summer months. Various factors could be attributed to this pattern like increased virus survival at low temperature, tendency of close gatherings in winter months and cold dry air reducing mucus in nasal passages. Clinically Vitamin D deficiency has been shown to associate with increased risk of diverse acute respiratory tract infections. It has been proposed that vitamin D, diminishes production of respiratory cytokines, which appear to play a central part in pathogenesis of severe COVID-19.

Keywords: COVID-19, Vitamin D, Severe acute respiratory syndrome

Introduction

Autumn is the most rich and transformative time of the year when the human body needs replenishment of vitamin stores in order to boost the immune system so as to keep the respiratory system upbeat to face the harsh upcoming winters. In Indian scenario this is of particular significance as autumn coincides with Deepawali festive season marked by exchanging of gifts, lighting lamps and burning crackers, contributing significantly to air pollution and adversely affecting respiratory health. However, this year, respiratory health was in news flashes 24/7, owing to COVID-19 global outbreak.

Outbreaks of respiratory viral infections, such as those caused by influenza A and Respiratory Syncytial Virus have long been associated with changing season reaching a peak in winter season and nadir in summer months. Various factors could be attributed to this pattern like increased virus survival at low temperature, tendency of close gatherings in winter months and cold dry air reducing mucus in nasal passages. Infection with the viral pathogen Severe Acute Respiratory Syndrome Coronavirus -2 (SARS-CoV-2) has reached pandemic status in 2020 and has put a great burden on Nation's healthcare system [1]. Where as practicing respiratory hygiene and adopting social distancing norms have been beneficial preventive measures but nourishing body with vitamins, especially with vitamin D could be promising in coping up with COVID-19 [2].

Vitamin D - bestows both skeletal and extra skeletal benefits. Vitamin D, popularly known as sunshine vitamin is synthesized upon exposing the skin to UVB rays which readily convert cholesterol stored in the skin to active form of vitamin D [3]. Therefore, this wonder of vitamin can be sufficiently generated by adequate exposure to sun, the possibility of which increases by outdoor activities. Vitamin D-deficiency was already a global pandemic owing to lifestyle changes and indoor confinement. As, India witnessed series of lock down as a preventive measure imposed by Government of India, the first one beginning on 24th March for 21 days which left no scope for people to

step out of their homes and replenish their vitamin D stores.

Work from home and online classes appeared a convenient working model for adults and kids respectively. But this lead to experimenting with food, made people eat excess than required, contributing to obesity and obesity is a strong risk factor for comorbidities like diabetes and cardiovascular diseases. These comorbidities have made people more vulnerable to risk of acquiring COVID-19. Infection with the viral pathogen, SARS-CoV-2 has reached pandemic status with global toll of more than million lives, leaving more than 33 million infected as per WHO [4].

Role of vitamin D in maintaining health and well being

Vitamin -D plays a ubiquitous role in maintaining health. During this hour of global crisis, it's role in prevention and improving COVID-19 outcomes can be talked about when vaccines are in trial phase and no particular treatment regime is substantiated. Recent studies conducted have reported that Vitamin D supplementation could possibly improve clinical outcomes of patients infected with COVID-19. It was observed that vitamin D is significantly associated with clinical outcomes ($p < 0.001$). For each standard deviation increase in serum 25 (OH) D, the odds of having a mild clinical outcome rather than severe outcome were increased 7.94 times [5].

Vitamin D has enhances adaptive immunity as well as expression of anti-oxidative genes. Vitamin - D has proved to reduce risk of common cold. It has been proposed by several authors that vitamin D supplementation can prevent COVID-19 [6]. Clinically Vitamin D deficiency has been shown to associate with increased risk of diverse acute respiratory tract infections. It has been proposed that vitamin D, diminishes production of respiratory cytokines, which appear to play a central part in pathogenesis of severe COVID-19. Studies have documented that COVID-19 mortality is enhanced in groups with increased risk of vitamin D deficiency particularly in Asians, blacks, people with high body mass index and institutionalized elderly [7].

Vitamin D and respiratory health

The Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2) infects pulmonary epithelial cells using the Angiotensin Converting Enzyme-2 (ACE-2) receptor [8]. Besides pulmonary epithelial damage, SARS-CoV-2 also infects macrophages through ACE-2 receptors and activates them [9]. Macrophages, neutrophils, and T cells get activated through sustained elevation of cytokines including Interleukin (IL)-1, IL-6, and Tumor Necrosis Factor (TNF) alpha, resulting in type 2 pneumocyte apoptosis, and in some patients a path that leads to Acute Respiratory Distress Syndrome (ARDS) [9]. The host responses are sometimes amplified by an overwhelming expression of pro-inflammatory cytokines [10]. This 'cytokine storm' is responsible for some of the serious manifestations of COVID-19 such as ARDS. This is further supported by study conducted by Martineau et al which included 25 randomized controlled trials, with a total of 10,933 participants aged 0-95 years from 14 different countries. The study reported that Vitamin D bestowed a significant beneficial effect in decreasing the risk of experiencing at least one acute respiratory tract infection (OR 0.88; 95% CI: 0.81, 0.96; P=0.003) [11]. Such findings are also in consonance with Bergman et al in which 11 randomized placebo-controlled trials with 5660 individuals (average age was 16 years, ranging from 6 months to 75 years) were carried out. The striking finding was that vitamin D supplementation significantly decreased the risk of respiratory tract infections (Odds Ratio [OR]: 0.64; 95% CI: 0.49, 0.84; p=0.0014). Also, this review found that the protective effect of vitamin D was greater in studies using daily single doses (300-2000 IU/day) (OR 0.51; 95% CI: 0.39, 0.67) compared to large doses given at certain intervals (100,000 or 200,000 IU per month or every 3 months) (OR 0.86; 95% CI: 0.62, 1.20) [12].

Conclusion and Recommendation

Keeping the current scenario in mind, where various cocktails of treatment are under experimental stage for this horrific pandemic, keeping the immunity upbeat by replenishing vitamin D stores will not only help fighting this global pandemic but will keep depression at bay amidst lock down and limited movement. Since, children and adolescents play an important role in spreading awareness regarding health and well being in a family, concerted efforts need to be made to educate them utilizing the online teaching platform regarding vitamin D deficiency foods rich in this vitamin D and importance of this wonder of a vitamin in dealing with COVID-19 pandemic . When the world is living amidst darkness and horror of this dreadful

COVID-19 pandemic, a little ray of hope could be this sunshine vitamin. Suggest achieving 25(OH)D serum levels over 30ng/ml (75nmol/L), a widely endorsed levels toward the risk of COVID-19. Recommend to adults vitamin D intake of 4000 IU (100mcg) daily (or at least 2000 IU) in the absence of testing. 4000 IU is widely regarded as safe [1]. Measurement of 25(OH)D levels in all hospitalized COVID-19 patients is important while under treatment with 25(OH) D or D3, ideally following a protocol described by Castillo et al. [13].

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