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View Point

Can Fasting Practices Improve Vitamin D Levels?

Pradeep M.K Nair, Karishma Silwal[1], Aarti Nagarkar

Interdisciplinary School of Health Sciences, Savitribai Phule Pune University, Pune, Maharashtra, [1]Department of Naturopathy, Sant Hirdaram Medical College of Naturopathy and Yogic Sciences, Bhopal, Madhya Pradesh, India

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Abstract

Vitamin D deficiency is emerging as a very serious public health problem. Numerous epidemiological studies link vitamin D deficiency to the pathophysiological process of several acute and chronic diseases. Sun exposure, vitamin D supplementation, and fortification of foods with vitamin D are the present strategies adopted to tackle this epidemic. While this can be effective, recent evidence suggests the need to consider the multifaceted causation of vitamin D deficiency such as impaired liver function, kidney function, hyperparathyroidism, and endocrine dysfunction. Therapeutic fasting, a popular nutritional approach has shown to have a positive association with vitamin D levels. This perspective attempts to provide an overview of literature discussing fasting and vitamin D, the possible mechanisms behind this association, and discusses the future possibilities of using fasting as a public/clinical tool in mitigating vitamin D deficiency.

Keywords: *25-hydroxyvitamin-d, cholecalciferol, fasting, nutrition, prevention, vitamin D deficiency*

Introduction

Vitamin D deficiency is linked to the incidence, progression, and complications of many communicable and noncommunicable diseases.[1] A deficiency in vitamin D has been linked to immune system dysfunction and inflammation, which is thought to be a rate-limiting step in the onset of numerous diseases.[2,3] An improvement in vitamin D levels is associated with positive clinical outcomes in numerous conditions like obesity, metabolic syndrome, autoimmune disorders, musculoskeletal disorders, cancer, and infectious diseases.[4,5] This underscores the importance of implementing interventions aimed at improving vitamin D levels in individuals with these acute and chronic health conditions.

Sun exposure and dietary intake are considered the primary source of vitamin D in humans. However, vitamin D levels are also influenced by various factors like impaired liver function, kidney function, hyperparathyroidism, and endocrine dysfunction.[6] Vitamin D supplementation and vitamin D food fortification are two main conventional strategies adapted to prevent and manage vitamin D deficiency. While conventional approaches to countering vitamin D deficiency are definitely promising, considering vitamin D deficiency as a metabolic disturbance and introducing other nutritional approaches may also be taken into account for achieving substantial outcomes.

Fasting (willful complete or partial abstinence from food or drinks) has grown in popularity and has been used for cultural, religious, and therapeutic purposes since time immemorial. Numerous observational and experimental studies very well demonstrate the health benefits of fasting, especially in metabolic disorders. Given the significance of vitamin D in improving the clinical outcome of various acute and chronic disorders,[4] it will be intriguing to investigate if fasting attenuates the vitamin D deficiency/insufficiency status in addition to its other metabolic regulatory mechanisms.[7] However, the role of fasting in improving vitamin D levels has yet to be thoroughly explored. This paper summarizes the current evidences linking fasting practices and vitamin D, the possible mechanisms associated and directions for future research.

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Address for correspondence: Dr. Aarti Nagarkar, Interdisciplinary School of Health Sciences, Savitribai Phule Pune University, Pune - 411 007, Maharashtra, India.
E-mail: aarati@unipune.ac.in

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Studies investigating the association between fasting and vitamin D levels

As discussed earlier, there are only a limited number of studies conducted to date exploring the role of fasting in improving vitamin D levels. Żychowska *et al*. reported an 8-day fasting regimen and exercise to improve serum vitamin D levels and its metabolites.[8] Pradeep *et al*., Arankale *et al*., and Tewani *et al*. showed a significant increase in serum vitamin D levels after a 10-day fasting regimen (<500 kcal/day).[9-11] Similarly, Tzotzas *et al*., in their study exploring the role of a hypocaloric diet for obese patients, demonstrated a significant rise in vitamin D levels. They further inferred that a 10% reduction in body weight postcalorie restriction could increase vitamin D levels by 34% without external supplementation.[12] All of these studies that found a link between fasting and vitamin D levels used a longer fasting period (fasting for more than 2 days). However, none of these studies examined whether the changes in vitamin D levels persist beyond the fasting period.

Potential mechanisms relating fasting and increased vitamin D levels

Aforementioned studies highlight the explicit role of fasting or calorie restriction practices in improving vitamin D levels. The most likely mechanism for fasting or calorie restriction increasing vitamin D levels is weight loss and reduction in adiposity after fasting. A preclinical study reported an augmented release of vitamin D from adipose tissue during fasting in response to weight loss during fasting.[13] Studies indicate that vitamin D accumulates inside the skeletal muscle or adipose tissues, and fasting stimulates its release into the circulation.[8] Even though the distribution of vitamin D is similar in both obese and nonobese individuals, an increased proportion of adipose tissue can lead to poor availability of vitamin D in circulation and for its hydroxylation.[14] A recent review concluded that fasting may have a distinct function in adipose tissue metabolism,[15] lending credence to the concept of a link between fasting, adipose tissue, and vitamin D levels.

Furthermore, numerous studies have established the link between weight loss and vitamin D deficiency. Vitamin D supplementation has been shown to enhance weight loss and reduce body mass index, waist circumference, and hip circumference in obese individuals compared with controls who were not under vitamin D supplementation.[16,17] However, another study that included 55 obese adolescents with vitamin D deficiency indicates serum vitamin D levels do not affect body fat loss.[18] This contradictory result indicates further research in this domain; nevertheless, a large scale of evidence shows an inverse relationship between vitamin D and weight loss.

Another possible mechanism behind the increase in vitamin D may be the probable impact of fasting on parathyroid hormones (PTHs).[19] PTH shares an inverse relationship with vitamin D levels; decreasing PTH levels can increase vitamin D levels.[20] However, this is a theoretical postulate, as no studies have been conducted to date to substantiate the explicit role of fasting in altering PTH levels. Furthermore, fasting is reported to

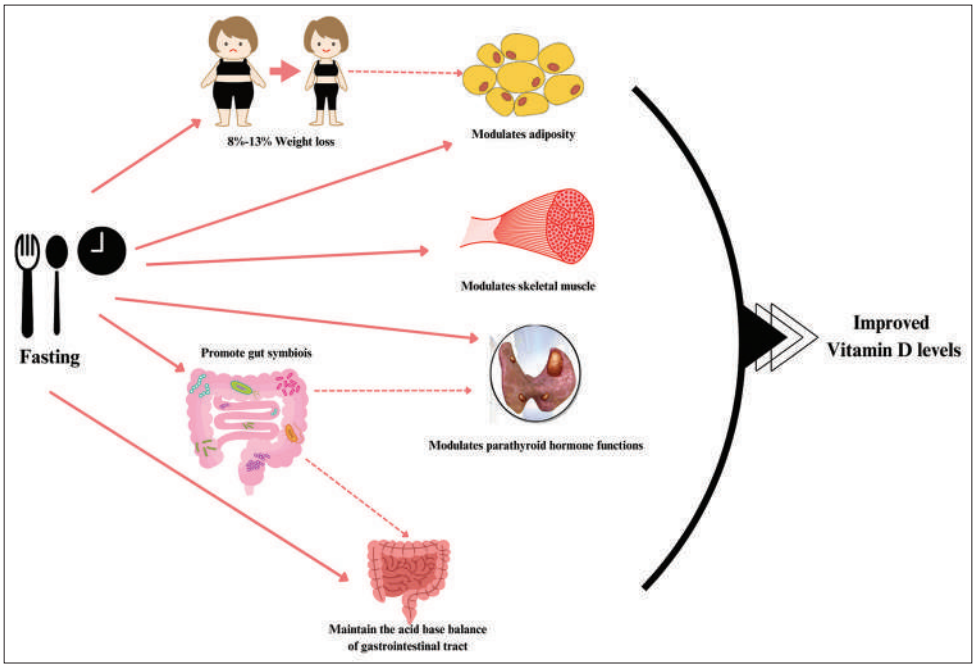

Figure 1: Plausible mechanisms by which fasting therapy can improve vitamin D levels

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be associated with metabolic regulation;[7] This may help improve the bioavailability of vitamin D by altering the gastrointestinal pH, which is considered to significantly interfere with the bioavailability of vitamin D.[21]

Furthermore, the role of fasting in reversing gut microbial dysbiosis could also be considered a contributing mechanism by which fasting can upregulate vitamin D levels. Gut microbial dysbiosis is postulated to play a significant role in the regulation of endocrine vitamin D metabolism by increasing the levels of fibroblast growth factor 23,[22] which inhibits parathyroid hormone, which subsequently reduces vitamin D production.[23] Apart from the metabolic upregulation, prolonged fasting has been shown to regulate the levels of circulating inflammatory cytokines.[24] Given the inverse relationship vitamin D shares with inflammation,[25] regulation of inflammation by fasting may be another potential mechanism whereby prolonged fasting enhances vitamin D levels. Figure 1 summarizes the possible mechanisms by which fasting can attenuate vitamin D deficiency.

Future directions for fasting and vitamin D research

Numerous questions need to be answered to substantiate the significance of fasting in improving vitamin D levels. Future research should explore the association of vitamin D levels with various fasting approaches, their sustainability, and specific mechanisms of action. Furthermore, the improvement in vitamin D may be an indicator of lipolysis;[13] however, whether the released vitamin D is transferred to other organs and its bioavailability requires further investigation in future studies. Although prolonged fasting is regarded beneficial and safe, several side effects have been observed to be associated with fasting, including headaches, sleeplessness, metabolic acidosis, palpitations, arthralgia, diarrhea, and indigestion.[26,27]

In addition, reports indicate a self-limited protein loss during the early phase of fasting, the effects of which may vary depending on the body composition (obese or lean) of the individuals undergoing fasting.[28,29] Further research is needed to rule out the potential adverse impacts that may lead to sarcopenia, malnutrition, or any other side effects related to prolonged fasting, as well as the preventative measures that must be taken to overcome these side effects. It will also be interesting to investigate the role of other fasting mimicking practices in improving vitamin D levels, such as calorie restriction, a fasting mimicking diet, or intermittent fasting since these may be significantly simpler on participants and have less negative implications.

Conclusion

Fasting is a common practice in many cultures and religions worldwide[30]. However, there is a growing issue of vitamin D deficiency.[4] Fasting may help improve vitamin D levels, making it a potential intervention strategy. We have presented a hypothesis based on the existing limited evidence that the weight loss induced by fasting may improve vitamin D levels. However, in addition to the weight loss, there are numerous other biological pathways associated with fasting that may be contributing to the increased vitamin D levels that need to be studied. This warrants that well-designed, robust, large-scale clinical trials are needed to confirm this hypothesis. Nonetheless, fasting shows promise as a therapeutic approach.

Data availability statement

Nil.

Author contribution

PMK and AN conceptualized the manuscript. PMK, KS and AN were involved in data collection and writing the manuscript. Final draft was approved by both the authors.

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Conflicts of interest

There are no conflicts of interest.

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