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Vitamin D and prostate cancer prevention

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Abstract

Vitamin D is a hot topic nowadays, especially its relationship with cancer prevention. Normally, vitamin D is associated with bone health principally, but the new research has discovered an impact on immune function and cellular signaling, even in some studies talk about a hormone, however, the most important relationship is its implication in cellular processes, inhibiting cancer growth. For now, the recent studies are oriented about a benefit and a cause-effect relationship between prostate cancer and normal levels of vitamin D. This premise opens a lot of questions in this scenario. This editorial highlighted the most important studies in this area.

Key Words: Prostate cancer; Vitamin D; Screening; Cancer; Prevention

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Core Tip: This editorial remarks the importance of vitamin D beyond bone health and its relationship with prevention prostate cancer in the light of recent studies what suggests how deficiency and increased levels are related with an augmented risk of prostate cancer.

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INTRODUCTION

According to the GLOBOCAN 2020 data, prostate cancer is the second most common cancer in men worldwide and it is also the fourth most common cancer overall. The incidence of prostate cancer is rising significantly, it is the most frequently diagnosed cancer in 112 countries and the leading cause of cancer death in 48 countries[1], accounting for more than 1.4 million cases and 396773 deaths. These numbers are expected to nearly double by 2040[2]. Furthermore, this is affecting younger men who are being diagnosed at more advanced stages of the disease. In summary, prostate cancer is a significant health problem, and early detection and proper management are critical to improving outcomes for patients. The relationship between very prevalent tumors such as prostate cancer and certain elements such as vitamin D has aroused great interest in recent days. Vitamin D serves as a precursor to the potent steroid hormone calcitriol, which regulates numerous genes that control homeostasis, epithelial cell differentiation, proliferation, and apoptosis. Low level of vitamin D is implicated in the development and progression of several diseases including bone fractures, cardiovascular disease, diabetes mellitus, and cancers[3].

VITAMIN D AND PROSTATE CANCER

Recently, Cassell and Konneh[4] in the last issue of *World Journal of Clinical Oncology* made a review about vitamin D as an essential nutrient that plays a crucial role in bone health and various body functions. Researchers have studied the possible link between vitamin D and prostate cancer. As the article indicates vitamin D possesses a potentially significant role in prostate cancer prevention, linked to its ability to influence cell proliferation, apoptosis, and angiogenesis, playing a fundamental part in immune modulation. Although no definitive cause-and-effect relationship has been established, it has been observed that adequate levels of vitamin D may be associated with a lower risk of certain cancers. There have been numerous epidemiological studies examining the relationship between vitamin D and prostate cancer, however, the evidence is mixed[5]. The findings from these studies vary, with some suggesting a potential link between higher vitamin D levels and a lower risk of developing prostate cancer, while others have not found a significant association[6,7]. The specific relationship between vitamin D and prostate cancer may vary among different populations due to factors such as sunlight exposure, genetics, dietary habits, ethnicity, and lifestyle factors.

The relationship between vitamin D and prostate cancer in the Nordic and African American populations is a topic of active research. Epidemiological studies have shown that regions with limited sun exposure, leading to decreased vitamin D synthesis, often indicate more prostate cancer incidence. A longitudinal nested case-control study conducted on Nordic men (Norway, Finland, and Sweden) has shown that both high and low levels of blood vitamin D are associated with a higher prostate cancer risk in Nordic countries. Research found that both low (< 19 nmol/L) and high (> 80 nmol/L) 25 (OH)-vitamin D serum concentrations are associated with higher prostate cancer risk. The normal average serum concentration of 25(OH)-vitamin D (40 nmol/L–60 nmol/L) comprises the lowest risk of prostate cancer[8]. Supplementing for vitamin D deficiency is recommended, but too high a serum level of vitamin D could also promote the development of cancer.

Vitamin D deficiency could be one of the reasons African American men experience more aggressive prostate cancer at a younger age compared to European American men. Vitamin D deficiency is more common in African Americans (AAs) and its deficiency is associated with advanced stage, higher tumor grade, and mortality in prostate cancer[9]. Study shows that African American prostate cancer displays quantitatively distinct vitamin D receptor (VDR) cistrome-transcriptome relationships regulated by BAZ1A. Study identified that genomic ancestry drives the VDR complex composition, genomic distribution, and transcriptional function, and is disrupted by BAZ1A and illustrates a novel driver for AA prostate cancer[10]. However, the role of vitamin D in aggressive prostate cancer in AAs is not well explored.

It is important to highlight that even in different populations there are different results that make it difficult to generate this cause-effect relationship between vitamin D and prostate cancer. Therefore, according to these studies, while vitamin D supplementation is recommended for individuals with a deficiency, it is essential to strike a balance to avoid excessive levels that could promote the development of cancer or other adverse health effects.

Cassell and Konneh[4] also explored supplementation of vitamin D in prostate cancer[4]. Do we have any guidance on vitamin D supplementation on either preventing or treating prostate cancer? Animal and cell studies have provided essential proof for a direct causal relationship between vitamin D and prostate cancer development, with data that provide solid support for the proof of principle that vitamin D signaling modulates progression through the early stages of prostate carcinogenesis and for the idea that early, life-long dietary manipulation of serum vitamin D metabolites can modify the course of early-stage prostate cancer[11].

There are several studies that have investigated the inclusion of vitamin D in the diet and the relationship of serum vitamin D levels with prostate cancer[6,12-14]. Campbell *et al*[13] with intake of vitamin D3 dose titrated to achieve serum level of 60 ng/mL founded that intensive nutritional intervention with vitamin D supplementation may benefit men on active surveillance for prostate cancer and that patients with higher initial vitamin D levels were twice as likely to have a

downward PSA slope [13]. However, there is still no definitive evidence of a beneficial effect of increasing vitamin D intake on prostate cancer risk. Therefore, there are still no specific recommendations regarding the optimal vitamin D intake to reduce the risk of prostate cancer in humans as well as to define the dose-response curve.

According to these data, the debate opens as to whether we should consider vitamin D values in all patients, even in the absence of a cause-effect mechanism, and whether it is cost-effective and sustainable for health systems. The cost-effectiveness of using vitamin D as a protective measure against prostate cancer is a complex issue and depends on several factors. The relationship between vitamin D and prostate cancer is not fully established. Some studies suggest that vitamin D may have a protective effect against prostate cancer, others have found no such association. Results strengthen the evidence that high 25(OH)D may protect against more aggressive prostate cancer [15]. Any public health intervention depends not only on its effectiveness but also on its cost. Vitamin D supplementation and food fortification are potentially effective strategies for preventing vitamin D deficiency, but their cost can be significant [16]. Additionally, measuring vitamin D levels in the entire population would also have an associated cost.

Another important topic is whether vitamin D can be used as a surrogate marker for prostate cancer screening that potentially will help predict the presence or progression of the disease. A recent study found an absence of correlation between the serum vitamin D concentration levels and prostate cancer risk [17]. There are still too few large-scale, well-conducted studies to confirm the absence of correlation. While research on the relationship between vitamin D levels and prostate cancer risk continues, it is important to note that using vitamin D levels as a sole marker for prostate cancer screening is not currently supported.

CONCLUSION

There is no evidence that vitamin D is a substitute for standard cancer treatments. The relationship between vitamin D and prostate cancer is an active area of research. Some studies suggest that vitamin D may have a protective effect against prostate cancer. However, the results are conflicting and inconsistent. In conclusion, while there are indications that vitamin D might play a role in cancer prevention, we cannot say for a definitive cause-and-effect relationship. More research is needed to better understand this connection in different populations.

FOOTNOTES

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