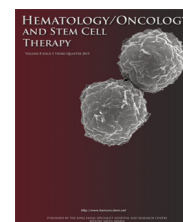




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ORIGINAL RESEARCH REPORT

Impact of vitamin D deficiency on increased blood eosinophil counts

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KEYWORDS

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Abstract

Objective/background: Vitamin D has been increasingly recognized as an immunomodulatory agent. Its deficiency has been associated with immune-mediated diseases such as asthma, rhinitis, and atopic dermatitis. These allergic conditions are dependent on T-helper type 2 (Th2) cells secreting interleukins, overproduction of immunoglobulin E (IgE), and eosinophil activation. We investigated the association between serum vitamin D levels and blood absolute eosinophil count.

Methods: We carried out a cross-sectional study of 669 men and women referred to a clinical pathology laboratory who underwent 25-hydroxyvitamin D testing and complete blood count analysis on the same day.

Results: Vitamin D levels were stratified into four ranges: severely deficient (<10 ng/mL), deficient (≥10 ng/mL and <20 ng/mL), insufficient (≥20 ng/mL and <30 ng/mL), or sufficient (≥30 ng/mL). The mean/median eosinophil count in the four groups was 267/254 cells/μL, 245/238 cells/μL, 191/159 cells/μL, and 182/146 cells/μL, respectively, ($p = .001$). The difference was significant between the severe deficiency group and each of the other three groups ($p = .012$, $p = .002$, and $p = .001$, respectively). There was no statistical difference among the four groups in terms of leukocyte counts ($p = .151$), neutrophils ($p = .177$), or lymphocytes ($p = .582$).

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Conclusion: Vitamin D deficiency was associated with higher blood eosinophil count. These results support the possible role of vitamin D in the eosinophil immune response.

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Introduction

Vitamin D plays an important role in calcium and bone metabolism as well as immunomodulation [1]. It is mostly generated in the skin by the conversion of provitamin D₃ to previtamin D₃ during exposure to sunlight, but some vitamin D is also derived from food sources. Vitamin D is converted in the liver to 25-hydroxyvitamin D-25(OH)D₃ and then converted to the active form, 1,25-dihydroxyvitamin D-1,25(OH)D₃ or calcitriol, in the kidneys [2].

It is known that vitamin D is a fundamental immunoregulator that exerts extensive anti-inflammatory actions through the vitamin D receptor (VDR) expressed in the immune system [1]. The protective role of vitamin D against allergic diseases has been supported by associations between low serum 25(OH)D₃ levels and higher rates of asthma [3–7], atopic dermatitis [8,9], and allergic rhinitis [10].

Eosinophils have long been associated with the effector arm of T-helper type 2 (Th2) cell immunity engaged in allergic responses [11]. However, a correlation between serum 25(OH)D₃ levels and circulating eosinophils is not strongly established. A few studies have noted that lower levels of vitamin D are associated with an increased blood eosinophil count [3,12], but most other studies have reported no significant association [4,5,7,13–16].

Given these uncertainties, we sought to evaluate the impact of serum 25(OH)D₃ deficiency on Th2 activation and increase circulating eosinophils in peripheral blood.

Materials and methods

This cross-sectional study was carried out on patients who had been referred to a medical laboratory on Campos dos Goytacazes, Rio de Janeiro, Brazil, from January to December 2015. Patients who underwent 25(OH)D₃ testing and complete blood count analysis on the same day were included in the study. We analyzed the following parameters: age, sex, leukocyte count, absolute eosinophil, neutrophil, and lymphocyte counts.

The study was reviewed and approved by the Institutional Ethics Committee (Faculty of Medicine of Campos, Campos dos Goytacazes, Rio de Janeiro, Brazil) and was conducted in accordance with the principles of the Declaration of Helsinki. In this study, institutional consent was obtained for record review, and all patient information was anonymized and deidentified prior to analysis.

25(OH)D₃ is the major circulating form of vitamin D, and its measurement is the best indicator of overall vitamin D status [2]. Peripheral venous blood samples were obtained from all patients and serum 25(OH)D₃ levels were measured using an electrochemiluminescence immunoassay. Serum 25(OH)D₃ levels were categorized as severely deficient (<10 ng/mL), deficient (≥10 ng/mL and <20 ng/mL), insufficient (≥20 ng/mL and <30 ng/mL), or sufficient (≥30 ng/mL).

A peripheral smear was performed. After Wright–Giemsa staining, the percentage of eosinophil cells was computed relative to the total number of white blood cells. The absolute eosinophil count was computed by multiplying

Table 1 Characteristics of study participants.

Characteristics	N = 669
Sex	
Male, n (%)	139 (20.8)
Female, n (%)	530 (79.2)
Age, mean ± SD (median)	44.5 ± 19.3 (43)
25(OH)D ₃ (ng/mL), mean ± SD (median)	32.2 ± 11.1 (30.9)
Severely deficient (<10 ng/mL), n (%)	11 (1.6)
Deficient (≥10 ng/mL and <20 ng/mL), n (%)	62 (9.3)
Insufficient (≥20 ng/mL and <30 ng/mL), n (%)	238 (35.6)
Sufficient (≥30 ng/mL), n (%)	358 (53.5)
Leukocyte count (cells/μL), mean ± SD (median)	6247.4 ± 1859.9 (6000)
Neutrophil count (cells/μL), mean ± SD (median)	3395.1 ± 1287.1 (3233)
Lymphocyte count (cells/μL), mean ± SD (median)	2190.4 ± 777.3 (2100)
Eosinophil count (cells/μL), mean ± SD (median)	192.6 ± 192.63 (156)

Note. SD = standard deviation.

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