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## Review

### Can Vitamin D supplementation alone effective to increase a physical fitness levels in post-menopausal women with metabolic disorders? Brief Review

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#### ABSTRACT

**Background:** During the climacteric period, occur an aging process of the skin, and promote several decreases in the ability of vitamin D synthesis in an organism and lower levels of Vitamin D may contribute to the appearance of conditions such as osteomalacia, osteoporosis, falls and fractures.  
**Aim:** The present brief review focuses on the influence of Vitamin D supplementation alone on physical fitness (strength, endurance, and balance) in postmenopausal with diseases or not.  
**Methods:** Search in Medline and PubMed relevant articles with Vitamin D supplementation alone on physical fitness (strength, endurance, and balance) in postmenopausal with diseases or not, were included only 5 clinical.  
**Conclusions:** In conclusion, the effectiveness depends on the amount was prescribed for supplementation and the patient's characteristics. Doses less than 1000 IU/d did not show significant changes in physical fitness on post-menopausal women with metabolic diseases or not.

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## 1. Introduction

The aging is a human natural process, the body suffers several changes along the years, changing in body composition, and muscle function is the most visible [1]. In a climacteric period, the women's health showed several modifications, with physical and mental symptoms [2,3].

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Menopause is characterized by the last menstrual period, followed by significant increases in follicle-stimulating hormone and significant decreases in estrogen [4,5]. This period represents a milestone in women's life and represents the end of the women's reproductive period [6]. With increases in life expectancy, the need to offer better health conditions and quality of life to these women has increased [7].

During the climacteric period, occur an aging process of the skin, and promote several decreases in the ability of vitamin D synthesis in an organism [8]. The lower levels of Vitamin D may contribute to the appearance of conditions such as osteomalacia, osteoporosis, falls and fractures [9]. In addition, several pieces of evidence suggest that vitamin D may influence non-skeletal pathological conditions, including to various disorders as immune and autoimmune diseases, cardiovascular and metabolic diseases, and cancer [10].

Several studies showed the association between Vitamin D status and physical fitness in elderly women with disease conditions or not. Vuksanovic et al. [11] verified the association of Vitamin D with a prevalence of metabolic syndrome on muscle strength and occurrence of sarcopenia, and the results showed that lower levels of Vitamin D in postmenopausal women is associated with high body fat, metabolic syndrome, low muscular strength and osteopenia. Bentes et al. [1] examine the association between muscle function, and body composition, vitamin D status, and blood glucose in post-menopausal women with type 2 diabetes, although that results showed an association between handgrip strength with a glucose, no associations were found between vitamin D status and physical fitness test.

Although that association of Vitamin D levels and physical fitness in elderly women are well known. The supplementation of Vitamin D alone on physical fitness still unclear and scarce in the scientific literature. The present brief review focuses on the influence of Vitamin D supplementation alone on physical fitness (strength, endurance, and balance) in postmenopausal with diseases or not.

## 2. Physical fitness and the influence of Vitamin D status

The American College of Sports and Medicine [12] defined the physical fitness as the ability to develop the daily tasks with energy and in emergencies be able to pass the unexpected event and in elderly women with high vitamin D deficiency may decrease the physical fitness [13,14]. However, does the Vitamin D supplementation able to improve the physical fitness and each component of physical fitness (cardiorespiratory fitness, muscular strength and endurance, body composition, flexibility, and neuromotor fitness) conceivably influence some aspect of aging and improve the quality of life.

In the present review we have not considered the full classification of physical fitness, were included only strength,

endurance, mobility, and balance, since all articles we have revised using "vitamin d supplementation alone" only in postmenopausal women with metabolic diseases. We have not considered the physical exercise or physical activities in a search.

### 2.1. Vitamin D supplementation on strength, endurance, mobility, and balance

The strength could be defined as a sum of the forces generated by sarcomeres that are transmitted to the tendon [15] and can be categorized as static and dynamic [16]. Furthermore, the maximal strength is the maximal amount of force a muscle or muscle group can generate a specified movement pattern at a specified velocity [17].

Higher levels of muscular strength can be associated with better health status and cardiovascular protection [18], lower risk of all-cause mortality and fewer cardiovascular disease events [19–21] and lower risk of developing functional limitations [22,23].

During years, the vitamin D was identified as important subtract for muscle quality and force production [24] and the deficiency has been related to decreased strength and muscle mass [25], with impaired balance and increased incidence of falls [9].

Vitamin D through its functions in intestine, kidney, bones and parathyroid glands is a key hormone for calcium homeostasis and for the development of a healthy skeleton [26]. Nevertheless, receptors of this hormone can be found in almost all tissues of the body and other actions unrelated to mineral metabolism have been attributed to it and among these effects are the actions on skeletal muscle involving calcium transport and protein synthesis [24].

Only five clinical trials (Table 1) verified the influence of vitamin D supplementation alone on physical fitness (strength, endurance, mobility, and balance) on postmenopausal with metabolic diseases or not.

### 2.2. Doses of 400 unit per day of Vitamin D

Only one study verified the influence of 400 IU/d of Vitamin D on physical fitness. Janssen et al. [27] in a randomized, double-blind placebo-controlled trial, they verified that vitamin D plus calcium supplementation improves muscle strength and mobility, compared with calcium mono-therapy in seventy elderly women with insufficient Vitamin D (>65 years and had a serum Vitamin D concentration between 20 and 50 nmol/L). The trial was conducted during 6 months (24 weeks) and the patients received the Vitamin D (400 IU/day + 500 mg/day) or Placebo (500 mg/day). The muscle strength, power and functional mobility (knee extension strength, handgrip strength, leg extension power, timed up and go and modified Cooper test) measurements were conducted baseline and after six months. The results showed that supplementation of Vitamin D (400 IU/day + 500 mg/day) alone was not sufficient to improve the physical fitness.

**Table 1**

State of Arts of Vitamin D supplementation alone on physical fitness in postmenopausal.

Authors/ year	Sample size subjects	Age (years)	Groups	Follow-up length	Dose of Vitamin D	Physical Fitness changes
Janssen et al [27]	70 women	>65	Two	Six months (24 weeks)	Vitamin D (400 IU/day + 500 mg/day) or Placebo (500 mg/day)	No
Zhu et al [28]	302 women	70–90	Two	One year	The intervention group used 1000 IU/d plus calcium citrate (1 g/d).	Yes
Cangussu et al. [29]	160 women	50–70	Two	Nine months	Vitamin D group (1000 IU/d)	Yes
Gao et al. [30]	485 women	55–70	Three	2-years	Group A (600 mg/d Calcium alone), Group B (600 mg/d of Calcium + 800 IU/d of Vitamin D) and Group C (600 mg/d of calcium + (0.25 µg/d of calcitriol),	No
Anek et al. [31]	52	45–55	Two	4-weeks	20,000 IU of vitamin D per week	Yes

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