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Association between Vitamin D Intake and Its Beneficial Effect on Cardiometabolic Disorders in Children and Adolescents with Obesity

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ABSTRACT

Introduction-Purpose: It is a fact that there has been a dramatic increase in the global prevalence of overweight children and adolescents with obesity in the last decade. From the existing literature, it has been shown that it is somehow related to the low serum concentration of 25-hydroxyvitamin D (s25(OH)D). Several studies suggest the consumption of vitamin D supplements in children-adolescent patients with obesity, despite its controversial effectiveness. The aim is to detect a correlation and evaluate the intake of vitamin D supplements and its effectiveness in the treatment of metabolic disorders of overweight and obese children-adolescents.

Material and Method: A review of current literature on vitamin D and cardiometabolic syndrome (MetS) in children and adolescents was carried out, using several databases such as PubMed, Cross Ref, Cochrane Library and Google Scholar.

Results: A combination of available sources shows that insufficient vitamin D levels have the potential to affect various aspects of health, including cardiovascular well-being. In children-adolescents with obesity, there is difficulty in increasing vitamin D levels due to its possible thinning in adipose tissue, either due to limited exposure to sunlight or due to low consumption of foods rich in vitamin D. Recommended doses daily vitamin D consumption is usually >4,000IU. A positive impact has been found with vitamin D restoration therapy on insulin secretion and function, improvement of lipid profile and reduction of body mass index (BMI). However, the effect of vitamin D appears to have limited clinical significance and controversial cardiovascular and metabolic effects.

Conclusions: In conclusion, it has been found that the consumption of vitamin D supplements slightly increases s25(OH)D levels in overweight-obese children-adolescents and that there is a link between its increase and its effects on certain complications that follow the disease. Nevertheless, more extensive research, continued vigilance of relevant bodies and parents and efforts to promote effective interventions to improve the health of parents are recommended. overweight children-adolescents.

KEYWORDS: Adolescent Obesity, Cardiovascular Disease, Children Obesity, Metabolic Syndrome, Vitamin D, s25(OH)D

ARTICLE DETAILS

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INTRODUCTION: The increase in the global prevalence of overweight and obesity in children and adolescents has emerged as a global public health problem[1]. Obesity is one of the most important risk factors for cardiovascular disease (CVD) and various other metabolic disorders such as dyslipidemia and hypertension. The mentioned risk factors for cardiovascular disease tend to cluster not only in adults but also in children. This grouping contributed to the definition of the metabolic syndrome-MetS[2]. It is crucial to identify subjects with the MetS and this is due to the great risk of developing CVD, type 2 diabetes, stroke, and kidney failure and in addition, each component can be treated on an individual basis[3].

Establishing a consensus definition for MetS in the pediatric population has always been challenging because of the changes in blood pressure, lipid concentrations, and body

proportions observed with increasing age. The International Diabetes Federation in 2007 developed a universally accepted and easy-to-use definition for MetS in children and adolescents[4]. Its creation was aimed at taking preventive measures before the child or teenager develops type 2 diabetes or CVD. A key part of the definition is waist circumference where it is an independent predisposing factor for insulin resistance, lipid levels and blood pressure[5].

Age (years)	Obesity (WC)	Triglycerides	HDL-C	Blood pressure	Glucose
6-<10	≥ 90th percentile	Metabolic syndrome cannot be diagnosed, but further measurements should be made if there is a family history of metabolic syndrome, T2DM, dyslipidemia, cardiovascular disease, hypertension and/or obesity			
10-<16	≥ 90th percentile or adult cut-off if lower	≥1.7 mmol/L (≥150 mg/dL)	<1.03 mmol/L (<40 mg/dL)	Systolic ≥130/ diastolic ≥85 mm Hg	≥5.6 mmol/L (100 mg/dL) (If ≥5.6 mmol/L [or known T2DM] recommend an OGTT)
≥ 16 (adult criteria)	Central obesity (defined as waist circumference ≥ 94cm for Europid men and ≥ 80cm for Europid women)	≥1.7 mmol/L (≥150 mg/dL)	<1.03 mmol/L (<40 mg/dL) in males and <1.29 mmol/L (<50 mg/dL) in females, or specific treatment for these lipid measurements	Systolic ≥130/ diastolic ≥85 mm Hg, or treatment of previously diagnosed hypertension	Fasting plasma glucose ≥5.6 mmol/L (100 mg/dL), or previously diagnosed type 2 diabetes

Figure 1. IDF Consensus definition of the Metabolic Syndrome in children and adolescents, Higgins, V., & Adeli, K. (2017).

Regarding vitamin D, its two most common forms are ergocalciferol (vitamin D2) and cholecalciferol (vitamin D3). These enter the circulation and, bound to vitamin D-binding protein, are transported to the liver where the first of two hydroxylation steps occurs, producing the predominant circulating vitamin D metabolite, 25-hydroxyvitamin D (25(OH). The most accurate method to determine a person's vitamin D status is to measure serum 25(OH)D concentrations[6]. The enzyme 25-hydroxyvitamin D3-1-α-hydroxylase (CYP27B1) is responsible for the second hydroxylation step and it is a member of the P450 family. It is responsible for the production of 1,25(OH)2D, which is the active form of vitamin D. The action of vitamin D is achieved through a mechanism mediated by the vitamin D receptor (VDR) in which 1,25(OH) 2D regulates the transcription of a wide variety of genes in vitamin D target cells[7].

In summary, it is understood that vitamin D can act through numerous non-genomic mechanisms, including protein expression, oxidative stress, inflammation, and cellular metabolism. The findings suggest that vitamin D plays a role in obesity[8]. Current evidence from various types of studies suggests that obesity leads to lower 25(OH)D, while the opposite relationship is generally not supported[9]. Whether routine vitamin D supplementation can restore normal circulating 25(OH)D levels in obese subjects is unclear[10,11].

METHODS

The literature search was conducted in several databases (PubMed, Cross Ref, Cochrane Library and Google Scholar) using the following search string: Vitamin D-25(OH)D, obese-overweight, children-adolescent, metabolic syndrome-cardiovascular disease.

RESULTS-DISCUSSION

High-dose Vit-D supplementation (over 4000 IU/day) would reduce several markers of cardiometabolic risk and improve insulin resistance[12]. In addition, vitamin D supplements offer to the human body many benefits and have a limited number of sides effects[13]. Vitamin D supplementation significantly increases 25(OH)D levels, but its effect appears to be of limited clinical significance. Data on effects on metabolic and cardiovascular outcomes remain controversial[14]. Therefore, high-quality, large-scale randomized controlled trials are needed to collect data. Their main pursuit will be to

investigate, explain, prove, or disprove epidemiological associations between low vitamin D status and markers of metabolic disfunction, MetS and CVD.

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