Metabolic Disorder in Sarcopenia Elderly :

is there any for Vitamin D

Yang Du · Jae-kyung No*  

Department of Food & Nutrition, Kyungsung University;

ABSTRACT

Vitamin D is an important regulator of calcium, phosphorus and bone metabolism and it is related to the development of many diseases. Nowadays, vitamin D deficiency is a worldwide public health issue. Vitamin D deficiency could impair muscle function, decrease the muscle strength and increase the incidence of sarcopenia and metabolic syndrome in elderly people. Supplementation with vitamin D may improve muscle function and reduce the risk for sarcopenia and metabolic syndrome. The aim of this review is to summarize the current knowledge from recently published studies on the relationship between vitamin D, sarcopenia, metabolic syndrome from the perspectives of vitamin D metabolism, main function mechanisms, reasons and results of vitamin D deficiency, and vitamin D therapy.

Key Word : Vitamin D, Sarcopenia, Metabolic syndrome, Elderly, Insulin

Introduction

Sarcopenia is defined as the age-related loss of skeletal muscle mass and strength. Recently, some studies showed that inflammatory cytokines produced by adipose tissue in sarcopenia elderly can lead to the reduction of skeletal muscle and the change of physical
fitness, and then the prevalence of metabolic disorder will increase. This paper aims to indicate the role of vitamin D in sarcopenia elderly will reduce the prevalence of metabolic disorder. In recent years, studies found that vitamin D has a protective effect on pancreatic islets(langerhans) in sarcopenia elderly, and is the essential substance to maintain normal insulin secretion and glucose tolerance. Studies have shown that vitamin D concentrations in the blood are associated with metabolic disorder. Meanwhile, clinical studies have also demonstrated that vitamin D is essential to ensure normal release of insulin and to maintain normal glucose tolerance. Vitamin D may affect fat formation and insulin resistance, however, the deficiency of vitamin D is not only directly related to the occurrence of insulin resistance and hypertension, but also significantly increases the risk of metabolic disorder.

The findings suggest that vitamin D deficiency in sarcopenia elderly is closely related to the metabolic disorder and is one of the vital factors for the occurrence of metabolic disorder.

Sarcopenia

As the elderly population has dramatically increased, the rising number of organization and researchers are incumbent to concentrate on aging related sarcopenia. The world’s elderly population has dramatically increased, with more and more seniors having to focus on aging related sarcopenia. Sarcopenia is a common clinical syndrome characterized by the decrease in skeletal muscle mass and function. And in the elderly, it is also accompanied by malnutrition, chronic diseases, malignancies, inflammation and other diseases. Now, there are 50 million patients with muscle reduction all over the world, and the number of patients will be about 500 million in 2050.1 The population of the elderly in Korea increased dramatically. The population aged over 65 was 400,000 (3.1%) in 1979, 11% in 2010 and 14.3% in 2018.2 With the aging of the population, sarcopenia is becoming more and more common, meanwhile, although the pathogenesis and pathogenesis of muscle deficiency is poorly diagnosed, the associated diseases caused by Sarcopenia have become the most important public health problem in current society.

Lee et al3 conducted a survey of 158 men (mean age 71.8 years) and 241 women (mean age 70.6 years) which found that a reduction in ASM was tightly linked to insulin resistance. There is growing evidence that metabolic diseases such as diabetes and high blood pressure can affect sarcopenia. According to the findings of previous researches, it is more certain that sarcopenia and metabolic risk factors are related in the elderly. 45

The muscle loss during aging is inevitable. Accordingly, it is necessary to conduct a thorough study on sarcopenia so that the elderly can prevent them in the early stage, so as to avoid causing chronic diseases such as metabolic diseases. Especially in the developed countries, the growth rate of the elderly is higher than expectation, therefore, muscle reduction is supposed to attract everyone’s attention.

Metabolic syndrome

The increase in the incidence of metabolic diseases among the elderly around the whole world has caused a heavy burden on society. Metabolic syndrome (MS) is a state in which multiple metabolic risk factors are clustered in the individual, and the study of MS is increasing. In 1999, the World Health Organization (WHO) defined the metabolic syndrome as impaired glucose regulation (IGR) or diabetes mellitus (DM), and / or insulin resistance, with two or more additional components, such as, hypertension, hypertriglyceridemia and / or LDL-C, metabolic syndrome, proteinuria and other diseases. With the improvement of living standards, the morbidity rate of metabolic syndrome significantly increased, and it has become a public health issue with global concern.

It is known that muscle depletes plenty of
glucose, and with the reduction of muscle mass, more glucose metabolism will be consumed, meanwhile, the morbidity of other metabolic diseases also can increase. Collectively, metabolic risk factors are closely relevant to hypertension and type 2 diabetes in the elderly. For these facets, with the aging process, finding metabolic risk factors with its early stage is capable of preventing its occurrence for the susceptible patients and is of great meaning for the preventive treatment of chronic diseases.

**Sarcopenia and vitamin D**

Vitamin D is an important factor in regulating the balance of calcium, phosphorus and bone metabolism are associated with a variety of diseases. Vitamin D deficiency can affect muscle function, and lead to the decrease of muscle strength and balance, and increase the risk of fracture of the elderly. The supplementation of vitamin D can improve muscle function and reduce the occurrence of fall and fracture. The main active form of vitamin D which is after transformation in the body is 1,25-dihydroxy vitamin D, 1,25(OH)2D. And vitamin D is an important factor in regulating the balance of calcium, phosphorus and bone metabolism. The secondary parathyroid hormone secretion induce by the lack or deficiency of vitamin D is one of the pathophysiological mechanisms of osteoporosis. Vitamin D deficiency not only affects bone metabolism, but also associates with cardiovascular disease, diabetes, metabolic syndrome, cancer, autoimmune diseases, multiple sclerosis and other related diseases.

Studies have shown that vitamin D and muscle are function related, and vitamin D deficiency can lead to the increase of body shaking and the decrease of muscle strength. Muscle weakness, muscle contraction, and muscular diastolic dysfunction occur in a variety of vitamin D deficient states, such as osteoporosis, malabsorption syndrome, gastrectomy, and chronic kidney disease.

Pfeifer et al. studied 242 older women whose age is from 73 to 81 living in the communities with 25 (OH) D levels <78 nmol / L, 1000 mg of calcium or 1000 mg of calcium combined with 800 U of vitamin D for 12 months and discontinuation of follow up for 8 months. The combination of vitamin D and calcium significantly reduced the risk of primary fractures (12 months: -27%; 20 months: -39%), and significantly improved quadriceps strength (+ 8%), reduced body swing (+28%), and shorten the time to complete the walking-walking experiment (-11%). Glerep et al. found that women living in Denmark, muscle strength and its serum 25 (OH) D levels were significantly related.

In women with vitamin D deficiency [serum 25 (OH) D levels <20 nmol / L], the maximum self-extension of the knee joint was reduced by 34% compared with the Danish control group. Monthly intramuscular injection of 100,000 U ergocalciferol, daily oral administration of 1200 mg of calcium and 400 U ergocalciferol, treatment of 3 months and 6 months after the maximum muscle maximum voluntary contractility increased by 13% and 24%. Myasthenia is a common symptom in patients with vitamin D deficiency [serum 25(OH)D levels<30 nmol/L].

Evidence suggests that body swing is an early manifestation of vitamin D deficiency related myopathy, with the increase in serum 25(OH)D levels<50 nmol/L. As a result, the incidence of non-vertebral fractures and falls is reduced in the elderly population using vitamin D prophylaxis.

**Metabolic syndrome and vitamin D**

Vitamin D is a necessary nutrient for the human body, and it is mainly from the sun after the skin synthesis and diet intake. In recent years, the studies found that vitamin D has a protective effect on pancreatic islets, and is essential to maintain normal insulin secretion and glucose tolerance. Studies have shown that serum vitamin D concentrations are associated
with hypertension, diabetes, obesity, insulin resistance, etc. Impaired glucose tolerance, diabetes, obesity, lipid metabolism disorders and hypertension are independent risk factors for cardiovascular disease, and when they exist in the same individual, the risk of cardiovascular disease greatly increases. This abnormal state of multiple metabolic components’ aggregation is called metabolic syndrome (MS). Clinical and animal model studies have verified that vitamin D is essential to ensure normal release of insulin and to maintain the normal glucose tolerance. The receptor gene polymorphisms of vitamin D may affect fat formation as well as insulin sensitivity. Vitamin D deficiency is not only directly related to insulin resistance and the occurrence of hypertension, but also significantly increases the risk of the occurrence of metabolic syndrome.

Conclusion

Because vitamin D levels are influenced by many factors, such as age, sex, heredity, culture background, lifestyle, region and season, the standard of vitamin D status is not unified at present. Vitamin D and calcium deficiency in patients currently recommended 800 U vitamin D and 1200 mg of calcium in combination therapy, but vitamin D levels in patients with normal vitamin D by the significance of the prevention of sarcopenia and metabolic syndrome, to maintain normal muscle strength required for proper vitamin D levels. And effects of vitamin D and metabolic syndrome of the specific mechanism of action still needs further study.

Reference


