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Mini Review

Nutritional Status of Minerals and Sarcopenia

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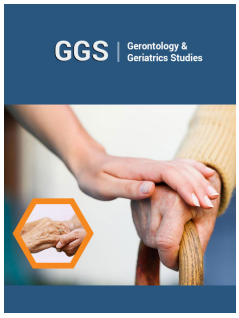

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Reduction in the quality or quantity of Muscle Mass (MM) constitutes the current concept of sarcopenia, a condition related to functional loss [1], falls, fractures and dependence, hospitalizations, and mortality [2]. Minerals are related to the prevention of sarcopenia [3], as they influence the functions of the antioxidant system [4,5], muscle synthesis [4] and muscle contraction and relaxation [6]. Some studies [7-9] found an association between minerals and loss of muscle mass, strength, and physical performance, also suggesting a role in the treatment of sarcopenia.

The role of Ca in sarcopenia has been suggested through the modulation of calpains and cysteine proteases responsible for regulating key processes in myogenesis [10]. Adequate Ca intake may be associated with lower chances of sarcopenia [8,11], but these findings are conflicting [8,9,12]. This may be due to the difference in the Ca intake of the populations studied and the serum levels of 25-hydroxyvitamin D, which were significantly lower in the studies that found an association between Ca and sarcopenia [8] than in the studies that did not, [9,12]. However, the study by Seo et al. [8] showed that after adjusting of 25-hydroxyvitamin D, Ca intake remained associated with sarcopenia [8].

Phosphorus (P) is as important as Ca in bone and muscle health. The ideal ratio of Ca: P intake is about 1:5, however, it is usually lower when there is a high consumption of processed foods [13]. A lack of P can lead to muscle weakness, and sarcopenic elderly people seem to consume less P in their diets than non-sarcopenic people [12]. A cross-sectional analysis of 7,421 subjects found an inverse association between phosphate and muscle strength in the elderly [14], but more research is needed to consolidate a link between P and muscle mass preservation.

Magnesium (Mg) depletion can cause changes in muscle cells by increasing oxidative stress and decreasing intracellular Ca homeostasis [4]. A recent cross-sectional study with 396,283 participants found an inverse association between Mg intake and sarcopenia [11]. The "In CHIANTI" study found a significant and strong relationship between circulating Mg and muscle performance in the elderly [15]. The "Maastricht Sarcopenia Study" demonstrated 12% lower Mg consumption in the sarcopenic group, compared to non-sarcopenic elderly people, but without differences in serum concentrations [9]. In the study by Verlaan et al. [12], Mg intake also differed significantly between sarcopenic and non-sarcopenic individuals, and in the last two studies, dietary Mg intake in sarcopenic elderly was below the recommendation, leading to the belief that this nutrient may be important to prevent and treat sarcopenia in these individuals [12]. In a cross-sectional analysis, individuals who reported higher potassium (K) intake were associated with lower probability of developing sarcopenia [11]. K is important for the maintenance of cell membrane and the regulation of

smooth, cardiac and skeletal muscle [13]. Any sudden changes in the intra and extracellular concentration of Na and K can affect muscle function.

Se seems to have a positive association with muscle mass, physical performance, and sarcopenia, even if there is consumption below the recommendation and low serum concentrations [9,12]. Through selenoproteins (SelP), Se influences muscle synthesis and function, although the exact underlying mechanisms remain unclear [16]. The variation in the Se state seems to influence different cellular pathways, such as the mTOR pathway, which correlates with the aging process [17]. Se intake was lower in sarcopenic older adults compared to non-sarcopenic older adults [9,12] and associated with better results on the walk, chair, and balance test [18]. However, Chaput et al. [19] found no association between Se and muscle mass, which can be explained by the high mineral intake, which was twice the recommendation [19].

Zinc (Zn), on the other hand, is involved in metabolic, structural, catalytic, co-catalytic and regulatory functions, being an integral part of antioxidant enzymes, such as copper-zinc-superoxide dismutase [20], delaying oxidative processes, which contribute to the muscle atrophy [4,6]. Iron (Fe), due to its role in oxygen transport, in a deficiency state, it seems to reduce physical performance. But the relationship of these minerals with sarcopenia are not described in the literature. According to a recent review, possible effects of sodium (Na) on sarcopenia remain unclear because of an insufficient number of articles [7].

Conclusion

According to these findings, minerals have a high potential for the prevention and treatment of sarcopenia due to their numerous functions. However, the lack of intervention and case-control studies limits conclusions about their effects in this condition, especially regarding supplementation. What is clear is the low intake of these micronutrients and the association with sarcopenia. The dietary consumption of these minerals, through food, should be encouraged in elderly people.

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