



Handgrip Strength: An Irreplaceable Indicator of Muscle Function

Sang Yoon Lee

Department of Rehabilitation Medicine, Seoul National University College of Medicine,
SMG-SNU Boramae Medical Center, Seoul, Korea

Handgrip strength (HGS) is a simple and reliable measurement of maximum voluntary muscle strength. It is an important tool for diagnosing sarcopenia and is widely used as a single indicator to represent overall muscle strength [1-4]. HGS can predict not only muscle mass and physical activity [5], but also the incidence of chronic diseases, nutritional status, quality of life, independence of daily life, length of hospital stay, and even mortality [6-9].

The European Working Group on Sarcopenia in Older People (EWGSOP) and the Asian Working Group for Sarcopenia (AWGS) recommended HGS as one of the axes for diagnosing sarcopenia [1,2]. HGS measurement is also the first step in the diagnosis of sarcopenia; according to the algorithm for sarcopenia detection from the EWGSOP-2, if a subject's HGS is normal, no further screening test is necessary [2].

HGS varies according to age, sex, and race [10]. In Asians, the AWGS first proposed a low HGS to be <26 kg in men and <18 kg women or the lower 20th percentile of the HGS of the study population before outcome-based data are available [11]. An update from the AWGS in 2016 suggested that previous consensus cutoff points might require further modifications [1], and the AWGS recently suggested a low HGS of <28.0 kg for men and <17.7 kg for women with pooled datasets from various countries in

Asia [12].

HGS is correlated with several medical diseases, including chronic anemia [13], dyslipidemia [14], hypertension [15], metabolic syndrome [16], and chronic kidney disease [17]. It is also associated with dietary intake [18] and dietary patterns [19]. Among micronutrients, vitamin D and HGS have been widely investigated, and low HGS is associated with vitamin D deficiency [20]. The serum 25(OH)D concentration is also significantly related to HGS [21]. These results are sufficiently predictable given the effect of vitamin D on muscle physiology. Vitamin D plays a major role in protein synthesis through vitamin D receptors in muscles, improving muscle strength and physical function [22]. Interestingly, one study reported that serum vitamin D levels were associated with HGS but not with muscle mass [23]. Thus, we conclude that HGS has a greater influence on muscle function than muscle mass.

Recent studies have shown that vitamin E is associated with muscle aging and regeneration. Vitamin E has been studied as an anti-aging agent mainly because of its anti-inflammatory and antioxidant effects [24]. However, in addition to these effects, vitamin E has been shown to induce myoblast proliferation and increase muscle mass [25]. Furthermore, vitamin E can reduce muscle damage,

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Corresponding author: Sang Yoon Lee

Department of Rehabilitation Medicine, Seoul National University College of Medicine, SMG-SNU Boramae Medical Center, 20 Boramae-ro 5-gil, Dongjak-gu, Seoul 07061, Korea. Tel: +82-2-870-2673, Fax: +82-2 831-0714, E-mail: lsy126@snu.ac.kr
ORCID: Sang Yoon Lee (<http://orcid.org/0000-0002-2906-3094>).

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enhance recovery from exercise, and prevent muscle atrophy [26]. Since most of these studies were conducted as preclinical studies or basic experiments, clinical studies are indispensable.

A study on the correlation between serum vitamin E levels and HGS published in this issue of the *Annals of Rehabilitation Medicine* is considered the first attempt on this topic and is a very remarkable study [27]. The authors analyzed the correlation between vitamin E levels and HGS in 1,814 adults by multiple logistic regression using data from the 2018 Korea National Health and Nutrition Examination Survey (KNHANES VII). The analysis revealed that young men with higher serum vitamin E levels had higher HGS. Although the results of the study have various limitations, they are expected to be a good reference for further studies as they were obtained from a large number of human subjects.

As in a large-scale study, HGS is the simplest and most accurate indicator that can reflect an individual's muscle strength status. Therefore, HGS has been continuously used as a biomarker of current status [28]. In addition, HGS has been identified as an indicator that can predict an individual's future health status, even mortality; a few meta-analyses have supported the association of weak HGS with all-cause mortality in the general population [29,30] and calculated a pooled hazard ratio of 1.16 per 5 kg reduction in HGS. In addition, it is a potential predictor of cardiovascular [31] and cancer [32] mortality.

Based on this evidence, HGS is now irreplaceable as an indicator of muscle function. Thus, HGS measurement should be strongly recommended as a routine test in hospital practice and community healthcare and not only in the research field.

CONFLICT OF INTEREST

No potential conflict of interest relevant to this article was reported.

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