

Editorial**No external load (no-load) resistance training to maintain muscle function in the face of the COVID-19 outbreak**

The respiratory disease named coronavirus disease 2019 (COVID-19)¹ that occurred in 2019-2020 spread rapidly around the world. The most affected people by this pandemic may be older individuals who have comorbidities and are susceptible to infections.² Safe and effective pharmacological treatment of COVID-19 has just begun.³ In many countries, however, quarantines are still ongoing as a precautionary measure against the spread of the disease. While this measure slows the spread of the virus, it also reduces people's physical activity levels. It is well known that physical inactivity and sedentary behavior leads to the development of cardiovascular diseases and mortality in older adults.^{4,5} A viable way to still get physical activity during the pandemic is through outdoor physical activity (e.g., walking, jogging, and cycling), which is carried out while avoiding close physical contact with people as much as possible. At the same time, it is important to include resistance exercises to prevent muscle weakness.⁶ Naturally, a method that does not require facilities or pieces of equipment for resistance training is desirable during the pandemic.⁷

No-load (no external load) resistance training can be performed anywhere and requires no equipment. In 2016, Counts et al.⁸ were the first to investigate the effects of no-load resistance training and traditional high-load (70% of one repetition maximum) resistance training on muscle strength and muscle size in healthy young adults. The authors reported that both no-load and high-load training programs elicited increases in elbow flexor muscle strength, although the degree of increase was greater for the high-load condition. However, the increase in anterior upper arm muscle size was similar between the no-load and high-load conditions. Regarding multiple types of exercise programs for hospitalized patients, Barbalho et al.⁹ compared the effects of no-load resistance training and elastic band resistance training on muscle size and function. Both training groups did upper body training (e.g., seated chest press, lat pull, elbow extension and flexion) and both groups observed an increase in muscle size of the biceps brachii, triceps brachii, and pectoralis muscles. The functional capacity using the 30-second elbow flexion test also improved similarly in both training groups. These results suggest that it is possible to improve muscular strength and function without the use of equipment or one's own body mass for resistance.

Of note, although it is said to be "No External Load", a high level of effort is required for effective training. Lack of motivation can lead to a failure to maintain contraction intensity which may produce insufficient improvements in muscle strength.¹⁰ The no-load training exercise is defined as a maximum voluntary contraction of muscle through the full range of motion in selected movements.^{8,9} No-load can also be combined with bodyweight exercise. By combining both, it is possible to maintain a high muscle activity level at all times regardless of the muscle strength level by performing voluntary maximum contractions during bodyweight exercise. No-load resistance training is also effective for movements where an individual's body mass cannot be used as resistance. There is no doubt that additional research is needed to determine the extent of training effects, however, no-load training may be a viable option to consider when more traditional methods (e.g. fitness clubs and gyms) are not available.

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