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Effect of TRX Suspension Training on Physical Function in Elderly Men with Sarcopenia

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Abstract: Elderly people have reduced muscle mass, decreased physical function and an increased hospitalization probability, which affect their quality of life and even lead to death in severe cases. Scholars at home and abroad have studied progressive body muscle loss associated with increase of age, decreased muscle strength and muscle function impairment syndrome and how to prevent them. Much research have been done preventing diseases and improving muscle strength through exercising, nutrition, and drug intervention, and these measures have been proven effective. This article describes the effect of exercising in reducing muscle disease, improving muscle mass, and physical abilities of the elderly. This study can not only effectively enrich the research results related to exercise therapy of sarcopenia, but is also in line with national strategies and policies such as the "national fitness campaign," "Healthy China 2030 Plan Outline," and "Healthy China Action 2019-2030" depending on the health conditions of the elderly population. Besides, this paper aims to develop individualized exercise programs, provide scientific basis for the prevention and treatment of sarcopenia in the elderly, reduce the risk of fall damage in the elderly, and promote the physical health level of the elderly.

Keywords: Elderly; Resistance movement; Sarcopenia; Muscle strength; Ability to walk

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1. Introduction

With the development of the world in the 21st century, the problem of aging has become increasingly alarming around the world, including China. Studies show that the elderly population in China (65 years old and above) will increase from 140 million to about 365 million, and is expected to peak (more than 400 million) from 2055 to 2060, with the fastest growth in 2015 to 2035. With the large number of elderly people in our country, there will be a widespread of a medical issue known as sarcopenia. Sarcopenia is a widely recognized geriatric syndrome. Sarcopenia in the elderly is defined by the European Union Working Group as a syndrome of generalized and progressive loss of skeletal muscle mass and muscle strength, leading to a variety of adverse outcomes, such as physical disability, reduced quality of life, and even death. Sarcopenia symptoms begin appearing around the age of 40, reducing muscle strength by 8% every 10 years before age 70, 15% every ten years after age 70, and even 50% by age 80. The past 20 years have seen an increase in the number of studies and knowledge of sarcopenia worldwide [1]. One of the risk factors of sarcopenia is low physical activity. Most of the patients are elderly, and the common characteristic among these elderly people is low physical activity. At present, there are not many methods for the prevention and treatment of sarcopenia. Among them, an effective method recognized by professionals is TRX Suspension Training and nutrition conditioning, which can delay the development of sarcopenia. However, at present, the optimization of TRX Suspension Training and nutrition conditioning plan still

needs to be studied. Most treatment methods of sarcopenia refer to are based on data from foreign countries, while few studies are done on sarcopenia in China [2]. High-level evidence of TRX Suspension Trainer's effectiveness as a treatment for sarcopenia is still lacking, and more studies are needed.

2. Effects of TRX Suspension Training on the body of elderly men with sarcopenia

TRX Suspension Training, also known as strength exercise, refers to a form of exercise in which muscles actively contract against resistance. Under normal circumstances, the intensity of this exercise is much higher than the capacity of muscles in the aerobic state, and the duration of it is short, and causes exhaustion. Muscles are responsible for human voluntary movements, and muscle movements, especially resistance movements, can cause a lot of physiological and biochemical changes in muscles. After the age of 30, people usually lose 5% of their lean body tissue every 10 years, and after the age of 50, they lose about 6%–7% of their lean body tissue every 10 years, which is equivalent to about half a pound (227 grams) of lean body tissue per year on average. In recent years, more and more literatures have verified that TRX Suspension Trainer can increase the number and cross-sectional area of skeletal muscle fibers, thereby alleviating or even reversing the muscle loss and muscle strength decline caused by aging. A study of more than 1600 subjects (aged 21-80) showed that 10 weeks of TRX Suspension Training resulted in an increase of around 1360g of lean body tissue; 36 weeks of TRX Suspension Training doubled the increase in lean body tissue compared with 10 weeks of exercise. Besides, another study showed that one cycle (12-16 weeks) of TRX Suspension Training increased thigh circumference by 11.4% and muscle volume by 3.8%. Moreover, numerous studies have shown that TRX Suspension Training-induced muscle growth can occur at any age, even in people in their 90s. Given the positive effect of resistant exercises on muscle mass, a growing number of studies have added resistance exercises in the treatment of muscle disease. A controlled study that involved 45 subjects shows that doing resistance exercise twice a week for 6 months, with a total exercise duration of less than 50 hours can significantly increase grip strength, walking speed. Another meta-analysis confirmed that while strength gains varied between studies, the positive effects were definite, with higher intensity exercise showing greater improvement, with strength gains ranging from 9.8 kg to 31.6 kg.

2.1. Effects of TRX Suspension Training on muscle strength in elderly men with sarcopenia

Based on anthropometric and bioelectronic findings, Calatayud et al. showed that TRX Suspension Training was the most challenging exercise for older men. At the same time, the effects of different forms of resistance exercise were analyzed, and it was concluded that the triceps and biceps muscles were both activated after exercise, and the intensity was 60% higher than that of the maximum voluntary contraction. According to these findings, postexercise exercises can fully strengthen the muscle strength and movement of triceps brachii, biceps brachii, and lateral and superficial muscle groups, and thus it is considered as one of the important means of strength exercise for elderly men [3]. This also indicates that TRX Suspension Training can promote the increase of muscle strength in elderly men. TRX Suspension Training increases deeper activation of muscle groups. In order to study the resistance movement, the degree of muscle activation was kept constant. 32 healthy men and women were selected, their deltoid, pectoralis major, saw muscle and triceps were tested before and after the training program. It was concluded that TRX Suspension Training can better activate [4] the upper body and core muscles significantly.

2.2. Adaptive changes of the nervous system caused by TRX Suspension Training

Increasing nerve impulses is the key to maximum strength or power. Increased nerve impulses are achieved by increasing the recruitment of motor units of active muscles and increasing the firing frequency. During intense muscle contractions, the weakening of inhibitory mechanisms (such as the Golgi apparatus) also

causes an increase in nerve impulses. It is clear that neural adaptation is complex and often precedes structural changes. The non-exercising population is less able to maximize the recruitment of motor units, especially fast muscle units [5]. Using MRI, Adam et al. found that the motor units that could be activated directly in people who do not exercise accounted for only 71% of the total muscle, while the percentage was much higher in people who exercises frequently. All motor units need to be activated when muscles need to exert maximum strength. The firing frequency of motor units affects muscle strength. The increase in maximum force or power is usually achieved by increasing the number of recruited motor units, increasing the firing frequency, and increasing the firing synchrony. The recruitment of motor units follows the principle of size, that is, the small slow motor units are recruited first, and then the large fast motor units. In the process of depolarization, the big fast muscles are also mobilized first, and then the small muscles. Power sports can enable selective recruitment of participants [6]. According to the size principle, for a quick move like a jump (< 0.4 seconds), all the slow muscles must be recruited first followed by the fast muscles, which means that the jump cannot be completed because there is no time to recruit the fast muscles. Selective recruitment of explosion-friendly movements, long-term weight-bearing practice also leads to decreased muscle activation levels for the same amount of load. A researcher found that after nine weeks of weight-bearing exercise, the quadriceps recruited fewer muscle fibers when lifting a specific load. This result illustrates the importance of increasing the load gradually. Another adaptation of weight-bearing exercise is the change in discharge frequency and order. There is a positive correlation between the discharge frequency and the force generated. Strength training increases the firing rate of motor units [7]. The high frequency discharge in the initial stage of rapid action is the key to increase the speed of force. In short, increasing the discharge frequency is the key to increasing the maximum power. TRX Suspension Training also helps to improve the synchrony of motor units, in which two or more motor units fire at fixed intervals. Synchronization is more critical for the timing of power generation, meaning it is significant for individual actions and limited for the generation of maximum power in general. The stretch reflex increases the rate and magnitude of muscle strength and is essential for rapid, explosive movements. TRX Suspension Training improves stretch reflexes by 19% to 55%. Soleus muscles of athletes who regularly participate in TRX Suspension Training have stronger reflexes than non-athletes. Neural adaptation plays a major role in the early stages of exercise (6–10 weeks), before the effects of muscle hypertrophy are seen [8]. After 10 weeks, muscle hypertrophy begins to appear, often accompanied by a decline in EMG. Although the muscle hypertrophy will eventually stall, the adaptation of the nervous system will lead to further improvements in performance if the exercise load is gradually increased. The neurological aspect is also very important for strength growth, explosive power growth, power growth during very intense exercise [9]. In addition to the improvement of muscle growth and muscle strength, TRX Suspension Training also has a great impact on bone mineral density, energy metabolism, blood pressure, and many more.

2.3. TRX Suspension Training and energy metabolism

At rest, a pound of muscle that has not participated in TRX Suspension Trainer s requires 5-6 kcal per day for protein breakdown and synthesis, while a pound of muscle that HAS participated in TRX Suspension Trainer s requires approximately 9 kcal per day for protein breakdown and repair [10]. High-volume TRX Suspension Training (8 sets of 8 exercises) increased energy metabolism by 8–9%, 72 h after exercise. Not only does TRX Suspension Training increases lean muscle mass, it also reduces fat accumulation in the body. TRX Suspension Training can reduce intra-abdominal fat in both men and women. 20 minutes of TRX Suspension Trainer three times a week can reduce body fat by 1.5 lbs/month. TRX Suspension Trainer is therefore recommended for the prevention and treatment of obesity [11].

2.4. Effect of TRX Suspension Training on walking ability in the elderly with sarcopenia

Aging can lead to decreased walking ability, shorter stride length, increased stride width, longer standing time, and reduced joint range of motion during walking. Walking ability can be divided into four areas: (i) pace (speed of walking a straight line), (ii) arm and torso movements, (iii) dynamic stability, and (iv) turning. The relevant parameters are walking ability cycle time, rhythm, stride length and leg range of motion. The average speed of an elderly person is 0.48 to 0.67 meters per second [10]. Elderly people often increase their walking speed by increasing stride frequency; in contrast, young people increase their stride length. TRX Suspension Training improves physical function and quality of life, reduces the burden of noncommunicable diseases and premature overall mortality, including specific mortality caused by cardiovascular diseases, cancer and chronic lower respiratory diseases [12]. Older adults who have undergone TRX Suspension Training also had better cognitive function or academic performance. Regular physical activity may slow age-related cognitive decline, delay the onset of dementia, and improve the walking ability of the elderly. Secondly, while maintaining balance, the elderly also have a decreased ability to adapt sensory information to the new environment. Unlike younger adults, elderly people have a harder time reintegrating new sensory information to control their balance and are more likely to exhibit postural instability as a result of receiving new sensory information [13]. Improvements in balance through TRX Suspension Training and effective training programs have improved postural control systems in older adults, including the musculoskeletal system, cognitive system, and somatosensory feedback system. Feng et al. performed an 8-week TRX Suspension Training program, which improved static and dynamic balance, strength, flexibility, and walking ability, physical function, and quality of life of elderly people [14].

2.5. TRX Suspension Training and blood glucose and blood pressure

Many studies have shown that TRX Suspension Training can significantly improve insulin sensitivity and glycemic control. Therefore, TRX Suspension Training is an effective method to prevent type 2 diabetes. There is evidence that TRX Suspension Training improves insulin sensitivity and reduces glycated hemoglobin more than aerobic exercise, and that high-intensity TRX Suspension Training is better than low-intensity TRX Suspension Training. The American Diabetes Association recommends three sets of 8 to 10 exercises in TRX Suspension Training for major large muscle groups, three times a week. TRX Suspension Training for over 2 months can lower quiet blood pressure. Participants who participated in 10 weeks of exercise, performing 20 min of TRX Suspension Training combined with 20 min of aerobic endurance exercise three times a week, reduced systolic blood pressure by 4.6 mm Hg. Another meta-analysis confirmed that TRX Suspension Training was effective in reducing blood pressure, with an average reduction of 6.0 mmHg in systolic blood pressure and 4.7 mmHg in diastolic blood pressure, similar to aerobic exercise [15].

3. Conclusion

In many cases, sarcopenia is age-related, but it can also be due to diseases in a few cases. Age-related sarcopenia can be improved by TRX Suspension Training. Proper TRX Suspension Training can improve muscle strength by improving the walking ability, regulate the endocrine system, improve blood pressure, blood glucose, and bone density, and enhance energy metabolism of the elderly. At the same time, the symptoms of sarcopenia can be controlled by intake of sufficient nutrients and active substances such as whey protein, unsaturated fatty acids, and short peptides, so that they can adhere to long-term, stable, systematic upper and lower limb training. In this way, their balance and proprioception can be improved, hence reducing injury caused by falls and bumps, allowing them to actively participate in other sports activities. Besides, it also helps slow down aging and increases the quality of life. However, TRX Suspension Training needs to be done correctly to avoid injury.

Disclosure statement

The author declares no conflict of interest.

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