

Resistance training for the elderly. Review of the literature

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Abstract

With age, there is a gradual decrease in muscle mass and strength, and the use of strength training contributes to the slowdown of this process. It is also recommended in older people due to the increase in bone mass. An important element of planning this type of training, including the advancement of the person exercising is their lifestyle and the results obtained in strength tests. Due to the age, remember to exercise caution when doing this type of exercise and monitor the course of the training, e.g. by controlling the exercising heart rate or using the Borg scale. Avoid extreme strength and endurance exhaustion as it results in an increase in blood pressure. Strength training brings a number of benefits, but unpredictably planned and conducted also a number of threats. It is indicated in some disease entities, e.g. obesity.

Keywords: resistance training, elder people

Introduction

Elderly people lead above all a sedentary lifestyle. Inactivity is accelerated by the decrease in performance as age increases. The consequence of this condition is the dysfunction of circulatory, respiratory and movement systems. In addition, glucose tolerance, water-electrolyte and orthostatic management are impaired [1].

In an aging body, there is a decrease in the number and size of motor units in rapidly shrinking fibers (FT). The level of activation and contractility of muscle fibers decreases. The hormone concentration and enzymatic activity of the body also decreases, which combined with poorer nutrition and greater susceptibility of the elderly to diseases reduces their level of physical activity [2].

Movement activity promotes the process of favorable aging and limits involution processes. By using regular activity, we can limit the loss of muscle strength. Only up to 30 years of age, there is an increase in muscle strength, and after exceeding this age you can shape strength, but this is a much less dynamic process. To reduce muscle regression, appropriate training should be used [3].

Between 20 and 30 years of age, about 45% of the human body mass is made up of muscles, and after the age of 70 it is only about 27%. In the aging process, muscle mass gradually decreases and muscle fatigue is associated with it [4]. Strength training will not stop muscle and mass loss, but it will slow down this process, which seems important, because lower muscle strength limits the ability to perform activities in everyday life. It is also recommended in older people due to the increase in bone mass, which tends to decrease with age. Recent results indicate that even in older seniors, under the influence of resistance training may increase muscle mass and strength [2]. The increase in muscle strength is also affected by the concentration of anabolic hormones, which in men is higher than in women. The endocrine system is stimulated by resistance exercise, which is why it is often recommended in order to maintain the highest possible efficiency of seniors [3].

Failure to exercise is a stimulus that significantly accelerates the progress of geriatric teams, which include: slowing bowel motility and constipation, emotional-behavioral disorders and cognitive functions, and urinary incontinence and disorders associated with it [5].

A special program was also created: the Elderly Recreation Program - PROS, the aim of which is to encourage seniors to spend time actively and lead a healthy lifestyle [6].

Movement activity in old age

In people in the third period of life, physical activity should be a duty. Activity inhibits the body's aging processes affect the independence of the elderly and psychophysical condition [6]. The Central Statistical Office (GUS) in Warsaw states that in 2005 in Poland, 3.6% of respondents after 65 years of age declared physical activity [5]. The most common obstacle in undertaking physical activity is the lack of adaptation to regular physical exercise and very often concerns about the costs associated with new activities [6]. Buford et al. conducted studies with young (23.8 ± 3.9 years) and elderly (78.3 ± 5.6 years) men and women, which showed that despite the reduction in muscle mass throughout the lower limb, which follows with age, the mass of the thigh muscles has a particular impact on maintaining the functional capacity of the aging organism [2].

Regular physical activity in old age contributes to a beneficial effect on the course of chronic diseases, e.g. hypertension or osteoporosis. The advantage of training is also to increase the sensitivity of cells to insulin and to improve glucose tolerance, and thus reduce the risk of diabetes. Regular activity also has an impact on reducing the risk of infectious diseases and reduces the amount of medicines used. In addition, it allows you to maintain or even improve mental performance in old age [1].

The program of systematic physical activity in people at an advanced age should include:

- 1) aerobic (endurance) exercises aimed at improving aerobic fitness, e.g. swimming, walking, cycling, dancing, cross-country skiing or jogging.
- 2) resistance (strength) exercises that increase muscular strength, e.g. climbing stairs, digging the soil in the garden; during the exercises, you can also use instruments such as band and weights.
- 3) stretching (stretching) exercises aimed at making the muscles more flexible, improving the blood circulation of the motor system and flexibility.
- 4) equivalent and coordination exercises, which have a positive effect on the general efficiency of the elderly person, the possibility of moving around and standing up, e.g. getting up from a sitting position, walking backwards, on the toes or heels [7].

It is recommended to enter the so-called a renaissance pattern of physical activity. The model is based on the introduction of various types of activities to the training in the following days of the week, depending on individual preferences, whereabouts and the time of year [8].

Strength training

Strength training as the name suggests is based on overcoming additional resistance (weights, barbells, training on machines) or the weight of the exerciser [9]. The main goal is to increase the mass (cross-section of the muscle), the strength of antigravity muscles and local strength. In the 1980s, resistance training was a contraindication for the elderly, in the '90s it was already included in the rehabilitation process and is currently indicated in the rehabilitation process [2]. Work on muscular strength is a key element in the prevention of overloads of passive system movements such as bones, joints. Disproportions in the level of force can manifest themselves in pains. One-time taking of physical effort does not give the desired results, on the contrary, it can cause negative effects. Only systematic physical activity, even of low intensity, is an indispensable element of long-lasting and effective prophylaxis [4].

Elderly people should use comprehensive resources of strength training, which includes exercises that affect both the entire muscular system of the body and separate muscle groups. The components of resistance training are: repetition, series, external load, rest time, pace of movement and learning and controlling the appropriate methodology of strength training, preferably under the supervision of a qualified trainer [4]. The proper breathing is important in strength training, so you should teach the elderly the correct respiratory rhythm. Elderly training should be very carefully planned and monitored for changes that take place. Before starting the workout, a muscle strength test should be performed to select the appropriate external load for the trainer. People who do not have experience in strength training (including the elderly) should skip the attempt to test the maximum weight value (100% CM). The maximum weight alternatively can be safely determined using the indirect method. The indirect method consists in exercising by the participant repetitions of exercises against such resistance, which allows to perform a maximum of 10 or 15 repetitions, which corresponds to 75% CM and 65% CM. In the first 8 weeks of resistance training, an external load of 20% CM should be applied, then it can be gradually increased, even up to 50% CM [3].

Beginners are included in the program with less intensity of effort. With the development of the strength of the exerciser, a greater load is activated and the number of repetitions and intensity changes. Between trainings one day free from resistance classes for regeneration is required [9]. The number of repetitions performed in a series depends on the purpose of the training. It is recommended to perform 8-12 repetitions (8-12 RM) of each exercise in shaping strength and muscle mass, while if the improvement is to build local strength strength, the number of repetitions should increase to 12-15 RM in a series. Although older people are able to perform both static and dynamic efforts, they are especially recommended to perform

dynamic (isoinertive, isotonic and isokinetic) exercises, because they burden the cardiovascular system to a lesser degree, and more closely imitate the daily activities of the senior. It is recommended that elderly people take strength exercises 2-3 times a week and perform a program of 8-10 exercises for the main muscle groups. Elderly people are offered 20 minutes of strength training three times a week.

Due to the age, remember to be cautious when doing this type of exercise and monitor the course of training by checking the heart rate (HR) of the exerciser. It is recommended that it should not exceed 220 years in the years [9]. A 20-degree Borg scale can be used to monitor the patient's feelings in relation to the sensation of physical exertion.

People with little experience in this type of training should not use free weights, such as barbells or dumbbells due to the lack of control of the appropriate trajectory. For people who have a sedentary and inactive lifestyle, start with a low external load, which should be about 30% of the maximum weight (CM). This will not cause a significant increase in strength, but will stimulate protein synthesis and activate the endocrine system. Over time, the load is gradually increased to 50-60% CM. This load value significantly contributes to the process of muscular adaptation, limiting muscular atrophy [10].

The basis for the training of muscle strength in older people is the observance of the principle of avoiding extreme strength and endurance exhaustion, which is the result of the increase in blood pressure at loads above 50% of CM [4]. For the first 3 weeks the training should last 20-30 minutes, and over time it can be extended to about 60 minutes.

Keep in mind that training of the elderly should take place in safe conditions, therefore it is recommended to: protect the spine, especially the lumbar, use small loads and gradually increase resistance doses.

Benefits of strength training

Many studies show that strength training brings good results to both young people and the elderly. Improvement of muscle performance as a result of resistance exercise results from improved nervous control and activation of antagonistic muscles. The condition for proper exercise is the use of appropriate intensification of resistance against working muscles. Resistance training has a positive effect on improving the vital functions of the elderly. It is expressed above all: improving the quality of walking on flat terrain and stairs, maintaining balance, the ability to carry heavy objects, increasing the oxygen ceiling, and decreasing body mass [11]. Strength exercises contribute to the increase of muscle mass and strength. They reduce the risk of sarcopenia and functional changes. In addition, regular physical exercise not

only reduces the loss of bone density and loss of muscle mass, but also increases the bone mineral density, thus preventing the onset of osteoporosis. The benefits of strength training are also: prevention of reduction of basic metabolism, increasing endurance, reducing insulin resistance, decreasing adipose tissue content, reducing the risk of falls, normalization of arterial pressure [12, 13].

Larsen et al. used the relationship between the results of the fitness test in everyday activities and the vertical jump from the place of legs. The jump was supposed to be a reference to checking the effectiveness of strength training in older women (69.7 ± 3.4 years). After 12 weeks of resistance training, which included two meetings in a week, a program of 5 exercises for the muscles of the lower limbs in 4 series was carried out. The authors noted an improvement in the jumping parameter in women and an increase in their strength, especially visible in the flexion of the foot. Ribeiro and Brochado confirm a significant contribution of muscles, extensors and flexors in the ankle joint, maintaining balance. Their tests are supported by the difference in parameters max. force mm. flexors and rectifiers before and after resistance training lasting 6 weeks. Women's age was 72-87 years. Suetta, on the other hand, proved that in approximately 30% the walking speed in older people increases after 12 weeks of resistance training, which significantly improves locomotion [2].

Contraindications and threats related to strength training

In the case of older people, make sure that their movements are not too complicated, too fast and that they do not involve too much range of motion in the joints. Disadvantageous for such patients is high intensity, static strength exercises, therefore it is necessary to pay attention to the elderly in the event of improper use of exercises on gymnastic devices. In patients with high blood pressure should not do isometric exercise [14].

There are general contraindications to making physical effort. Among them, you can distinguish among others:

- unstable angina pectoris
- aortic valve stenosis
- unregulated pharmacological hypertension
- reduced resting systolic blood pressure
- circulatory insufficiency
- uncontrolled arrhythmias
- a recent heart attack
- resting tachycardia

- decompensated diabetes
- fever or inflammation in the body [15].

Strength training in individual disease units

Strength training in the treatment of overweight and obesity

After the age of 45, the ability to maintain the body in balance is deteriorated, muscle performance decreases and this adversely affects the quality of life of patients. Resistance training is particularly indicated in cases of muscular system dysfunction, occurrence of rheumatoid arthritis or peripheral artery disease [16].

The following years of life bring with it a decrease in strength and bone mass, a decrease in bone density and a decrease in bone mineral content. This is particularly evident in women, especially after menopause [16].

In patients with age, you can observe a decrease in muscle strength, and undergoing a slimming treatment in obese people, intensifies this phenomenon. It is advisable to use strength training. Resistance training in the treatment of overweight and obesity should limit exercise with the use of free weights, and use exercises in the positions of sitting down and lying down. It is possible to use free weights when there is no possibility of training on specialized devices. In fitness clubs, strength training is based on the station method. This means that people using the equipment perform a certain number of series and repetitions at subsequent stations. Device change takes place after all planned series have been made. Resistance size is determined at 50-60% of maximum resistance, the number of series is 2-5, and the interval between exercises lasts 1-5 minutes [16].

Strength training in overweight and obese patients is also carried out using the peripheral method. It is characterized by: the number of peripheral exercises comprehensively shaping individual muscle groups, which is usually 8-12; load size at the level of 30 repetitions and their weight, which does not exceed 30% of the maximum weight. Muscle work time is usually about 1 minute, and the break time around the whole circumference is 2-4 minutes [16].

Other authors also mention the possibility of performing 8-15 exercises with a load of up to 50% of the maximum weight. Their exercise should not last longer than a minute, breaks between exercises are eliminated, and the pace of exercise is moderate and fast [16].

Strength training in osteoporosis

Physiotherapeutic treatment is an important element of osteoporosis treatment and prophylaxis. Physical activity affects the bone density and reduces the risk of fractures. One of the

recommended forms of training in osteoporosis is strength training, which in addition to improving muscle strength also increases BMD. While performing strength exercises, osteogenic processes are stimulated. Strength training may contribute to an increase in BMD in patients with osteoporosis in the lumbar spine and hip joints. In this case, the recommended intensity of exercise should be about 70-90% of the maximum weight, and the number of repetitions done in each of the three series should oscillate between 8 and 12. It is recommended that the exercises take place two or three times a week. [17]. Resistance exercises are beneficial in preventing bone loss and impact on balance and reducing the risk of falls. It has been noticed that in postmenopausal women, increasing the strength of the extensor helps reduce the number of osteoporotic fractures in the spine [18]. It is important to strengthen the muscles of the back, buttocks and abdomen.

Resistance training in inflammatory degenerative diseases

In rheumatic diseases, comprehensive rehabilitation is considered the basic way to restore the function and improve the patient's health. An important part of it is an individually selected kinesitherapy program. In RA and ZZSK, appropriate preventive measures should be taken from the beginning and throughout the duration of the disease, which should be aimed at preventing contractures and joint deformities in the affected areas. In advanced rheumatic disease, the most important goals of therapy are: treatment of deformities, compensation of functional defects and improvement of the functioning of the musculoskeletal system.

The effectiveness of kinesitherapeutic treatment in RA and ZZSK is determined by the amount of time devoted by the patient to exercise. American College of Sports Medicine (ACSM) recommends exercising for 30 minutes every day for 5 days a week. According to numerous studies, such training results in improved mobility of the joints and reduces fatigue associated with the disease, which positively affects the emotional state and quality of life of the sick person.

In programming the kinesitherapy procedure, attention should be paid to the occurrence of periods of exacerbation and remission of the disease. In exacerbation, it may be necessary to stop exercising, while remission should be intensified in order not only to maintain the functional state of the joint, but also to improve its function and create new motor patterns in the patient.

ACSM in patients with RA at the age of 50-64 recommends exercises strengthening the muscular corset, equivalent and increasing the flexibility of the musculoskeletal system. Increased muscle strength in these patients is achieved by using resistance exercise. Systematic

resistance training reduces the cachexia caused by the disease by decreasing muscle cell apoptosis. Exercise with a load also has a positive effect on the functioning of the cardiovascular system due to the regulation of systolic pressure as well as cholesterol and lipoprotein density. Resistance to each training unit should be individually matched to the nature of the disease and the associated degree of damage to soft tissues and joints. During exercise, it is possible to intensify pain, which should pass within 2 hours of their completion.

Studies carried out by van Rensburg have shown a positive correlation between the expansion and extension of the muscular corset and the normalization of the autonomic system.

The effect of adding up all the beneficial effects of the kinesitherapeutic process is better nutrition of joint cartilage, maintaining ranges of mobility in the joints, elimination of contractures and expansion of the muscular corset and muscle strength (resistance training) which increases the stability and protection of exposed structures [19].

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