

Physical activity and the aging process

Aktywność fizyczna w procesie starzenia się

ABSTRACT

After reaching old age, the elderly most often withdraw from social life. This is a serious problem because by isolating themselves from society they become less active. This has an impact on the emergence of many diseases related to both old age and the impact of physical inactivity on the body.

The aim of the study was to present the consequences of the aging process in various aspects of the body's functioning and the role of physical activity in eliminating these consequences. Unfortunately, there are still too few activities focused on physical activity for people over 65. This should change, because physical activity has a very positive effect on the human body and its well-being. Additionally, it can be observed that the earlier physical activity is started, the less changes in the body associated with the progressive aging process will occur. Such a person will be more agile and will not have major problems in dealing with overcoming the difficulties of everyday life.

Keywords: physical activity, aging, functional tests, physical exercise

STRESZCZENIE

Osoby starsze po osiągnięciu podeszłego wieku najczęściej wycofują się z życia społecznego. Jest to poważny problem, ponieważ przez izolowanie się od społeczeństwa stają się mniej aktywne. Ma to wpływ na pojawienie się wielu chorób związanych zarówno z podeszłym wiekiem, jak i wpływem braku aktywności fizycznej na organizm.

Celem pracy było przedstawienie konsekwencji procesu starzenia w poszczególnych aspektach funkcjonowania organizmu i roli aktywności fizycznej w niwelowaniu tych konsekwencji. Niestety, wciąż jest zbyt mało zajęć ukierunkowanych na aktywność fizyczną przeznaczoną dla osób po 65. roku życia. Powinno to ulec zmianie, ponieważ aktywność fizyczna bardzo korzystnie wpływa na organizm człowieka oraz na jego samopoczucie. Dodatkowo można zaobserwować, że im wcześniej aktywność fizyczna zostanie zapoczątkowana, tym w organizmie będą zachodziły mniejsze zmiany związane z postępującym procesem starzenia się. Osoba taka będzie sprawniejsza i nie będzie miała większych problemów, by zmagać się z pokonaniem trudności dnia codziennego.

Słowa kluczowe: aktywność fizyczna, starzenie się, testy funkcjonalne, ćwiczenia fizyczne

INTRODUCTION

Research carried out by the Central Statistical Office shows that there are more and more elderly people in Poland (over 65), which indicates that Polish society is getting older [1]. This problem also concerns other European countries. Due to the fact that the number of elderly people will increase, it should be taken into account that these people will require appropriate care and the creation of places enabling their participation in social life. Unfortunately, many people,

both young and old, do not care about their physical condition, explaining it as being due to a lack of time. However, physical activity is very important for the physical and mental development of a person, and also has a beneficial effect and slows down the aging process of the body. Many sources in the field of physiotherapy and medicine refer to the impact of physical activity on the human body, often comparing people who train and those who do not to each other, show-

ing that people who exercise regularly have better condition, and a more efficient circulatory system - blood pressure is lower, the heart works slower at rest, and in addition, people who train have a lower body weight, which has a positive effect on the motor apparatus and reduces the risk of certain diseases in old age, including heart diseases [1, 2].

Physical activity additionally motivates the elderly to take an active part in social life, thanks to which they do not feel excluded and it improves their psychological condition.

AIM

The aim of the study was to present the consequences of the aging process in various aspects of the body's functioning and the role of physical activity in eliminating these consequences.

THE AGING PROCESS

According to its definition, aging is a slow, progressive change in the body's functioning over time, which will eventually lead to death. There are two types of aging: eugric (that is, true) and pathological. According to World Health Organization WHO, aging is divided into the following stages [2]:

- pre-filing age - from 45 to 59 years,
- early old age - from 60 to 74 years,
- old age - from 75 to 84 years,
- old age - from 85 to 90 years,
- longevity - over 90 years.

The process of aging of the body begins between 30 and 40 years of age. It develops slowly and in stages, and it begins in cells thanks to telomeres, or the ends of chromosomes, which are designed to protect the chromosome from damage. Over the course of life, the stem cell divides into two or several cells, and with each division, the telomeres shorten, which leads to the beginning of the aging process of the organism [2]. In addition, the aging process also affects individual systems in the human body. The musculoskeletal system ages, obesity occurs due to the accumulation of fatty tissue in the abdomen and, there are changes in the sense organs, especially sight and hearing deteriorate. Additional changes concern the cardiovascular system, which reduces exercise tolerance and the emergence of many cardiovascular diseases [2]. With age, the level of sex hormones decreases, this process influences, among others, the skin. In addition, changes in the respiratory system can be observed in the body (including reduced lung vital capacity), changes in the nervous system and, urinary, digestive and endocrine systems [2]. As a result of aging, there are inevitable changes in all the layers of the skin.

As a last resort, despite the long-term aging process, old people are seen as being 65 years of age [2]. Human life is extending. It should be noted, however, that it is influenced by many factors, including easier access to medical supplies and greater attention to spending time actively.

Currently, it is often said that the proportion of elderly people in the society is increasing every year, and this will grow due to the low birth rate. Thus, both in Poland and in Western Europe, it is stated that societies are aging. With retirement and the emergence of diseases, the elderly are slowly beginning to withdraw from social life [2]. This is due to an environment that is not fully adapted to accommodate an increasing number of elderly people who will require care from the point of view of society. Moreover, in smaller towns there are no properly adapted groups or activities that would take into account the activity of the elderly [2]. Therefore, such people are doomed to being by themselves, and therefore to isolation from society. Apart from changes in the body, they develop depression, which over time begins to have a large impact on the well-being of such people [2]. That is why the activity of the elderly is so important, because it not only improves the overall fitness of the body, but also their well-being, and motivates such people to leave the house and be active.

Benefits of physical activity

Physical activity in both young and old people has a very beneficial effect on the body. It improves its overall efficiency, strengthens muscles that weaken with age, has a positive effect on the work of the lungs and heart, and also improves general well-being. In addition, taking into account the fact that "movement is life, and stillness is death" [3], physical activity has a positive effect on slowing down the progressive aging process. Any activity is good, but for any benefit, you should exercise regularly (at least three times a week) for at least 30 minutes a day, with a heart rate of 130 beats per minute. However, the intensity of the exercises is not so important as their regularity, and this should be paid attention to by every elderly person who undertakes exercise.

In the elderly, most changes occur in the organs of sight and hearing. Visual impairment is caused by a reduced ability to accommodate the eye, which reduces the flexibility of the lens [4, 5]. In addition, there is a deterioration in hearing as far as treble is concerned. Research was conducted on a group of people actively practicing sports (mainly running) and it was observed that physically active people have better eyesight than less active people [6]. This is probably due to better blood supply to the eyeballs. In addition, running reduces the risk of macular degeneration in the elderly. Regular jogging also has a positive effect on the hearing organ. According to some studies, people who regularly practice this sport have more acute hearing (sometimes it is even 6% better compared to those who do not train), which is due to an improvement of circulation in the hearing organ [6]. Both the eyesight and hearing organs play an important role in everyday functioning, so better functioning of these organs will positively affect and facilitate the daily life of seniors [7].

Over the years, exercise tolerance decreases because the minute capacity does not reach an adequate level for the body's

needs during exercise. In the elderly, during exercise, the maximum heart rate and maximum contractility decrease, but the work of the heart muscle does not change when resting [8].

Cardiovascular system

Changes appear over time in the heart and blood vessels: synthesis is reduced, and there is also a significant reduction in the release of factors affecting vasodilation by endothelial cells, including nitric oxide. This has the effect of increasing the risk of atherosclerosis later in life, and the arterial vessels are less flexible, which means that the elderly are more likely to experience an increase in systolic blood pressure [8]. However, in healthy people, although it does not exceed the normal values, there is an increased risk of developing isolated systolic blood pressure in these people, relaxation of the heart muscle is reduced, which increases the risk of heart failure, and very often elderly people develop diastolic failure in which blood filling of the heart chambers is impaired, but the contractility of the heart muscle is normal [8], the sinoatrial node is much less active, which causes the heart rhythm to be slightly slower at rest, which causes the heart to be disturbed, the response to β -adrenergic stimulation, which results from changes at the receptor level, favors changes in the response to stress and the burden on the body. This may increase the risk of orthostatic hypotension [8].

Exercise is also beneficial for the cardiovascular system. It makes many physiological changes in the entire system: it reduces the heart rate, cardiac output and stroke volume increases, it increases the oxygen content in the blood, blood vessels are more elastic, it improves coronary blood flow, which nourishes the heart, increases tolerance to exercise and improves physical efficiency, facilitates the supply of venous blood to the heart and increases the content of good cholesterol [8].

If physical effort is to have an adequate effect on the circulatory system, it must be performed systematically. In addition, it should affect large parts of the muscles, and the load during exercise should gradually increase [8].

Respiratory system

Changes in the respiratory system affecting the elderly depend mainly on environmental factors and previous respiratory diseases, including from diet. With age, four significant changes in the respiratory system can be observed: reduced mobility of the chest, this is due to the respiratory muscles, which weaken over time. This condition affects the exercise tolerance of the elderly, the lung vital capacity decreases, and between the ages of 30 and 80, the residual volume increases, i.e. the air that remains in the lungs after maximum exhalation is doubled, and gas exchange deteriorates, which means that arterial oxygen capacity is reduced. In addition, the risk of hypoxemia during stress is increased, the cough reflex is weakened and the ciliary clearance is reduced, so that the secretion stays in the bronchial tree,

which promotes the appearance and growth of bacteria, and this in turn leads to respiratory tract infections.

During exercise, the body's need for oxygen increases. Physical exercise also has a large impact on the respiratory system, because the following occurs: lung ventilation increases, diffusion capacity increases, lung capillarization increases, lung vital capacity increases, respiratory system efficiency increases, respiratory resistance, and the respiratory rate during exercise decrease

Nervous system

There is a reduction in the number of neurons in the nervous system. However, the number of cells is not so important in the functioning of the brain and the entire nervous system, which worsens the efficiency of signal transmission between individual cells [8]. With the passage of time and the loss of nerve cells between the remaining cells, they compensate [8, 9]. If there are no pathological changes in the body, then larger changes can be observed in the nervous system, while in a healthy person with age, memorization and fresh memory deteriorate. In the peripheral nervous system, impulse conduction slows down and the time of reflex reactions is extended [9, 10]. There is also disturbance of peripheral sensation which may increase the risk of injury. Physical activity slows down the aging of the nervous system, influences the formation of new neurons, and also delays the emergence of degenerative diseases of the nervous system with age. In addition, exercise facilitates changes in the body's adaptation to exercise [10].

Hormones

Parahormone excretion increases in the elderly. This affects changes in the bone. With age, the excretion of certain hormones in the human body also decreases. These include: melatonin, growth hormone and dehydroepiandrosterone. Glucose metabolism is also reduced, which promotes the appearance of type II diabetes [10].

Locomotor system

The aging process affects all parts of the locomotor system: bones, muscles and joints [11, 12]. Moreover, deep feeling is disturbed. In the case of the skeletal system, old age promotes the occurrence of osteoporosis, i.e. bone mineralization. The bone structure is significantly weakened and people become more prone to fractures over time. Osteoporosis is more common in women, especially around the menopause, but it also affects men. It is caused by the imbalance between bone structure by osteoblasts and bone weakening by osteoclasts [12]. Regular exercise densifies the bone mass, strengthens the bones, reduces the risk of osteoporosis and makes bones less prone to fractures. The use of loads during exercise and an appropriate diet also have a great impact on increasing bone mass. Elderly people should walk for about

30 to 60 minutes every day [12]. Light aerobics with exercises including jumping and running are recommended. Regular physical exercise increases the bone mass, changes the bone structure and improves blood supply to the bones.

In the case of the muscular system, a decrease in muscle mass occurs with old age, and this is associated with a weakening of muscle strength. This is called sarcopenia. Older, people who do not exercise have a problem with carrying out some activities of everyday life, because, for example, most women over 75 are not able to lift a weight above 4.5 kg. This is due to the reduced amount of creatinine excreted with urine, which has a large impact on the reduction of muscle mass [11]. Muscle tissue, on the other hand, is replaced with adipose tissue, because with age the metabolism in the body slows down [12]. Increasing adipose tissue leads to obesity, which adversely affects, among others, the joints. In order to avoid a significant decrease in muscle mass, people should exercise regularly, including strength exercises.

The effect of exercise on skeletal muscles is: an increase in the amount of myofibrils, contractile proteins and cell nuclei, an increase in muscle strength and mass, an increase in glycogen and myoglobin, phospholipids, ATP and phosphocreatin, an increase in enzyme activity and better energy utilization [12].

In the case of joints, the amount of water in them decreases, which causes the joints to stiffen, and consequently increases the risk of mechanical injuries. Additionally, there is an increased susceptibility to the appearance of degenerative changes in the joints. The ligaments and articular capsules are reduced, which means that the range of motion in the given joints is smaller. Exercise strengthens the tendons and ligaments and stabilizes the joints. They increase the volume of cartilage tissue and increase the secretion of fluid into the joint cavity. It also increases the mobility of the joints and improves their blood supply and oxygenation. Stress relief exercises, especially in water, such as aqua aerobics, swimming and cycling, have a positive effect on the joints [12]. The influences of physical exercise on joints include: hypotrophy of collagen fibers in tendons, better blood supply to the ligaments and increased synthesis of collagen fibers.

Urinary system

With age, the process of aging of the urinary system also occurs, i.e. the weight, size and volume of the kidneys decrease. This is due to the reduced number of active nephrons. The reduction in the number of nephrons alone does not lead to major changes or disturbances in homeostasis [12]. However, other nephrons are supposed to take over the function of those that have ceased to function, so they operate under conditions of overload. In addition, there is a reduction in renal blood flow and a decrease in glomerular filtration. Between the ages of 30 and 80, glomerular filtration decreases by almost a half, which reduces the ability of plasma to remove harmful substances [13]. Due to the gradual decrease in mus-

cle mass with age, a slight decrease in excreted creatine (5-10%) can be observed between the ages of 40 and 80. There are also atrophic changes in the renal tubules, which in turn leads to a deterioration of their functioning [13]. It affects: urine concentration and dilution, regulation of serum electrolytes concentration and regulation of acid-base balance.

Changes can also be observed in the bladder and urethra. This promotes urinary incontinence. These changes are: the maximum volume of the bladder is reduced, the time between the first urge to urinate and forced urination is shortened and the contractility of the bladder detrusor is reduced, which increases the volume of residual urine after voiding. There are also spontaneous contractions of the detrusor of the bladder, which affects urinary incontinence, in women the urethra is shortened and the effectiveness of the urethral sphincter is reduced, in men the prostate gland becomes enlarged [14].

First of all, exercise strengthens the weakened muscles that contribute to urinary incontinence. Additionally, they improve urine excretion and have a positive effect on increasing the time from the first urge to urinate [15].

Digestive system

The changes in the digestive system are small, but they do affect the well-being of the elderly. The following can be observed: dry mouth, slowed gastric motility and decreased acidity of the digestive system, slower intestinal peristalsis, constipation, reduced absorption area and improved blood supply to the intestines, which causes the absorption of nutrients to deteriorate. The liver's weight and its ability to regenerate are also reduced. Additionally, hepatic blood flow is reduced, which reduces drug metabolism [16].

The influences of physical activity on the digestive system include: improvement of digestive function and intestinal peristalsis, prevention of urine settling in the urinary tract, increase of glycogen concentration and metabolism activity in the liver, blood supply to the visceral area, improvement of smooth muscles and efficiency of organs in the abdominal cavity and pelvis, strengthening of the stomach, kidney, intestine and liver function, preventing constipation and intestinal problems [17].

TESTING THE PHYSICAL FITNESS OF THE ELDERLY

These are tests designed to assess the fitness of patients, including in the elderly, and checking their muscle strength. By means of tests, it is possible to assess the level at which the elderly are able to carry out everyday activities and whether there are any limitations in everyday functioning related to the appearance or development of deteriorating health, by checking, apart from fitness, blood pressure [18], heart rate and the reaction itself, the body's ability to cope with light and gradually increasing loads. A basic fitness test for seniors is for example the Fullerton test [18-21].

Fullerton test

This is a six-component test that indirectly measures upper and lower body strength, aerobic endurance, coordination, and balance. The test itself consists of the following parts:

1. Arm Curl - bending the forearm,
2. 30- Second Chair Stand- - getting up from a chair in 30 seconds,
3. Back Scratch - scratching the back,
4. Chair Sit-and-Reach - sit down and reach,
5. 8-Foot Up-and-Go - 8-foot complex coordination test,
- 6a. 6-Minute Walk - the 6-minute walk test, which is replaced in special cases by:
- 6b. 2-Minute Step Test - 2-minute step in place [19].

By performing the Fullerton test, you can:

- assess the rate of changes in functions that deteriorate as a result of the progressive aging process,
- define what activities the respondent has a problem with,
- determine the level of impairment in the performance of a given activity,
- set individual goals that the respondent wants to achieve,
- establish an individual training program focused on the improvement of impaired functions,
- check the effectiveness of training in achieving the ability to do the desired activities,
- motivate the respondent to introduce exercises into his daily life that will improve his daily functioning,
- make the person examined interested in the types of physical activity and monitoring their progress during exercise [19].

Tinetti scale

The gait and balance of an elderly person can be assessed using the Tinetti scale. By using it for research, you can identify problems with movement and incorporate appropriate exercises into training. It consists of two parts: the first part assesses balance and the second gait [21].

The first balance exercise is done in a sitting position. The person being examined sits on a hard chair without a hand-rail. Then he gets up from the chair, and the examiner assesses his balance when getting up, the standing up itself (whether the test person got up the first time and whether they needed help). In addition, the maintenance of balance when the subject is released, as well as 360° turning and the manner of sitting down are assessed. During the test, the subject may obtain a maximum of 16 points [21].

The second attempt to assess gait is to observe the subject while he is moving. Attention is paid to such details as: how he starts walking, the length of steps with both legs (it is checked if the steps are equal), smoothness of gait and its path, the work of the torso and positioning of the foot. The subject moves along the corridor one way at the usual pace and back faster. If necessary, the person examined may use auxiliary devices. The maximum value of the points awarded in this trial is 12 [21].

The perfect score is 28 points. A smaller number means that the patient's risk of falling increases. If you score less than 19, the test subject is five times more likely to fall than a person with the maximum score [21].

SELECTED FORMS OF PHYSICAL ACTIVITY

Physical activity for the elderly is very important because it not only allows them to stay physically fit, but also allows them to believe in themselves, take an active part in social life and find meaning and satisfaction. In addition, during systematic and relatively intense exercise, the elderly increase their aerobic capacity and muscle strength, and also avoid osteoporosis [22]. The most popular forms of physical activity for the elderly include the following [23, 24].

Nordic Walking

Nordic walking is a form of physical activity that involves walking at an appropriate pace using specially adapted poles. Nordic Walking, as opposed to regular walking, involves the muscles to a greater extent. The muscles of the arms and stomach are used in addition to those of the legs albeit less intensively [24]. This form of activity promotes the development of the strength and endurance of the arms, the ease of climbing hills and stairs, helps to maintain a slim figure, reduces pressure on the shins, knees, hips and back, relieves the joints while walking, improves the respiratory and cardiovascular systems, strengthens the muscles incl. lower limbs and improves the mobility of the upper spine [25].

Aqua aerobics

Aqua aerobics is aerobic endurance exercise performed in water. It strengthens the respiratory and circulatory systems and relieves the joints. With the use of appropriate equipment, classes are performed in two parts: the endurance part and the strengthening part [25]. They relieve the joints of the spine, reduce muscle tension, improve the work of the respiratory and cardiovascular systems, delay the time of fatigue, increase mobility and range of motion in the joints, increase the flexibility of muscles, tendons and ligaments, increase muscle strength, improve coordination, balance, condition and the analgesic effect [26].

Cycling

Regular cycling outdoors or on a stationary bike at home is a great physical activity for people of all ages. It has a very positive effect on the respiratory system and the general condition of the exerciser. In addition, due to the fact that people ride in the open, the body is adequately oxygenated, which also affects the work of the brain [26]. Cycling has a positive effect on: general improvement of condition, improvement of the respiratory system and circulation, strengthening the muscles of the legs, abdomen and back, relieving the joints during exercise, reducing body weight, improving motor coordination

and concentration, increasing the body's ventilation, preventing varicose veins and preventing blood clots [27].

Dancing

Dancing is also a form of physical activity and is becoming more and more popular with older people. Here, the movement is performed to the rhythm of anti-depressant music [28], and the activity itself motivates people to attend classes. Dance meets the psychophysical needs of seniors and allows them to establish social contacts [14].

Resistance exercises

Resistance exercises, especially in the form of an outdoor gym, are a very popular form of activity among the elderly. More and more often you can meet groups of older people in the parks, who exercise on the generally available equipment. Such exercises allow, among other things strengthen muscles and have a positive effect on the cardiovascular and respiratory systems, they also improve balance and motor coordination and improve well-being [14, 28].

SUMMARY

The influence of physical activity on the aging process has been presented in relation to the elderly, because with age the efficiency of the body significantly decreases, which translates not only into deterioration of health, but also affects well-being and everyday functioning. Nowadays, lack of physical activity is becoming more and more the norm as more and more people, including the elderly, have a sedentary lifestyle. It is influenced by many factors, including lack of motivation, financial problems, emerging diseases or shame. Due to the fact that we are dealing with an aging society today, the lack of physical activity in people over the age of sixty-five can be considered a social problem. Despite the fact that in many places physical activities are conducted with seniors in mind, the majority of people exercising are people in the age range from 20 to 50 years. Also, outdoor gyms, which are also established in rural areas, are more often used by the younger generation. The article presents examples of forms of physical activity proposed for seniors and the positive effects of their introduction. A large number of people over the age of sixty-five are not socially active, so if this were to change, it would be necessary to create a nationwide media campaign to encourage seniors to spend their free time actively, e.g. in specially created regional activation groups.

CONCLUSIONS

The appropriate level of physical activity has a decisive impact on changes taking place in individual systems in the human body, which, according to studies, reduces the risk of civilization diseases appearing in the elderly.

Regular physical activity has a decisive impact on slowing down the aging process of the body.

The proposed forms of physical activity presented in the work are popular among the elderly, but their effectiveness is mainly related to the necessity of performing them regularly, which is decisively influenced by the motivation of people exercising and logistical and financial availability.

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