

# The Application of Specific Physical Activities in Response to Musculoskeletal Diseases among Seniors

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## Abstract

Suitable physical activities implementation can be very good like the prevention and treatment for movement systems diseases. These changes appear particularly in seniors, when these serious organism changes begin opening. Suitable chosen movement stimulation facilitates solution in muscular matter loss, increased ligament toughness, lowered articular movability, osteoporosis and balance disorders in old age.

**Keywords:** *Activities in nature, Movement system, Seniors.*

## Introduction

The demographic characteristics of the current population point out to her aging. In the Czech Republic, seniors will gradually form more than one third of all citizens [1]. Therefore the concern of each individual, as well as of the state's policies, is the maintenance of quality of life as it is determined by the actual health of an individual. Health in older age is also affected by degenerative changes in the organism. However, this process is substantially variable, because it involves every cell of the body, the body's tissues, organs and systems. The most concerning changes happen within the musculoskeletal system (bones, joints and muscles). Degeneration in the bone tissue leads to osteoporosis and osteoarthritis. Osteoporosis is a progressive metabolic disorder characterized by the loss of bone tissue and by the breakdown of its microstructure. As results we can see some asymptomatic manifestations, but in most cases we find pain and relatively frequent micro-fractures as well as regular bone fractures. Among the serious ones are especially fractures of the femoral neck. After suffering this fracture, up to 20% of affected seniors die within one year and 25 to 37% of them become dependent on permanent nursing care [2, 3]. Frequent are also compression fractures of the thoracic and lumbar vertebrae. These lead to the formation of a particular silhouette of the

figure of an affected person, which is marked with exaggerated thoracic kyphosis and lost cervical lordosis [4]. The development of osteoporosis in women has an additional contributing cause - the period of menopause, which is characterized by an initial increased production and subsequent deficiency of estrogen [5, 6]. Additionally, a healthy lifestyle in the first 30 years of an individual, when a sufficient amount of movement positively stimulates the growth of bone tissue, is also important [3, 4].

The diseases of bone tissue also include osteoarthritis, which affects a large portion of seniors [7,8]. The cause of the disease is a decreasing ability of chondrocytes to produce a sufficient amount of a quality extracellular matrix. The result is a thinning fibrillated cartilage, which has a decreased absorbing ability that induces non-modeling changes in the bone tissue. Gradually, we find slight swelling at the site of the damage and the elderly patient complains of feelings of morning stiffness and straining pain caused by the formation of subchondral sclerosis and osteophytes. Steadily, the mobility of an affected joint is decreasing with a typical friction and sometimes there is an occurrence of deformation and joint instability. In advanced age, we find a number of hormonal and other regulatory changes that alter the structure as well as the function of skeletal

muscles. The levels of testosterone, insulin and insulin-like growth factor 1 are decreasing, which has a negative affect on the function of special satellite cells of skeletal muscles. These cells are important for growth and regeneration of muscle tissue [9]. With increasing age also increases the production of the hormone myostatin. According to Joulia-Ecaz and Cabello [10], myostatin negatively affects a specific "receptor for activity" of skeletal muscles and as such it inhibits growth, proliferation and differentiation of muscle cells. Blocking of the function of this hormone in animals has shown a gradually increasing hypertrophy and hyperplasia of muscle cells along with the increase of their contracting abilities and faster regeneration [11, 12]. But the most important changes are related to the decrease of proper physical stimulation of muscles. The deficiency of such stimulation (especially after the age of 65) rapidly decreases the number of type II fibers, which are replaced by type I fibers (at the age of 80, this could be already around 40% of the total muscle mass). Lack of exercise also reduces the capillary system in muscles with a dramatic decline of the possibility to utilize energy through oxidative phosphorylation and it probably also decreases the speed of muscle contraction [13].

### **Movement as the Prevention of in Volutive Changes in the Musculoskeletal System**

The above described causes prove that any physical activity is a suitable preventive factor that reduces the development of in volutive changes in the musculoskeletal system. In general, physical movement can improve the health dependant quality of life of an elderly person [14, 15]. In the case of osteoporosis, exercise activates the muscle insertions. Subsequent stimulation of bone osteoblasts affects the quality of bone structural design and its increased renewal [16]. Among the recommended forms of exercise are forms of light and medium intensity endurance and strength training, which last at least several tens of minutes. A senior person should perform such exercises at least three times a week. Endurance training, which improves particularly the function of the transport system, should reach at most 75-80% of maximum performance capacity of the organism. At best, every individual should maintain the recommended "safe" level of heart rate

during exercise. This level corresponds to the range between 105 -120 beats per minute. A very important exercise, which prevents loss of muscle mass, is resistance (strength) training. For the elderly, this is probably more important than mere endurance performance and its benefit increases significantly with age, especially in the eighth and ninth decennium [17, 18].

Aside from improving overall fitness and the self-serving capacity of an elderly person, physical activity also increases muscle mass and fat tissue. Thus, it creates the necessary protection against mechanical damage to bones (for example in case of femoral neck fractures) and leads to strengthening of spinal muscles that form an important muscle corset, which prevents an excessive compression between vertebrae. At this age, exercise should not include swinging movements that challenge coordination. All movements should be smooth, without sudden changes in body position, especially the head. For seniors who demonstrate already relatively high loss of muscle mass, usually caused by prolonged immobilization, it is most suitable to start exercising with training units that are shorter than 15 minutes in length [19].

### **Suitable Physical Activities for the Elderly**

Various forms of physical activities in nature, even ones that include focus on emotions, enjoyment or adventure, are recommended as the solutions to a health-dependent quality of life [20,21]. A suitable outdoor aerobic exercise for seniors remains to be walking and its various modifications. According to Macek [22], we can begin a regular exercise of this type in combination with acceleration and extension of walking distance. For example, if we walk every day, we can alternate two days of slow walking with days when we include fast walking, and gradually extend the length of completed distance. It is important that the walking regimen gradually adopts higher intensity exertion. This can be achieved by simple acceleration, or there are various forms of modified walking suitable even for seniors, such as walking uphill, walking in the sand, walking with a light load or "walking in sea surf." In recent years, more and more seniors incorporate Nordic walking into their exercise regimen. This type of walking

utilizes specially adjusted walking poles. These poles are made out of lightweight, durable and shock absorbing material. Nordic walking has many advantages over normal walking, since it utilizes back muscles, reduces muscle tension and pain awareness in the neck and shoulder areas. At the same time, it also increases mobility of the cervical, thoracic and lumbar spine. The use of walking poles also stabilizes the pelvis during hip extension [23]. Paffenbarger et al. [24] Suggested walking the range of at least 16 kilometers a week as a suitable physical activity for elderly people, and this should be realized with medium and high intensity, or with modified walking. In addition, Máček et al. [22] pointed out that the appropriate walk for this age is also a total of at least 16 kilometers per week at a speed of at least 4 km/h. Of course, walking can be substituted by any other endurance activity such as cycling, swimming or running. But it is important to maintain regularity, length (minimum of 20 minutes) as well as the intensity of physical exertion (medium and high intensity). If an individual does not use any monitoring of heart rate, he or she can evaluate the intensity of physical exertion by the amount of produced sweat. Of course, we never forget principles of safety, such as that we exercise preferably in a well known natural environment, which provides zero risks of injuries, particularly falls.

In recent years, it is becoming increasingly clear that the implementation of resistance training is very important for the slowing of involutive changes within the movement system among the elderly. The most recommended outdoor form of resistance training is exercises utilizing body's own weight (squats, push-ups, pull-ups) or weights (for example lifting of a stone, a piece of wood, etc.). It is important that the person exercising repeats each exercise for a single muscle group in two to four sets of 8 to 15 repetitions. The exercise begins with a lower intensity, which should correspond to 60% 1RM. Later, we will increase the physical exertion to 80% of 1RM for the same number of sets and repetitions [25]. 1RM corresponds to the maximum intensity of contractions, which allows only one realization with no

capacity for repetition. Also, when resistance training, it is important to maintain regularity while including training units 2-3x a week at best [22, 26]. Due to the fact that the movement system in the elderly is more vulnerable and "fragile," every training begins with a thorough workout warm-up. Initially, we use lower load and the movement during each exercise is performed in full range of joint mobility [27, 28, 29]. The most beneficial exercises involve the usage of large muscle groups, especially those that are used in everyday activities of elderly people. Therefore, the training shall focus on leg muscles, i.e. muscles moving the hip and knee joints, and muscles of the shoulder girdle, chest and back [30].

## Conclusion

The quality of life of seniors depends mainly on their health. The implementation of appropriate physical stimulation can deal with the increasing involutive changes in the organism. These changes affect musculoskeletal system the most, with frequent manifestations of osteoporosis, osteoarthritis and sarcopenia (muscle weakness). In addition to the solutions of the clinical manifestations, the essential preventive and therapeutic means is the implementation of suitable physical stimulation. If we undertake this stimulation in nature, we provide its health benefits alongside other environmental benefits, which are also suitable for a good quality of life. In general, we must stimulate the musculoskeletal system with corresponding endurance and resistance workouts. Among the basic movement stimulations performed in nature can be counted all forms of aerobic exertion. The best are various modifications of walking, as well as swimming or cycling. A combination of endurance training with resistance training is also appropriate, where the resistance is usually provided by the body's own weight, or by some items with appropriate weight. The result of regular physical stimulation is better function of the musculoskeletal system of an aging organism, which provides a better quality of life during this important stage of every person's life.

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