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# Physical activity during aging – role of physical activity in muscle atrophy and physical impairment during aging

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**Abstract**

Regular physical activity and exercise have many beneficial effects for physical and mental health in almost every population. Regular exercises may induce reduction of age-related lean body mass loss and decrease risk of bone fractures. Furthermore it has been observed that regular physical activity may reduce the risk for several chronic diseases including metabolic syndrome, hypertension, diabetes mellitus type 2, and depression. Exercise, however, especially in elderly populations are not done very often. This is due to the lack of awareness of their beneficial effect and the lack of ideas for such type of activity. The aim of this review is to summarize current knowledge regarding to role and effects of physical exercises on muscle functioning and coordination specially during aging. Before a final recommendation can be made with respect to the possible therapeutically role of physical training in aged people, there is a substantial need for further studies to be performed on this topic.

**Keywords:** muscle strength, coordination, exercise, physical activity, aging

## Introduction

Physical activity and physical training are one of the main factors affecting human body and influencing normal body aging. It has been observed that regular physical training may significantly slow down aging process and may induce adaptive changes in the functioning of most human body systems.

Stopping the progression of involution changes developing in the course of the aging process applies to both somatic features as well as mental sphere. This significantly translates into the functioning of the elderly in the physical (biological), social and mental aspect (Paluska et al., 2000; DiPietro, 2001; Hawkins et al., 2003).

In addition, changes related to the aging process in many situations may lead to deprivation and social exclusion, which may effects normal social functioning. Regular physical activity of a certain intensity carried out on people in the elderly has a positive effect on the functioning of most human body systems, including the circulatory, respiratory, muscular and osteoarticular systems (Ogawa, 1992; Poole et al., 2003; Padilla et al., 2011; Behnke et al., 2012; Gavin et al., 2014; Akerman et al., 2015). Invariably regular physical activity is also an important stimulus for normalizing and improving the

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functioning of the central nervous system. Numerous studies have proven that it significantly contributes to inhibiting the progression of age-dependent involution changes. In addition, it helps to improve brain functioning and may induce volume changes in brain and hippocampus structure, (e.g. an increase in hippocampus volume (Raz et al., 2005)). This translates into the increased speed of consolidation of stimuli registered within short-term memory and their transfer to long-term memory. That may lead to improvement of learning ability's (Neeper et al., 1995; Fabre et al., 1999; Berchtold et al., 2002; Farmer et al., 2004; Pang et al., 2004; Daniels et al., 2006; Larson et al., 2006).

In addition, regular physical activity is effecting synthesis of some neurotransmitters and hormones (including 5-HT, endorphins, enkephalins and many others) which may affect the human mental state, reducing the likelihood of depression and mood disorders (Strawbridge et al., 2002; Weuve et al., 2004; Colcombe et al., 2004; Netz et al., 2005; Uda et al., 2006).

Regularly physical activity contributes to prevention or slowing down the progression of many civilization diseases (such like atherosclerosis, ischemic heart disease, obesity, diabetes, osteoporosis and many other). This significantly affects the length and quality of life in elderly populations (Thompson et al., 2003; Keysor et al., 2003; Netz et al., 2005).

Regardless of the nature and intensity of the used "stimulus", which is physical activity, the adaptive response in the elderly can be very diverse and largely dependent on the initial physiological state of the body (Hampl et al., 2004, Pearce et al., 2010; Kennel et al., 2010). However, physical activity always effect normal body functioning and it is essential to know the effect of it is beneficial for human health. The aim of this review is to summarize current knowledge regarding to role and effects of physical exercises on muscle functioning and coordination specially in aging populations.

## Human muscle functioning

An analysis of the anatomical structure of the human body shows its unusual diversity, and at the same time a very high level of organization. All analyzes on body movement and activity are centered on a structure and functioning of a human skeletal muscles. Structurally, these are tissues qualified for the active components of the musculoskeletal system, enabling the movement of the human body in space and enabling the movement of its individual components in relation one to each other (Marecki, 2004; Drake et al., 2010).

Skeletal muscle activity is determined by their structure and properties of individual myocytes that make up the structure of this tissue. Muscle fibers are able to generate any contraction as a result of which their length is shortened (Reicher et al., 2003; Woźniak, 2010).

By classification, striated myocytes are classified as excitable cells, and their activity is conditioned by conduction of the "stimulus" provided by spinal cord alpha motoneurons. With the cessation of pulses from the spinal cord, the activity of muscle cells also ceases. Muscle fibers together with a nerve cell that determines their function (contraction) is called a motor unit (Marecki, 2004). The activity of every motor unit that is involved in body movement is changing after a period of physical activity adaptations.

The analysis of the contraction of muscle fibers showed that each time an increase in their tension is a necessary to overcome internal and external resistance, which manifestation will be movement in the area of the joints in which the muscles occur. The structure and functional properties of striated muscles resulting from the above considerations are also the basis for the interpretation of the concept of muscle strength and all its manifestations (Woźniak, 2010).

Attempting to define the concept of muscle strength, it is impossible not to cite the definitions common in the sciences of physical culture and sport defining it as a motor ability of a human being included in the group of fitness abilities (Raczek, 1996). Of course, the above considerations on overcoming external resistance coincide with the definition proposed in the 70s of the last century, which defines muscle strength as the ability to overcome and/or resist external resistance with the involvement of the muscular apparatus (Starosta, 2003, Starosta, 2006). The analysis of muscle fiber contraction strength for the needs of physical culture and sport is based solely on the assessment of its direct and indirect manifestations (strength assessment) (Starosta, 2006). Indirect manifestations of muscle strength are most often understood as motor activities conditioned by the activity of specific muscle groups performed under standardized conditions, e.g. throwing a medicine ball of a certain weight or other activities under standardized conditions. Direct manifestations of muscle strength are currently most often analyzed in laboratory conditions and relate mainly to measurements using a variety of dynamometers. The specificity of these devices, despite their continuous development, is each time based on moving a body segment through the contraction of the muscles that are under examination (Trzaskoma and Trzaskoma, 2001).

The specificity of muscle strength as well as all its components (anatomical, neurophysiological) changes with individual development of a human body. Starting from birth, through adolescence, a constant development of body tissues is being observed, along with many hormonal changes (e.g. increase in testosterone level), increase in lean body mass, level of muscle fiber diversity, level of fiber innervation, but what is equally important in our considerations of increasing muscle strength. The peak stage of individual development is the period of adulthood, when man achieves optimal tissue strength potential resulting from the consolidation of muscular strength determinants (McCall et al., 1996; Faigenbaum et al., 2009; Wolański, 2012).

Individual development of a human includes all changes in the body from the embryonic period, through birth, adolescence, adulthood, early and late old age, to his death (Wolański, 2012). The manifestation of those changes are being observed during whole life time and sometimes there are very specific and resulting in better functioning. On the other hand it may effect normal body state and cause body dysregulation. Variability of factors that may have impact on the human body is very big (e.g. lifestyle, nutrition, muscle fiber loads in everyday life, work, training, taking anabolic androgenic substances and others). The genetic background largely determines the muscle cross-section, and thus the available amount and size of muscle fibers. The resulting muscle mass will be largely associated with the manifestation of muscle strength. The consequence of this hierarchy is the effect, the larger the muscle cross-section, the greater its strength capabilities (Miyatani et al., 2000; Miyatani et al., 2004; Akagi et al., 2008; Akagi et al., 2009). This relationship directly occurs only for spindle-shaped muscles, characterized by parallel location of the fibers along the entire length of the muscle, in which the fibers are located in parallel along the entire length of the muscle (Bottinelli and Reggiani, 2000). In the case of other types of fibers (e.g. feathery), the muscle contractile potential, and hence the strength capabilities are determined mainly by the physiological cross-section of the muscle taking into account all fibers of the working muscle (Burkholder et al. ., 1994; Fukunaga et al., 1997). A particularly important factor determining muscle strength potential is the neurophysiological component, which results in differentiation of the excitability of motor units (Moritani and Devries, 1980; Noakes, 2000). This is due to the fact that muscle fibers shrink each time with maximum potential under given conditions. With the activation of a larger number of interacting fibers, there is an increase in the manifestation of muscle strength. The fiber involvement and the duration of their contraction depend on the number of active motor units and the frequency of their discharges. The greater the number of discharges of a given motor unit per time unit, the more the muscle contraction strength increases (Rhea et al., 2016; Trezise et al., 2016). Of course, the duration of muscle contraction and its ability to generate manifestations of strength depends on the histological structure that determines the physiological and biochemical diversity of the muscles. When trying to assess the strength capabilities of muscles, we must not ignore the various concepts describing the characteristics of the generated strength. The basic criterion in such assessment of strength capabilities are always the anatomical conditions prevailing in the joint generating strength (static-isometric force; increase in fiber tension without shortening the length of the muscle; dynamic force-concentric contraction (the approach of the bone attachment approaches), eccentric contraction (despite the contraction muscle fibers extend their length). The presentation of strength abilities is possible in two ways. The result can be expressed in absolute values, which are the value obtained with the help of measuring tools such like dynamometer. However, this method does not take into account the anatomical diversity of the subjects, which significantly affects the value of the generated force. The correct representation of strength manifestations should always be based on normalized values, taking into account the anatomical differences in the study group (Markovic and Jaric, 2005). In scientific research, due to the specificity of working muscle fibers, the most preferred form of the results analyzes seems to be methods based on the cross section of the muscles involved in the contraction. The use of imaging methods showing the actual cross-section of the working muscle, e.g. magnetic resonance imaging, computed tomography or two-energy X-ray absorptiometry (DXA) from the diagnostic point of view seems to be the most expedient, but due to the cost of unit analysis they are still not widely used (Moisey et al., 2016). Different method (like normalization to a lean body mass) seems to be not to expensive and on the other had quite easy to perform.

## Physical training and muscle strenght

When analyzing the phenomenon of changes in muscle strength, the effects of training are most often expressed by the increase in the value of strength, moments of strength or the gradient of strength. The increase in those values is considered in the context of adaptive morphological (mainly hypertrophic-pronounced hypertrophy of muscle fibers) and neurological changes (increasing the share of motor units at the time of activity, motoneurons generating more potentials, synaptogenesis and others) (McCall et al., 1995; Folland and Williams, 2007; Seynnes et al., 2007; Del Balso and Cafarelli, 2007; Sale, 2008;). Most of the work related to improving the body's strength potential relates mainly to strength training. Repetitive resistance training has been proven with progressively increased load contributes to the increase of moments of strength. Initially, this phenomenon occurs without noticeable structural changes to get together with an increase in training duration, give rise to hypertrophic muscle changes and co-occurring clear metabolic changes (Griffin and Cafarelli, 2005; Del Balso and Cafarelli 2007; Nader et al., 2014). It seems obvious that the pace of changes shaping the strength capabilities of striated muscles resulting from neuronal mechanisms is much slower. Along with the increase in training time, changes in neuromuscular coordination and in the functioning of the cortical areas of the brain are observed, which directly determines the neuronal mechanism of the increase in muscle strength (Remple et al., 2001; Carroll et al., 2002; Kleim et al., 2004; Griffin and Cafarelli, 2005; Del Balso and Cafarelli, 2007). Considerations regarding the impact of aerobic training mainly show the beneficial effects of such specific exercises on cardiovascular, respiratory, nervous and metabolic regulation (Blumenthal et al., 1989; Maiorana et al., 2000; Whelton et al., 2002 ; Tokmakidis et al., 2004; Smart and Marwick, 2004; Farid et al., 2005; Colcombe et al., 2006). In addition, repeated aerobic activity of a certain intensity is considered to be one of the most important factors modulating the health of the population, contributing to a decrease in the incidences of various diseases, and reducing the mortality rate in the populations.

For many years, however, there has been a paradigm in the sciences of sport and physical culture that aerobic exercise has a slight effect on muscle strength and minimally affect skeletal muscle mass. With the development of modern methods of muscle structure imaging (computed tomography, magnetic resonance imaging, X-ray absorptiometry of two energies) subjects undergoing aerobic training, it has been noticed that, similarly to strength training, this type of training method can contribute to the increase in skeletal muscle mass.

This is especially important in the case of populations that poorly tolerant the strength training (e.g. the elderly),and in whom the rate of atrophic changes leads to loss of muscle mass and muscle function. Progressive sarcopenia and skeletal muscle atrophy during the aging process are mainly due to inhibition of the ability to synthesize new proteins, a decrease in the size and number of skeletal muscle fibers. Furthermore a decrease in mitochondrial function and an increase in intracellular catabolic pathways has been observed (Short i Nair, 1999; Short et al., 2004; Durham et al., 2010). Aerobic physical activity can contribute to a number of adaptive changes resulting in muscular hypertrophy.

Of the mechanisms identified, special attention deserves: a decrease in intracellular catabolic pathway activity, an increase in muscle energy production, an increase in proliferation and dynamics of mitochondrial processes, a decrease in protein and DNA damage, a decrease in induction of inflammation process, a decrease in myostatin activity, an increase in blood flow through muscles, same like an increase in utilization of nutrient substrates, and progression of muscle protein synthesis are being observed (Short et al., 2004; Konopka et al., 2010; Lovell et al., 2010; Konopka et al., 2011; Harber et al., 2012; Konopka et al., 2013).

The manifestation of such changes may lead to improvement in the functioning of striated muscles, which in many situations can be compared to changes caused by strength training. A measurable effect resulting from such training method can be also observed as a increase in the strength capabilities of muscles of subjected undergoing such type of training (Harber et al. 2009; Crane et al. 2012; Zampieri et al. 2014; Konopka and Harber, 2014).

Research on the increase in strength capabilities of people performing aerobic training, which uses modern techniques for imaging muscle structure and their cross-section, clearly shows that performing aerobic exercises can contribute to skeletal muscle hypertrophy, regardless of the age group that performs the training (Harber et al., 2009; Konopka et al., 2010; Konopka et al., 2013). One of the earlier works on comparative analysis of the effects of aerobic training on structural changes of striated muscular tissue and body composition in various study populations is the work of Schwartz et al. (Schwartza et al., 1991). It has been observed that aerobic training can contribute up to a

9% increase in thigh muscle cross-section (CSA). This change was particularly marked in the elderly population. Most likely, this was due to the fact that older people had a greater training attendance throughout the study. Such a conclusion also suggests that the frequency of aerobic exercise may play an important role in the intensity and pace of structural changes used during exercise of skeletal muscle groups. Of course, the effect of muscle hypertrophy, in addition to the training frequency mentioned above, depends largely on the duration of the exercise (Harber et al., 2009; Konopka et al., 2010; Konopka et al., 2013).

We find similar conclusions in numerous of scientific studies from the last two decades. The authors showed that aerobic exercise has the ability to stimulate structural and metabolic changes in working muscles (Short et al., 2004; Harber et al., 2009; Konopka et al., 2010; Harber et al., 2012). The concept of muscle growth with an increase in the intensity of performed exercises is not entirely clear. Mitchell et al. (Mitchell et al., 2012) observed that regardless of the intensity of exercise loads used (30% or 80% of the maximum load for a single muscle contraction), muscle growth while maintaining the frequency of training will be similar (an increase of 6.8 +/- 1.8% and 7.2 +/- 1.9% was observed). Therefore, it seems that high frequency, but low intensity (30-40% of maximum) can cause beneficial increase in skeletal muscle mass.

Fujita et al. (2007) indicate that aerobic training with an intensity of 70% of maximum heart rate can be an effective method of restoring the anabolic response of muscle proteins to insulin by affecting vascular endothelial function and PI3K / AKT / mTOR signaling. Such interaction can significantly contribute to the increase in the rate of muscle protein synthesis and the generation of a positive nitrogen balance.

Converging conclusions regarding the metabolic impact of aerobic training in older people presented by Timmerman et al. (2012). The aerobic exercises used in conjunction with the randomized cross-construction of the study showed that the use of such training method contributes to the improvement of blood flow and supplying amino acids to skeletal muscle, significantly opposing age-related metabolic disorders.

An interesting relationship was also observed by Harber et al. (2012) in their work comparing two populations with each other-young and elderly, performing relatively the same aerobic exercise. Despite the lower intensity of exercise and lower values of achieved mechanical work, the elderly noted an analogous increase in skeletal muscle volume. This may suggest that the population of people over 65 may have a greater capacity for exercise-induced muscular hypertrophy.

However, such a conclusion presented in the paper absolutely requires further confirmation, including the performance of histopathological tests taking into account genetic inter-individual variability. It should be remembered, however, that many authors show a slight impact of aerobic training on the direct manifestations of muscle strength in the form of maximum moment of strength and strength gradient (Lattier et al., 2003; Grandys et al., 2008; Cohen et al., 2010). It seems important here, however, that the characteristics of aerobic exercise is not limited to changes in strength abilities, and is also directly associated with a decrease in the risk of morbidity and mortality. In the case of the elderly population (in which a number of involutional changes affecting muscle tissue are observed) and with diagnosed disorders of myopathy, aerobic training can significantly contribute to improving the quality of life by improving functioning in everyday life (Netz et al., 2005; Deschenes et al., 2010; Zampieri et al., 2014; Mosole et al., 2014).

All such observations may contribute to the promotion of aerobic exercise as an effective method of improving the health of the population, especially for people with low tolerance to resistance training (Redaction, 2004; Klecha et al., 2011).

## Muscle strength and aging process

Maintaining a high level of muscular strength and the functional capacity of working muscles is an important factor in the health of the population and closely related to quality of life. Although muscle atrophy progresses with age, correlate with a decrease in strength and endurance is considered as a process that is always associated with the aging of the body. A analysis of the direct mechanisms underlying the changes associated with aging and their impact on the level of strength allows us a better understanding of the etiology of these processes, and thus the determination of methods to prevent or counteract of their presence (Brooks and Faulkner, 1994). The involutional changes observed in the case of muscles are an unavoidable and conditioned physiological process of aging tissue. A characteristic decrease in maximum force (by about 35%), maximum power (about 30%) and a decrease in normalized values of peak force moments in 20% and the rate of development of maximum moment of force are observed (Brooks and Faulkner, 1994). All changes are accompanied by a marked decrease in muscle mass (up to 40% compared to adults) and a decrease in the fiber cross-section (Holloszy et al., 1995).

To a large extent, the decrease in muscle mass observed with age and a decrease in their strength capabilities can be explained by mechanisms similar to those observed in the course of the phenomenon of hypokinesia. However, considering the aging of the body as a progressive process affecting its various elements, the analysis of muscle strength must be much more advanced. Particularly noteworthy is the presence of selective denervation of muscle fibers, and as a result of increased apoptosis of progressive loss of spinal cord motoneurons (MNs). Age-related degeneration of spinal cord motoneurons occurs with a decrease in the number and size of muscle fibers (muscle sarcopenia). This entails functional disorders of the muscular tissue resulting from mechanical damage to their structure, impairment of agonist muscle function, and in many cases the activation of antagonist muscles (impairment of movement precision) (Macaluso et al., 2002; Caserotti et al., 2008; Aagaard et al., 2010; Reid and Fielding, 2012). Part of degenerated muscle fibers is regenerated by producing collaterals from neighboring motoneurons that have not undergone atrophy. This results in the formation of very large motor units, with the consequence of which the correct, selective activation of individual motoneurons is disturbed (Tracy and Enoka, 2006; Aagaard et al., 2010). Evidence of the presence of such a process is found in the works of Stålberg and Fawcett, (1982), Lexella et al. (1988) and Vandervoorta (2002). A decrease in central activation of muscle contraction is also observed (Klass et al., 2008). Selective activation of apoptotic pathways as well as progressive muscle atrophy and/or sarcopenia observed in the course of muscle aging with a decrease in the tissue's ability to regenerate tissue, these are common features of muscle aging and pathological changes observed in the course of various muscular dystrophies, amyotrophic lateral sclerosis, neoplastic lesions or in the course of such disease entities as AIDS (Aagaard et al., 2010; Mitchell et al., 2012). Progressive metabolic and physiological changes lead to muscular degeneration and permanent degeneration of muscle proteins (Janssen, 2010). Each time, apart from physiological changes, a decrease in insulin-dependent growth factor I (IGF-1) cell signaling, an increase in oxidative stress markers (TNF-α, TNF-β, IL6), activation of various proteolytic systems (dependent on calpain, caspase) is observed, the ubiquitin-proteasome system (Aagaard et al., 2010; Mitchell et al., 2012; Sayer et al., 2013). Studies of numerous authors have shown that all physiological, metabolic and structural changes taking place in muscle tissue and directly resulting from the natural aging process are very large and irreversible at the same time. The intensification of the pace of these processes necessarily leads to permanent tissue dysfunction and loss of its function (Brooks and Faulkner, 1994; Klass et al., 2008; Aagaard et al., 2010; Mitchell et al., 2012; Sayer et al., 2013). Having the above in mind, it can be stated that taking various actions aimed at slowing down and / or inhibiting the process of muscle fiber degeneration with age in the light of the aging of the society and a significant extension of life time is a deliberate and desirable action that allows to extend the health of the aging population.

**Body balance, proprioception and geriatric processes**

In a highly developed society, the phenomenon of population aging poses a serious challenge, both in social and economic aspects, as well as demographic aspect and what is important from the point of view of this health dissertation (Mossakowska et al., 2012). The entirety of the involutional changes resulting from the aging process affects almost all components of the human body. It is accompanied by both local and generalized tissue aging, various inflammatory responses and the resulting progressive degeneration, and a significant decrease in metabolism and regeneration. The pace and severity of involution changes are conditioned by the presence of compensatory mechanisms involved in counteracting the effects of a decrease in functional body function. However, the progression of involutional changes observed in the aging process of the body is inevitable, and the effects of loss of performance and progressive dysfunction with age are increasingly noticeable (Maki et al., 1990; McClenaghan et al., 1995; Collins et al., 1995; Williams et al., 1997; Zużewicz and Konarska, 2004; Dmowska and Kozak-Szkopek, 2010). Changes associated with the aging process resulting in a decrease of a body balance results from both the degression of the functional efficiency of the nervous system, both in the sphere of recording stimuli associated with the change of body position in space and their ability to send, interpret and generate responses to various distraction factors that disturb balance (Woollacott et al., 1986; Teasdale and Simoneau, 2001; Błaszczyk and Czerwosz, 2005; Błaszczyk and Michalski, 2006; Mossakowska et al., 2012). Of course, the level of balance can also be influenced by the used drugs, pain associated with degenerative changes, fatigue, atrophy of muscle fibers (muscle atrophy in the aging process), reduced reaction time, and deterioration of memory and reproduction. In addition, cognitive impairment or mental illness such as depression may contribute to the worsening of the body balance. According to PolSenior research, depressive symptoms occur in almost one in five people in the population 55-59 years and in 29.7% in the population of people over 65 years of age (Mossakowska et al., 2012). Control and the ability to maintain balance is also conditioned by numerous environmental factors, which in the case of older people combined with numerous disorders affecting the musculoskeletal system may acquire special significance (Teasdale et al., 1991; Teasdale and Simoneau, 2001; Błaszczyk and Czerwosz, 2005; Mieszkowski et al. 2018).

In the aging populations, the situation of falls is a significant social problem and usually results from the consequences of locomotion. The direction of fall usually occurs in the front (they constitute over 50% of cases), and less often in the back and/or the sides (Thornby, 1995; Edbom-Kolarz and Marcinkowski, 2011; Mieszkowski et al. 2018). The risk of falls, correlates with age and in many cases is associated with secondary sequelae of bone fractures. Statistically, however, in relation to the total number of events in this population, falls ending in a bone fracture invariably represent a small percentage. This is proved, among others, by the works of Sadigh et al. (Sadigh et al., 2004), who in a population of 865 people over 65 years of age who had falls, found a fracture in only 24 cases (2.8% of the study population). However, analyzing the main causes of bone fractures in the elderly populations, we found out, unfortunately that 80% of fractures are a consequence of falls. In addition, as evidenced by the research of Edbom-Kolarz and Marcinkowski, every third person over 65 is at risk of falling at least once a year (Edbom-Kolarz and Marcinkowski, 2011). Due to a number of involutionary changes affecting the musculoskeletal system (in the course of aging), in the aging population the probability of occurrence and presence of serious complications resulting from fracture is many times larger.

In addition, prolonged immobilization contributes to the intensification of circulatory disorders, a decrease in muscle tone and an increase in the rate of bone mass loss, which can be very dangerous for health (Bikle and Halloran, 1999). A serious problem is also often found in the elderly population-diseases affecting the architecture of bone tissue (e.g. osteoporosis), significantly increasing the risk of serious consequences of bone fractures (e.g. fractures of the femoral head are one of the factors significantly increasing mortality in the elderly population). Structural disorders of bone tissue, combined with impaired tissue healing and recovery may repeatedly lead to a situation in which recovery may be many times longer and in many cases even impossible to achieve (Melton et al., 1989; Thornby, 1995; Edbom-Kolarz and Marcinkowski, 2011). In situations of falling episodes, even if no bone fractures or other serious injuries are found, anxiety disorders associated with falling may take place. They result directly from the risk of a secondary fall episode and re-injury. This significantly affects the daily lives of older people, contributing to a further decline in physical activity and active forms of recreation (Maki, 1997). This leads to an increase in the percentage of physically inactive older people and an increase in the phenomenon of hypokinesia, along with all health consequences. Unfortunately, the increase in the incidence of hypokinesia in populations with low physical activity in everyday life contributes to the intensification of balance disorders and further deterioration of motor coordination and, consequently, health.

To sum up, falls occur in the course of the fall in the equilibrium level significantly contribute to the deterioration of the health of the elderly populations. Analyzing this phenomenon, we come to the conclusion that both fractures occurring as a result of fall and other secondary disorders (e.g. anxiety disorders) are a significant clinical problem that can modulate the health status of older people (Teret et al., 1981; Kado et al., 1999; Błaszczyk and Czerwosz, 2005).

## Conclusion

In conclusion, regular physical activity and exercise may induce reduction of age-related muscle strength and muscle atrophy. All beneficial effects in aging populations occur due the fact of influence on muscle functioning and coordination, and the magnitude of this response may be depend on the strength of the stimulus-the type of used physical training. It is essential to seek for best forms of physical training in aging population to increase strenght and body coordination . All those effect may contribute to the affect that regular physical activity in elderly populations is the main factor effecting human health.

## Disclosure

The funding organization does not affect the study results.

## Conflicts of interest

The authors declare that they have no conflicts of interest.

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