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## RESEARCH ARTICLE

### EFFECTS OF RESISTANT POWER TRAINING IN THE FUNCTIONAL CAPACITY OF THE ELDERLY

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#### ABSTRACT

Aging refers to a natural process inherent in every Human Being. Important advances in the area of health, the awareness of this population to lead a life with more quality and thinking of incorporating a healthier style based on the practice of physical activity, makes life expectancy increase symbolically. In this aspect, the practice of physical exercise plays a very important role, causing the elderly to develop through resistance training the different physical capacities, each of which will provide several functional, neural and strength gains. This study aimed to investigate in the literature through the research in scientific articles, the benefits of resistance training of power over the functional capacities of the elderly. These abilities refer to the basic skills that demand the day to day of the elderly, such as getting up from a chair, getting around and climbing stairs. The practice of physical exercise with focus on physical capacity muscular power evidences a gain of functional capacity and thus it offers the quality of life and the autonomy of the elderly.

## INTRODUCTION

According to the World Health Organization's World Aging and Health Report, (2015) the rapid growth of the world's elderly population is an irreversible reality, which will have a strong impact on health, the health system, budgets and health workers. thus recommending new policy guidelines on health and ways to provide health for this population. Studies presented by this organization showed a significant increase in the population over 60 years of age, with projections showing a trend that is expected to continue over the next few years. By the year 2025, it is estimated that there are more than 800 million elderly people worldwide, an increase of almost 50% compared to the present day (FECHINE E TROMPIERI, 2012). According to data from the United Nations, the number of older people will still exceed the number of young people around the world from the year 2050. Martin and preston, 1994, apud fechine and trompieri, 2012). The World Report on Aging and Health, WHO (2015) still mentions the small relationship between aging and the loss of functional capacities, the most significant of which is the whole of the life trajectory, which can be modified. For the elderly population, the conservation of the functional

capacities is something relevant for the good quality of life and conservation of the independence. Among the determinants for the growth of the life expectancy of this population of the elderly is the evolution of science, which allows important advances in the area of medicine and enables the control and cure of degenerative diseases. In addition, understanding the relevance of physical exercise practice allows quality of life and contributes to the health of the elderly, reducing the risk of accidental falls in the day to day. Observing this worldwide trend of societies with an increasing number of elderly people, it is indispensable to think of instruments that promote an increase in the quality of life and insertion programs aimed at improving their physical fitness, in order to preserve their independence in the tasks of the day to day. Numerous studies in the field of physical education have revealed positive effects of resistance training on the improvement of functional capacity, specifically training involving power (strength x velocity). BEAN *et al.* (2002 apud Sayers, Gibson, 2010). Research in the literature on the aging process has investigated the relationship between decreased muscular power and the decline of functional abilities in the elderly, and the muscle power variable presented more relevance when compared to muscle strength. CUOCO *et al.* (2004, Sayers, Gibson, 2010). Muscle power showed an accelerated decline in the aging process compared to muscle strength due to factors such as sarcopenia, which is loss of muscle mass, changes in muscle

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composition and contractile properties of individual muscle fibers, and changes in function neuromuscular. The present article aims to investigate through the method of literary research how the effects of resistance training of power impact on the elderly population regarding the functional capacity and magnitude on the quality of life during the aging process. The methodology used in the analysis of the research data was the theoretical screening of scientific articles in the database of Pubmed and Scielo.

## LITERATURE REVIEW

### Impact of Aging on Neuromuscular Fitness and Functional Performance:

The aging process occurs naturally and progressively in humans, and can vary from individual to individual and occurs more quickly or gradually (CAETANO, 2006, apud FECHIN, TROMPIERI, 2012). It is an irreversible process that does not occur homogeneously, and is characterized by loss of adaptation to the environment and decreased functionality (CARVALHO SOARES, 2004 apud TIGGEMAN *ET AL.*, 2013). Consequently, the physical abilities are affected (MARCELL, 2003, apud SAYERS, 2008). The factors that will determine the quality and speed at which this process will occur may be exogenous and endogenous in nature. (PALACIOS, 2004, apud SANTOS *et al.*, 2009). As the main endogenous factors are genetics and neurobiological factors, which are related to cellular aging and its ability to divide, renew and regenerate. (SANTOS *et al.*, 2009). Exogenous aspects are related to environmental factors such as quality and lifestyle, diet, physical inactivity, and chronic diseases. For Nobrega *et al.* (1999 apud Tiggeman *et al.*, 2013), physical inactivity and sedentary lifestyle negatively impact this process, leading to loss of muscle mass, physical deconditioning, muscular frailty, loss of autonomy and the appearance of psycho-emotional symptoms. The loss in the capacity to develop muscular strength becomes decisive to respond to the daily tasks in this population BRILL *et al.*, 2000; Hughes *et al.*, 2001 apud TIGEMANN *et al.* 2013. This damage in the capacity to produce muscular strength is directly linked to the loss of muscle mass, an inherent process of aging. The loss of muscle mass resulting from the aging process is identified as sarcopenia. For Evans (1995 apud Manini, Clark 2012), the reduction of muscle mass related to the aging processes are directly associated with the loss of muscle strength in the elderly (dynapenia). For Doherty (2003, Wallerstein 2012), loss of muscle mass is associated with poor capacity to produce muscle strength and the inability to perform day-to-day tasks with this population of the elderly.

Loss of muscle mass also contributes to decreased muscle power. Studies indicate that muscle power declines before the force and faster, with its onset in the third and fourth decade of life METTER, CONVITT, FOZARD (1997 apud SAYERS). For the same authors, the atrophy of these fibers is related to the loss of strength, and because of its loss of strength, it is due to the loss and atrophy of type II fibers LEXELL, TAYLOR (1991 apud FLECK, KRAEMER (1999 APUD FECHINI, TROMPIERI 2012). The decrease in muscle strength and potency is associated with a decrease in the quantity and quality of the proteins in the contractile units of the muscle (LEXELL, TAYLOR, 1991; FLECK, KRAEMER, 1999, apud FECHINI, TROMPIERI 2012). Studies have related the loss of muscular power with the decrease of stiffness in the tendons, which hinders the transfer of force from the muscle to the bone structure. Macaluso, De Vito 2004 (Tigemann *et al.*, 2014)

Another determining factor for the decrease in the capacity to produce muscle strength is neuromuscular aging, which is a decreasing condition in the recruitment of motor units (BARRY, CARSON, 2004 apud SAYERS 2008). In the aging process, there are significant changes in the central nervous system, which directly interfere with the production of strength DUCHATEAO, ENOKA (2011 APUD HUNTER, PEREIRA, KEENAN 2016). With aging, the nervous system presents changes with a reduction in the number of neurons, a reduction in nerve conduction velocity, a reduction in reflex intensity, a restriction of motor responses, the power of reactions and the coordination capacity DE VITTA, (2000 APUD FECHINE , TROMPIERI 2012). According to Hunter, Pereira, Keenan (2016), these changes related to aging in the neuromuscular system have negative impacts on the performance and motor function of the elderly. For Tribess and Virtuoso (2005, apud Civinski, 2011), the determinant factor for the decline in functional aptitude and manifestation of diseases related to this process is due to the reduction or lack of physical activity in the elderly population, which consequently leads to a decrease of functional capacity. In this scenario, resistance training is revealed as a satisfactory physical activity for health promotion and is efficient for increases in muscle strength, muscle mass, muscular power and muscular endurance (WILLIANS, WILKS, 2006; FLECK, KRAEMER, 2004). C It is necessary to show that muscular power and strength are physical abilities necessary to perform the day-to-day functional tasks, since some tasks demand more force and less muscle velocity and other more speed and less muscle strength (SAYERS, GIBSON and COOK, 2012).

**The effects of training and power:** Studies in this area of research have presented the benefits of resistance training on functional capacity in this population of elderly people, improving motor skills such as balance and locomotion, prevention of falls, increase of muscle mass, and benefits on the cardiorespiratory system. LIU, FIELDING (2011 APUD LOPEZ *ET AL* 2017). In addition to these findings, scientists who investigated this population of older adults observed a very favorable response to resistance training performed at muscle contraction velocity with regard to neuromuscular and functional variables TIGGEMANN *ET AL* (2013). The muscle strength performed at high speed, also known as muscular power, is conceptualized as the rate of accomplishment of work or the relation of the force by unit of time FLECK; KRAEMER (2006 APUD TIGGEMANN *ET AL*). Evidence is a highly relevant variable for the population of older adults regarding muscle functioning (CUOCO *et al* 2004, apud SAYERS, GIBSON, 2010).

## DISCUSSION

This review aimed to find updated information on resistance training with emphasis on muscular power in the elderly and the impact on functional capacity. Following are the results of research conducted in scientific articles. Resistance training of muscle strength performed at high speed clears muscle power and has at the speed of muscle contraction that is performed a significant element for its optimization. (STEIB, SCHOENE and PFEIFER, 2010; SAYERS, GIBSON, 2010 apud SAYERS, GIBSON and COOK 2012). Resistance strength training performed with rapid movement, as well as slow-moving strength training, develop muscle power in the older adult population, and when performed with rapid movement, the muscle power velocity component is improved, if related to

resisted training performed with slow movement. It is therefore pertinent to assert that the speed component of muscle power is trainable. (Says, GIBSON, 2011). Other studies comparing the effects of power training on strength training protocols returned significant data regarding peak muscle power in leg press reporting a 97% increase in muscle power in protocols performed in 16 weeks at 70% of 1RM, against an increase of 45% increase of the peak of power in traditional drills of force executed in the same time and same intensity. FIELDING ET AL. (2002, apud SAYERS 2008). However, the variable high speed was presented as decisive to generate increases in the functionality of the elderly. MISZKO (2003 apud SAYERS 2008). Example for this statement and the result of the powertrain research conducted at high speed at approximately 20% 1RM which reported a relevant impact on balance in the elderly compared to results with powertraining performed at 50% -80% of 1 RM. ORR (2006 apud Sayers 2008). Resistance training of power in fragile individuals provides an increase in muscle cross-sectional area with less fat infiltration, enhancing muscle size and muscle quality. These results suggest that fragile individuals preserve their muscle plasticity and are able to increase muscle size. Some studies have demonstrated similar results in the elderly population submitted to muscle strength training and muscle power training in terms of maximal strength gains, however, greater gains in functional assessments were refined in the group submitted to muscle power training. The tests used for these analyzes were climbing stairs, chair lift and walking. Results such as improvement of muscular power were also obtained in this group. FIELDING *et al.*, 2002; MISZKO *et al.*, 2003; CUOCO *et al.*, 2004; BOTTARO *et al.*, 2007; SAYERS; GIBSON, 2010) APUD TIGEMANN *ET AL*, 2013.

Most of the studies presented in the literature related to the muscular power gain in the elderly population submitted to the muscular power training revealed a gain of this physical capacity. In addition, few studies have sought to identify the most effective load for the improvement of muscular power FIELDING *et al.*, 2002; MISZKO *et al.*, 2003; CUOCO *et al.*, 2004; BOTTARO *et al.*, 2007; SAYERS; GIBSON, 2010) APUD TIGEMANN *ET AL*, 2013. For Cuoco *et al*; 2004; Harris; Cronin; Koegh, 2007 apud Tiggeman *et al*, 2013 The ideal loads found from cross-sectional studies using different percentages of the maximum load (% 1RM) to promote gains in muscle power are between 40 and 70%. De Vos *et al.* 46 carried out an investigation of different intensities in order to identify the ideal load to increase muscular power gains in healthy elderly individuals. This training was performed with loads of 20%, 50% and 80% of 1RM, all loads had good results, but the loads that favored the gain of muscular power were 50% and 80%. The strength gains and localized muscular endurance had better results with high loads. The study also showed that power training with all types of loads is safe for healthy older people. Thus, de Vos *et al.*46, lifting heavier loads as fast as possible is the most efficient method to improve potency, strength and muscular endurance in older adults, while Orr *et al.*47 concluded that lifting loads as soon as possible brought superior improvements in balance. One of the studies researched in our review of literature involving the elderly population describes the transfer of the development of physical capacity muscular power in a resistance training program for a day to day functional activity, this being the braking speed in the driving of a car. Eleven elderly were randomly selected in three groups: high speed resistive training, low speed resistive training and control (warm up and

stretching exercises). The duration of the training was 12 weeks. The leg press at 1RM and external resistances of 40-90% of 1 RM were manipulated. The dominant effect of this study was that the group of elderly subjects submitted to resistance training with high speed optimized muscle performance and contraction velocity. In addition, the groups of elderly subjects submitted to resistance training with high speed and resistance training with low speed optimized the muscular power, being that, the group submitted to the resistance training of high speed potentiated the component of the speed of muscle contraction, which supposedly influenced in the improvement of the action of moving the foot quickly from the accelerator to the brake (Says, GIBSON, 2011). In a recent review of the literature, they compared power training results in improving functional capacity. An advantage was demonstrated for the Powertraining performed on light loads and high loads. TSCHOPP *ET AL.* (2011 apud CELES 2012) In the study conducted by Henwood and Taaffe (2008 apud CELES 2012), eight-week old men and women participated in resistance training twice a week, performing three sets of eight repetitions at 35, 55 and 75% of 1 RM showed an increase (21.4%) in strength and in the chair lift and sit test (10.4%). Some studies with muscle power training did not show significant increases in neuromuscular parameters, strength and muscle power (KIM *et al.*, 2015, 2012; LUSTOSA *et al.*, 2011). In these studies the intensity of the resistance training was prescribed by the subjective perception of effort, which could explain the absence of changes. It is possible that physically fragile elders may have reduced ability to exercise based on perceived exertion, which could result in an underestimated intensity and therefore affect the magnitude of increased strength and muscle power.

## Conclusion

This literary review article pointed out that resistance training performed with high-speed muscle contraction movements optimizes the physical capacity of muscular power in the elderly. This context gives the elderly a better condition in their functional capacity and day-to-day tasks.

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