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Short communication Article

Sarcopenia and Frailty: exercise treating methodology

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Abstract

Being given the characterization of the two sides of the same coin, sarcopenia and frailty, represent two geriatric syndromes that concern a great number of elder population. The impact of these pathological states on the health status of the individual is well-established through associated scientific papers and is encountered by health professionals through their daily clinical practice. Given that fact that both geriatric syndromes target both physical and mental aspects of an individual, the need for improving the treating methodologies of sarcopenia and frailty, is of great importance. The following paper provides key pointers to the reader regarding the effects an individual will have, after the adherence to a program including a variety of physical activities.

Keywords: Exercise, Frailty, Physical Activity, Sarcopenia, Treating Methodology

Introduction

Following the first associated documented reference back in 1989, sarcopenia has become - especially the last two decades – the main focus of a largely growing scientific interest[1-3]. Rosenberg et. al, taking advantage of the permissible variety defining the Greek language, used the words "sarx" standing for flesh and "penia" standing for loss, to propose a universally accepted and scientifically structured term for the state of sarcopenia. Having that in mind, we could fairly reach the point of describing the case of sarcopenia as a pathological state correlated with progressive and generalized loss of skeletal muscle strength and mass. Even though sarcopenia is characterized by a large group of people as a geriatric syndrome, it's state and it's progress can be associated with conditions that are not exclusively seen in elder people[3,4].

Moving to frailty, it is portrayed as a geriatric syndrome that is associated with high vulnerability of the individual, for adverse health events such as e.g. physical disability, cases of falling, hospitalization and even morbidity due to the progressive deterioration of homeostatic reserves and functional properties of the body's systemic structures[5-7] leading to reduced resistance to stressors – endogenous as well exogenous[1,2]. In order to understand completely the concept of frailty, the health professional should approach frailty as a collection of factors – better known as deficits. The most well-known model for frailty, adopting that particular ideology, is the one proposed by Linda P. Fried and her scientific team[8,9].

Exercise as a treating methodology

Up to this point someone could say that sarcopenia and frailty are quite similar – they both are given the status of geriatric syndromes and seem to be the natural process of an individual's life since they represent the impact of time's passage on bodily structures and systems. As the title of a recent study proposes, with a fair use of the right words, frailty and sarcopenia are the "two sides of the same coin"[10]. As we accept with excess ease the similarity between the two syndromes and the associated overlapping[11] the adverse outcomes of both pathological states oppress a large number of elderly around the globe as the life expectancy in Western cultures is getting considerably bigger – to be precise, according to World Health Organization (WHO) the social group of individuals older than the 60th year of age is growing in a more rapid way than the others[12]. We reach to a point that we need to find ways of rehabilitating or even preventing patients to reach that level of disability. An abundance of studies has shown that the following of a physical activity regime helps in many different ways the

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associated individual to tackle the adverse outcomes of these syndromes. According to the World Health Organization (WHO) and the associated available literature, the compliance of a strategically organized exercise schedule will lead to improved functional/public health – better performance of activities of daily living, improvement or/and conservation of muscular attributes such as power and mass, notable value for bone mass density, decent cardio-respiratory properties as well as preservation of cognitive function and psychological well-being.

Is exercise the best way of confronting the sarcopenia and frailty syndromes?

The question that usually arises in such cases, and concerns a large number of health professionals, is the possible adequacy of a physical activity intervention plan for an elder individual, the possible limitations (physical or even mental), the compliance that the individuals will present to a specific setting or even possible adverse outcomes e.t.c. One more important factor that should always be considered is reluctance – in most cases, community-dwelling elders have never before been engaged in physical activity. It's a responsibility of the health professional to make the transition from the sedentary way of life that characterizes them into a life including physical activity as passable as it can be. The implementation of physical activity for elder populations should be done throughout a well organized pattern which will emphasize, according to the needs of the individual, on the short-term as well as the long-term therapeutic and preventive outcomes of the whole intervention[13].

Effects of exercise intervention on frailty and sarcopenia syndromes

According to the proposition made by the American College of Sports Medicine's (ACSM) the implementation of a physical activity program for elder populations could lead to the acquisition of a healthy ageing[14]. Leading a life which includes a regular exercise regime would reduce in a respectful extent the risk of falling occurrences[15,16], improve or conserve the individual's mental health and cognitive function[17-19], enhance the pulmonary and cardiac function[20-22] and will develop functional properties such as balance, gait and mobility[23-26]. As the picture of physical activity intervention is getting clearer, there are a large number of studies supporting the extensive effects of several types of exercises on elders suffering from sarcopenia or frailty.

Effects of aerobic/resistance exercises on frail and sarcopenic patients

The effects of exercise intervention on frail and sarcopenic elderly can be met in many different levels concerning the involved individual.

The importance of participation for the elderly population in an aerobic type of exercise program is enhanced by the need of confronting the decline of aerobic capacity that is observed with aging[27,28]. That state will influence the performance of daily activities of living and consequently the independency of the individual. The above mentioned state is the result of mainly three factors:

- The decline of the functions performed by the cardiopulmonary system that associate with the delivery of O_2[29]
- The effect/impact of time on the extraction of O_2 performed by the associated muscle groups[29]
- There is a detected decrease in metabolic muscle mass accompanied by a parallel increase in metabolically inactive fat mass[29]

In the same pace, there is evidence for an age-related reduction of cardiovascular efficiency[30], followed by a decline in the number and the quality of the mitochondria structures in the skeletal muscles[31-34]. Encouraging the patient to attend an aerobic/endurance type physical activity program will improve the aerobic capacity and thus counter the associated decline being the result of aging and physical inactivity[27,35]. Studies that was performed in a large group of elders for a period of 9 months and included strength training and walking exercises, improved individual's endurance, resistance against fatigue and muscle's oxidative capacity. The quantity of mitochondria as well as their function – following aerobic exercise, plays a crucial role in the metabolic control[36,37].

Effects of resistance exercises on frail and sarcopenic patients

Regarding the alleged resistance exercise, the traditional, slow-velocity resistance exercise's benefits are well established. According to studies that took place in the recent years, resistance type of exercise is an important appliance in the improvement/increase of muscle mass and therefore the muscle strength in both younger and older adults[27,28]. It is commonly accepted that the strength presented by a muscle structure is facing deterioration as a natural aftereffect of the ageing process[27,38,39]. Being well-documented, the associated decrease of muscle strength is up to 12-15% per decade after the age of 50 for both genders and is taking its peak after the age of 70 years old[38,39]. The processes that have been accused of that decline are the atrophy that is met on type II muscle fibers and the impaired neuronal activation[28]. As mentioned before there is a close connection between muscle strength and muscle mass and as several studies impose the decrease of the muscle strength is the result of the age related loss of muscle mass[14].

Examples of resistance exercises for elderly

Trying to define what "resistance exercise" really means, we encounter the performance of eccentric or concentric contraction of each muscle – for duration of 2-3 seconds[40]. Following there are some examples of these exercises, suitable to be performed by a group of elderly:

Resistance Exercises Program
Duration: 8-12 weeks
2-3 sets of 8-10 repetitions
Performances: 2-3 days per week
Focuses more on the concentric type of muscle contraction
Increase of muscle strength but limited changes in functional tests[44]
Progressive Resistance Exercises Program
Performances: 2-3 days per week
Intensity: High
Large effect in the muscular strength / small but significant improvement of physical ability[36]

Table 1. Recommendations – Resistance Exercises program / Progressive Resistance Exercises program.

Positive Outcomes of "Resistance Exercise"	Relating Comments
Muscle Hypertrophy **Muscle Strength**	High intensity resistance exercise counterattacks muscle weakness and physical frailty in elderly people
Increased Muscle Protein Synthesis	The rate of protein synthesis adapts in contractile activity[45]
Satellite Cells Activation & Proliferation	3 months of resistance type of exercise led to an increase of Satellite Cells[46]
Anabolic Hormone Production	
Decrease Catabolic Cytokine Activity	
Increase of type I and type II Muscle Fibers	

Table 2. Positive Outcomes of "Resistance Exercise" Relating Comments.

- Straight leg raises – Working abdominals and hip flexors.
- Bent Knee Raise – this exercise also works the abdominals and hip flexors
- Back Extension – Stretching and extending the lower back and =mid back muscles
- Curl Ups – Strengthening core muscles
- Arm raises on back – improvement of range of motion of upper extremities and shoulders
- Arm raises on knees – improvement of upper back and shoulder stability
- Hip flexion and extension – improvement of range of motion and flexibity

According to studies carried out by trusted medical databases, reviewing the available literature and studies, resistance exercise training led to desirable results for individuals raking from healthy ones to even nursing home individuals.

Concerns regarding resistance exercise

Usually the concern arises for the adequacy of the exercises that are performed since the group of participants consists mainly of elderly people. Resistance exercise is regarded as an affordable and safe intervention through which the individual will succeed in acquiring increased muscle mass and muscle strength – as well as many more positive outcomes e.g. increase of type I and type II muscle fibers, increase muscle protein synthesis[41,42] e.t.c. Exercise carries a crucial role also in the case of satellite cells. Satellite cells are small mononuclear cells normally activated with the presence of exercise. These cells have the ability to maintain muscular function by fusing into muscle fiber – an ability that is over pressed during the states of sarcopenia and frailty[43]. Respecting the results coming from studies that were carried out in healthy older males (aged 60 to 70 years old) we reach the point of visualizing that 3 times per week performance of whole body resistance exercises - for a reasonable period of time- will lead to reduction of the associated age-related deficits[44]. The individual should start as soon as possible to exercise[44].

In the following Table 2, there are collectively the positive outcomes of the resistance exercise

Power Training / Fast Velocity Exercises

After reaching the age of 60, every individual will encounter a steeper degradation of the muscular strength (up to 3-4% per year in particular), a case that is linked to the subsequent -and inevitable- atrophy of type II muscle fibers[47]. The importance of the muscle strength can be perceived throughout the daily living and the activities in which its necessity is met[48]. Several studies imply that training aiming at the improvement of muscle power output leads to a state of better functional properties – regarding the musculoskeletal system. To be more precise it was observed that functional capacity of the elder population was improved after their participation in such a way of physical activity – characterized by high speed movement and loading stimulus. There are novel results coming from many studies that prove that the long-term adherence of the individual to such activities (4-12 weeks) is able to improve characteristics such as strength, muscle cross-sectional area, muscle fat infiltration, muscle power output as well some functional characteristics such as balance, gait ability, occurrences of falls. This type of exercises will recruit type II muscle fibers and increase muscle power[49-51]. The access to those studies is a privilege to each health professional since they are the proof that exercise intervention is important and should be part of the rehabilitation program even for patients that might present cognitive impairment and very poor physical condition.

Conclusion

Reviewing the available literature, a point is reached where it is obvious that the benefits of long-term exercising are of crucial importance for the associated elderly people. As time goes by, the body faces a progressive deterioration in all of its systems and functions. That is completely natural as it is also the necessity of our on-time intervention as health professionals. Some elderly are at great risk of physical disability, falls, breathing problems and many other adverse outcomes that could lead to hospitalization and even morbidity. The adherence to a physical activity program counteracts the risks and keeps the individuals active and able to be characterized community-dwelling. Chronic illnesses and medical conditions such as Alzheimer's disease, dementia, osteoporosis can be improved by the participation in a exercise regime.

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