128 - INFLUENCE OF PHYSICAL EXERCISE ON AGING AND OXIDATIVE STRESS HUMAN

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1.INTRODUCTION

The aging is a natural and universal biological process that consists of morphological, functional, biochemical and psychological changes, which are likely to cause impacts over the health and the life quality of the elders (HAYFLICK, 2007).

This biological process is active and irreversible;causing vulnerability of the organism to internal and external aggression, it being from multifactorial causes and linked to the genetic programming and to the modifications that occur in the cellular-molecular level (MORAES, 2009).

This process may also relates to the presence and action of the free radicals in the organism.According to the theory of oxygen's radicals defined by Harman (1956), stated that the aging could be secondary for the oxidative stress.The free radicals are atoms and molecules unpaired of unstable nature and highly reactive, this meaning they have the capacity of oxidising the electrons of several molecules of the cellular structure and its derivatives (NATHAN, 1994).When it is in excess, the free radicals may lead the organism to an oxidative stress state, causing serious molecular damage to the cellular structure and as a result promoting imbalance or even the loss of its functions (DROGE, 2002).

The age, physiological status, diet, lifestyle, emotional state, intense exercise, aging and chronic-degenerative diseases, are factors that have influence in the damaging effects caused by oxidative stress in the human organism (DROGEet al, 2002).

In a review about the influence of free radicals in the muscle aging, Full (2004) showed that oxidative stress is closely linked to fitness and physical performance decrease in the elderly. However, many of these effects may be accentuate also due to lack of physical activity.

According to the Brazilian Society of Sports Medicine and the Brazilian Society of Geriatrics and Gerontology, the physical exercise practiced regularly, improves the life quality of the elderly and its functional abilities, minimize theeffects of physiological changes increasing the general wellbeing and the physical and psychological health. It helps to preserve the independent living and to control the particular conditions and illnesses; it helps also to minimize the consequences of certain incapacities (GUERRA, 2007).However, it may have special attention to the prescription of these exercises, the frequency, intensity, duration and the type of exercise practiced, why it is known that high intensity exercise may lead to increase in the free radicals production and consequentlyresult in oxidative stress (RIBEIRO, 1993).

Given the above statement, this article aim to verify the relation between the process of aging, the oxidative stress and the regular practice of physical exercise, through reviews of bibliographies searched in the following data bases: Scielo, PubMed, Sciencesoft.gr and Cev.org.br in the Portuguese and English languages.

2.AGING AND OXIDATIVE STRESS

The aging process is a unique characteristic of the life cycle of virtually all eukaryotic organisms, in which the functional capability of a variety of physiological or biochemical systems suffer a progressive deterioration during the called "post-maturation phase", attenuating the ability of the organism of maintaining physiological homeostasis and culminating in its death (SOHAL et al., 2002). However, several biological hypotheses had been describe to explain this process, many of them have no empirical support.

Between the years 1954 and 1957 the publications of Denham Rarman in the United States, and later the experiments of Daniel Gilbert, consolidated the theory of aging caused by free radicals.

The relation between the production of these highly reactive chemical species and the human aging process aroused the interest of many scholars who looked to elucidate the involvement of these species in the natural degenerative process of aging. Thus, different theories had been establish to explain the molecular basis of this process.

In 1999 the theory was expanded by Halliwel and Gutteridge to “oxidativedamagetheoryofaging”, pointing out that other toxic species non-radical derived from the oxygen (EROs) and from the nitrogen (N2) (ERNs) also damageoxidatively cellular structures (BARBANTI et al., 2002).

Aclinical study realized by Matsubaraet al (1992) compared30 years old young people and elder people with overage of 69 years old, both healthy.The results show that the elders present lower levels of GSH-Px (glutationareduzina), a potentantioxidantenzyme, and decrease in the activity of GSH-Rd (glutationareductase) and GSH-Px (glutationa-peroxidase) erythrocyte relative to the young people, thus demonstrating the heterogeneous behaviour of the antioxidant defence system relative to aging.

According to SohaleWeindruch, (1996), the hypothesis of oxidative stress is the primary cause which links the loss of physiological functions with the senescence, which can be attenuated in case that there is a decrease in the generation of oxidative stress or in the damage caused by the different types of EROs.

Thus, the EROs play an important role in the development of the endothelial dysfunction and chronic diseases such as hypertension and atherosclerosis (FORTUÑO et al., 2005). Furthermore, frequent senescence diseases are also associated with the increase of oxidative stress, such as Parkinson's disease, cerebral vascular accident, the Alzheimer's disease, multiple sclerosis and cataracts (NOHL, 1993).

3.AGING AND PHYSICAL EXERCISE

The aging is a gradual, universal and irreversible process and leads to a progressive functional loss in the organism (physiologic, psychological and social).

Scientific evidences clearly indicates that the participation of elderly people in physical activities programs is anindependent way to reduce and/or prevent several functional decreases associated with the aging (NELSON et al. 2007). Thus, the main benefits of an active behaviour of the elderly can be classified basically in the biological, psychological and social spheres, standing out among these benefits: a)increase / maintenance of the aerobic capacity; b)increase / maintenance of the muscle mass; c) reduction of the total mortality rate; d)prevention of coronary heart disease; e)improved lipid profile; f)change in

the body composition due to the reduction in fat mass and risk of sarcopenia; g) prevention / control of type II diabetes and arterial hypertension; h) reducing the occurrence of stroke; i) primary prevention of breast and colon cancer; j) reduction in the occurrence of dementia; k) improvement of the self-esteem and self-confidence; l)decrease in the anxiety and stress; m)improvement in the mood and quality of life (NELSON et al. 2007).

Nelson et al (2007) published a document issuing recommendations on the types and amounts of physical activity needed to improve and maintain the health of the elderly, in which shall be taken into account the mode, duration, frequency, intensity and progression; besides the physical needs, social, psychological and physical characteristics of the elderly and must have a plan of individualized exercises, taking into account the previous results of the medical and physical evaluations.

Aerobic endurance and strength exercises are essential for a healthy aging. The aerobic exercises improve functional capacity; increase the cardiac output, preventing and reducing the risk of cardiovascular diseases. The strength exercises improve muscle function, reducing mainly the frequency of falls. Both exercises contribute to significant improvements, concluding that these habits can reduce the risk of chronic disease, early mortality, helping to maintain independence and aging with quality (NELSON et al. 2007).

Meurer et al (2009) conducted a study on the psychological benefit, with 150 elderly people of both sexes who practiced physical exercises in two public universities in the south of Brazil, the results showed that participation in these activities may be one of the factors of the positive perception of self-image and self-esteem found in the population studied.

In the physical area, it could be seen a decrease in the premature death risk, heart diseases, stroke, colon and breast cancer and type II diabetes; as well as acts in the prevention or reduction of arterial hypertension, prevents the weight gain (reducing the risk of obesity), helps in the prevention or reduction of osteoporosis, promote wellness, reduces stress, anxiety and depression (OMS, 2006).

4.PHYSICAL EXERCISE AND OXIDATIVE STRESS

The increase in oxygen consumption, as well as the activation of specific metabolic paths during or after exercise, results in the formation of oxygen free radicals, substances known simply as free radicals (HALLIWELL, 1999). The production of free radicals during the physical exercise depends on the frequency, intensity, duration and type of exercise performed, however, during an intense activity there is an increase of 10 to 20 times in the total oxygen consumption of the organism and of 100 to 200 times in the oxygen uptake by muscle tissue, favouring increased production of EROs (HALLIWELL, 1999).

According to this theory, the exercise is associated with increased generation of free radicals mainly due to the dramatic increase in the VO2 for the active tissues (COOPER et al., 2002).

In many studies, aerobic exercise is used as protocol for induction of oxidative stress, since it raises in a great amount the VO^2 consumption, therefore this modality develops more the capacity of promoting the release of these substances in comparison to those that obtain energy by anaerobic metabolism (GOLDFARB, 1999).

The damages associated to oxidative stress induced by intense exercise are related to decreased physical performance, the presence of muscle fatigue and muscular damage, the overtraining syndrome, and may even cause changes in the immune system (KONIG et al., 2001).

Schneider and Oliveira (2004) demonstrated in rats that the aerobic training performed by treadmill running, increases myocardial capacity to handle a challenge by perfusion with H2O2, causing less contracture and less formation of TBA-RS (substances reactive to acid thiobarbituric), a marker of muscle damage.

Besides the increase in VO2, aerobic exercise can cause increased production of free radicals due to increased release of catecholamine (MCANULTY et al., 2003), the production of lactate (ALI, 2000), the hyperthermia induced by exercise (OSORIO et al., 2003) and the process of ischemia-reperfusion injury associated with exercise (DRÖGE, 2002).

The study of Selamogluet al. (2000) showed adaptive differences between aerobic and anaerobic exercises. The enzyme GPx activity in erythrocytes was increased in long distance runners compared with weightlifters. On the other hand, Subudhiet al. (2001), evaluating elite alpine skiers after intense training, observed no change in markers of oxidative stress, assuming then that these athletes had a positive adaptation in their antioxidant mechanisms due to the training.

In general, muscle damage caused by oxidative stress are more pronounced in less trained individuals who perform exercises with intensity and duration beyond the state of fitness (LAMPRECHT et al., 2004).

Recently, Schneider et al. (2004) found increased activity of erythrocyte GPx enzyme in trained triathletes compared to untrained subjects and total plasma antioxidant capacity (TRAP) increased after exercise on a treadmill in both groups, in other words, there was a greater release of antioxidant substances .

Regular moderateexerciseresults in adaptations in antioxidantcapacity, which protects cells agains tthe delete rious effectso foxidative stress, preventingsubsequentcellulardamage (AGUILO et al., 2003).

Power et al (1999), detailed the increased activity of antioxidant enzymes in response to physical training, as well as the increase in the concentration of antioxidant molecules, mainly GHS, induced by training. However, even if the exercise is associated with increased generation of free radicals, the antioxidant defense systems are able to adapt to such circumstances, increasing its capacity to act in the organism.

The role of resistance exercise on oxidative stress has also been studied in the elderly. Vincent et al. (2002) examined the effects of 6 months of resistance training on basal lipid peroxidation and after acute bout of treadmill exercise. At the end of six months, no change was observed in the basal levels of lipid peroxidation. However, the trained volunteers showed lower levels of lipid peroxidation after acute aerobic exercise session, being this protection associated with increased concentration of circulating thiolswhich act as antioxidants.

Fatouroset al. (2004) evaluated the responses of some markers of oxidative stress and antioxidant status in sedentary elderly during aerobic training, lasting 16 weeks, and after a detraining period of 16 weeks. At the end of the training period it was found that aerobic exercise resulted in adaptations that attenuated the basal lipid peroxidation and increased protection against oxidative stress via increased total antioxidant capacity activity and the GPx. However, the detraining period completely reversed the exercise-induced adaptations.

5.FINAL CONSIDERATIONS

During the aging processthe organism undergoes morphological, functional, biochemical and physiological changes that are accelerated by the action of free radicals in cells and tissues of this organism and when they are found at elevated levels, may even cause deleterious damage to their cells, which is called oxidative stress.

Physical exercise has been pointed as an important antioxidant agent in the elderly reducing oxidative stress, increasing longevity, improving health and quality of life of elderly.

The choice of exercise intensity is of fundamental importance, being a modarate intensity recommended as

antioxidant agent, causing adaptations in the organism, ensuring an efficient system in the fight against aging by protecting the cells against the deleterious effects. In contrast, high intensity exercise promotes adverse effects, in other words, it increases the production of free radicals causing oxidative stress.

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INFLUENCE OF PHYSICAL EXERCISE ON AGING AND OXIDATIVE STRESS HUMAN

ABSTRACT

Among the many theories that seek to explain the aging process, the free radical theory has shown strong evidence, and that when found in high concentrations, cause changes in the cells and tissues of this body, we call oxidative stress. However, exercise of moderate intensity, is considered a strong antioxidant for the elderly, where it causes adaptations in the antioxidant system, thus ensuring a more efficient system in the fight against aging. The aim of this review was to assess the relationship between aging, oxidative stress and exercise. The methodology used was a survey of references and analysis of survey data using classic papers that addressed the topic. The databases were selected: SciELO, PubMed, and Sciencesoft.gr Cev.org.br (Virtual Sports Center).

KEYWORDS: Elderly. Free Radicals.Exercise.

INFLUENCE DE L'EXERCICE PHYSIQUE SUR LE VIEILLISSEMENT ET LE STRESS OXYDANT HUMAINE

RÉSUMÉ

Parmi les nombreusesthéories qui tententd'expliquer le processus de vieillissement de l'homme, la théorie des radicauxlibres a montré des preuvessolidesquelorsqu'on les trouvedans des concentrations élevées, provoquer des changementsdans les cellules et les tissus de cetorgane, on appelle le stress oxydatif. Toutefois, l'exerciced'intensitémodérée, estconsidérécommeunantioxydant puissant pour les adaptations causantâgéesdans le corps, assurant un système plus efficacedans la luttecontre le vieillissement. Le but de cette revue de la littératureétaitd'étudier la relation entre le vieillissement, le stress oxydatifetl'exercice. La méthodologi eutiliséeestunexamen et une nalysedesdonnées de l'enquête àpartir d'articles classiquescouvrantlesujetlittérature. Les bases de donnéessélectionnéesontétéSciELO, PubMed, et Sciencesoft.gr Cev.org.br (Virtual Sports Center).

MOTS-CLÉS: Personnesâgées. Lesradicauxlibres. L'exercicephysique.

INFLUENCIA DE EJERCICIO FÍSICO EN ENVEJECIMIENTO Y ESTRÉS OXIDATIVO HUMANO

RESUMEN

Entre lasmuchasteorías que tratan de explicar elproceso de envejecimiento humano, lateoría de losradicales libres ha demostrado fuerte evidencia de que cuando se encuentraen altas concentraciones, causa cambiosenlas células y tejidos de este órgano, que llamamosestrésoxidativo. Sin embargo, elejercicio de intensidad moderada, se considera un potente antioxidante para lasadaptaciones que causanmayoresenelcuerpo, lo que garantizaun sistema más eficiente enla lucha contra elenvejecimiento. El propósito de esta revisión de la literatura fue investigar larelación entre elenvejecimiento, elestrésoxidativo y elejercicio. La metodología utilizada fuelarevisión y análisis de datos de encuestas de artículos clásicos que abarcanel tema de la literatura. Las bases de datosseleccionadasfueronSciELO, PubMed, y Sciencesoft.gr Cev.org.br (Centro Virtual de Deportes).

PALABRAS CLAVE: Ancianos. Radicales Libres. Ejercicio

INFLUÊNCIA DO EXERCÍCIO FÍSICO NO PROCESSO DE ENVELHECIMENTO E ESTRESSE OXIDATIVO HUMANO

RESUMO

Dentre as várias teorias que procuram explicar o processo de envelhecimento, a teoria dos radicais livres tem mostrado fortes evidências, que quando encontrado em altas concentrações, causam alterações nas células e nos tecidos desse organismo, o que chamamos de estresse oxidativo. Contudo, o exercício físico de intensidade moderada, é considerado um forte agente antioxidante para os idosos, causandoadaptações no organismo, garantindoum sistema mais eficiente na luta contra o envelhecimento. O objetivo desta revisão de literatura foi verificar a relação entre o envelhecimento, estresse oxidativo e exercício físico. A metodologia utilizada foi o levantamento bibliográfico e análises dos dados das pesquisas através de artigos clássicos que abordam o tema. As bases de dados selecionadas foram: Scielo, PubMed, Sciencesoft.gr e Cev.org.br (Centro Esportivo Virtual).

PALAVRAS-CHAVE: Idoso. Radicais Livres. ExercícioFísico.