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ORIGINAL ARTICLE

Changes of stress proteins and oxidative stress indices with progressive exercise training in elderly men

Changements des protéines de stress et des marqueurs du stress oxydant lors d'un entraînement progressif chez des sujets âgés de sexe masculin

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KEYWORDS

Malondyaldeyde;
Heat shocks
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capacity;
Elderly men

Summary

Purpose. – Excessive generation of free radicals and oxidative stress play an important role in acceleration of the aging process and contribute many chronic diseases. Nevertheless, it has been shown that the elderly who are physically active benefit from exercise-induced adaptation in cellular antioxidant defense systems and associated increase in the generation heat shocks proteins (HSPs). Therefore, the aim of the present research was to investigate the effects of 14 weeks participation in concurrent (resistance and aerobic) training on indices of oxidative stress and HSP70 concentration in inactive elderly men.

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MOTS CLÉS

Malondyaldéhyde ;
Protéine HSP 70
carbonyle ;
Capacité
antioxydante totale ;
Sujet âgé

Methods. – Twenty-four inactive elderly men voluntarily participated in this research and were assigned to either training ($n = 12$) or control ($n = 12$) groups. In the control group, participants were advised to maintain their normal lifestyle during the study, while the training group was prescribed a combination of resistance and aerobic training for 14 weeks. At baseline and after 14 weeks, venous blood samples were obtained for measurement of malondialdehyde (MDA) and carbonyl protein (PC), total antioxidant capacity (TAC) and HSP70 concentration.

Results. – The results indicate very significant effects of exercise training on all measured experimental variables when compared to the control group: MDA and PC concentrations decreasing, whilst HSP70 and TAC in aged men were increased significantly after exercise training in training group (all $P < 0.01$).

Conclusion. – This study shows conclusively that concurrent exercise training for 14 weeks decreases indices of oxidative stress in elderly men and can ameliorate age-related deficits in HSP70 and the circulating antioxidant defense system.

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Résumé

But. – Une production excessive de radicaux libres et le stress oxydant jouent un rôle important dans l'accélération du processus de vieillissement et sont impliquées dans beaucoup de pathologies chroniques. Néanmoins, il a été démontré que les personnes âgées qui sont physiquement actives profitent des modifications induites par l'exercice dans les systèmes de défense antioxydants et l'augmentation associée des protéines du choc thermique (HSP). Le but de ce travail était donc d'étudier les effets de la participation à 14 semaines d'entraînement associé (résistance + endurance) sur les marqueurs du stress oxydatif et les concentrations de HSP70 chez des hommes âgés sédentaires.

Méthodes. – Vingt-quatre hommes âgés sédentaires ont volontairement participé à cette recherche 20 et ont été affectés aux groupes entraînement ($n = 12$) ou contrôle ($n = 12$). Dans le groupe témoin, les participants ont été invités à maintenir leur mode de vie habituel au cours de l'étude, tandis que le groupe entraînement a réalisé 14 semaines d'entraînement associé (résistance + endurance). Avant le début de l'étude et à la fin des 14 semaines, des échantillons de sang veineux ont été obtenus pour la mesure du malondialdéhyde (MDA), de la protéine carbonyle (PC), de la capacité anti-oxydante totale (TAC) et de la concentration en HSP70.

Résultats. – Les résultats montrent un effet marqué de l'entraînement physique sur toutes les variables mesurées en comparaison avec le groupe contrôle : les concentrations de MDA et PC diminuent, la ue HSP70 et la TAC augmentent de façon significative après l'entraînement physique dans le groupe de sujets âgés soumis à l'entraînement ($p < 0,01$).

Conclusion. – Cette étude montre de façon concluante que 14 semaines d'entraînement combinant résistance et endurance diminuent les marqueurs de stress oxydant chez des sujets âgés de sexe masculin et peuvent ainsi contribuer à corriger les déficits en HSP70 et en système de défense antioxydant liés à l'âge.

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1. Introduction

Aging, as a complex multifactorial biological process, is a progressive decline in physiological function that is often accompanied by increased susceptibility to diseases leading to disability and often premature death [1]. The free radical theory of aging, involving the accumulation of deleterious effects caused by reactive oxygen species (ROS) and reduced antioxidant defenses in elderly people, is the most popular theory proposed for the aging process [2]. According to this theory, oxidative stress increases with age and the ability of organism to cope with cellular damage induced by this stress decrease [3], finally causing cellular dysfunction and resulting in apoptosis [4]. Moreover, abundant experimental and observational studies have found that age-associated oxidative damage and reactive oxygen species (ROS) have

an important role in diverse chronic age-related diseases such as cancers, cardiovascular disease (CVD), Alzheimer's and Parkinson's diseases [5,6].

It seems that proteins, because they have specific functions, are one of the most obviously affected macromolecules in age-related oxidative damage [7]. An age-related increase in the protein carbonyl (PC) concentration, which has been used as a marker of ROS-mediated protein oxidation, was observed in various tissues [8]. Mutlu-Türkoğlu et al., in this regard, observed that plasma malondialdehyde (MDA) and PC levels associated with accumulation of oxidative damage were significantly higher in the plasma of elderly subjects as compared to young subjects [9]. Moreover, it has been shown that the capacity to produce heat shock proteins (HSPs) decreases with aging in normal older subjects [10]. HSPs act as molecular

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