RESEARCH PAPER

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Modulation of brain antioxidant enzymes in response to treadmill exercise training with reference to aging

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Aging is an universal, intrinsic, progressive, irreversible and deleterious phenomenon. As age advances, several enzymes show an increase, while some decrease and some do not show any change in their activities. These specific alterations in the enzymes must have inflicted a great impact on the process of aging. This process is thought to be related to increase in free radicals generation and oxidative stress. In the present study an attempt was made to investigate the impact of exercise training on aging by selecting two age groups (3months as "young" and 18 months as "old"). Standard protocols were followed for the assay of selective antioxidant enzymes with rat as an animal model. Superoxide dismutase (SOD), catalase (CAT), glutathione reductase (GR), glutathione peroxidase (GPx), and glutathione (GSH) levels were decreased with the advancement of age. The decline in antioxidant enzymes with age could be due to the disturbances of intracellular prooxidant-antioxiadnt homeostasis, which leads to cell death. However, the activities of SOD, CAT, GR and GPx and levels of GSH were augmented with exercise training in both age groups of rats. The elevation of SOD observed might be aimed at the removal of superoxide anion radicals generated due to aging process. Where as, the increase in GPx activity indicate its active participation in the decomposition of hydrogen peroxide and organic hydroperoxides generated via dismutation of super oxide anion by SOD. It was concluded that 2 months treadmill exercise is beneficial in order to avoid detrimental effects of free radical generation during the process of aging.

Key words : Aging, Exercise, Antioxidant enzymes, Rats.

INTRODUCTION

It is well known fact that every organism, which has come into existence, has to face death sooner or later. However, scientists with the hallmark of enquiring nature could not stop, wondering about this inevitable phenomenon of aging and death (Subba Rao, 1990). Aging is an inevitable biological process and characterized by a general decline in physiological functions. In 1956, Harman suggested that free radicals produced during aerobic respiration cause cumulative oxidative damage, resulting in aging and death. In recent years, convincing (believable) data have been accumulated to suggest that mitochondria act like a timer that ticks all the way through the aging process (Wei and Lee, 2002). Age related damage from oxidative stress could be elicited through increased ROS, decreased antioxidant enzyme activities or a combination of both. Free radical oxidation of proteins also increases with age (Stadtman, 1992; Haramaki and Packer, 1994). Several investigations have shown an increase in production of ROS in various tissues of older animals (Davidge *et al.*, 1996).

Exercise is an elixir of life. Many studies show that aerobic activity continuing at least 20 minutes is necessary for obtaining psychological well being. Either high or low intensity exercise lead to positive changes in mood (Kennedy and Newton, 1997). Exercise can be accomplished only through the series of complex interactions within the body involving all the body systems. Exercise is a general term that refers to many types of physical exertions that may vary in its duration, intensity and type. The benefits of regular physical exercise include reduce risk of cardiovascular disease, cancer, osteoporosis and diabetes (McCarteer, 2000). It is well known that regular performed moderate exercise has many beneficial effects, whereas, acute exercise can produce significant damage in the tissue (McCutcheon *et al.*, 1992). Nevertheless, an age related decrease in the expression of several genes involved in mitochondrial bioenergetics and mitochondrial biogenesis occurs during aging.

To cope with oxidative stress, like other organs of the body, brain also well equipped with highly sophisticated and complex defense mechanism known as "antioxidant defense system". This defense system includes antioxidant enzymes such as, superoxide dismutase (SOD), catalase (CAT), glutathione peroxidase (GSH-