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Influence of short-term exercise on Reelin synthesis in the postnatal cerebral cortex of rats

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ABSTRACT: Reelin is a large neuroprotein which synthesized and secreted by GABAergic interneurons in adult cerebral cortex. This protein is vital for neuronal migration and development of the brain cortex in embryonic period. In adult period, Reelin induces dendrites generation, dendritic spines formation and so increases plasticity. Exercise has positive effects on brain structure and function. Some types of exercise can improve long-term potentiation, neurogenesis and plasticity. Present study investigated the effects of two weeks of treadmill running exercise on Reelin protein concentration in the cerebral cortex of adult male rats. In this study twenty male rats with 200±50 g weight were randomly divided into two groups; Test group that treated with two weeks of running exercise and control group without any training program. Rats of test group ran for 60 min /day at 22 m/min, 5 days/week on treadmill. After training period, all animals were deeply anesthetized and killed with rapid decapitation. Then brain cortex was immediately removed and concentration of Reelin protein in the cerebral cortex were measured by ELISA assay. Results shows that forced exercise could not significantly affect concentration of Reelin protein in the brain cortex of adult rats. This study suggested that treatment with short-term regular exercise could not affect Reelin protein synthesis and secretion by GABAergic interneurons of the brain cortex.

***Keywords*:** Reelin, physical activity, Cerebral cortex

INTRODUCTION

During embryonic period, Reelin is secreted by Cajal–Retzius (CR) cells located in the marginal zone into the extracellular matrix of the brain cortex. This neuroprotein regulates migration and positioning of cortical neurons that do not synthesize Reelin (Pesold et al., 1998).

In the adult brain cortex, Reelin is expressed by GABAergic interneurons (Alcántara et al., 1998; Fatemi, 2004). This protein is expressed in synaptic contacts, and induces long-term potentiation (LTP) (Pesold et al., 1998; Beffert et al., 2005). Reelin Modulates NMDA Receptor Activity (Chen et al., 2005), generation of dendrites, and formation of dendritic spines (Niu et al., 2008).

Exercise improves behavior and brain function. Some types of exercise increases metabolism, bioenergetic capacity and neuronal activity in the motor cortex (McCloskey et al., 2001). This study examines the effect of short-term treadmill running exercise on Reelin protein concentration in the cerebral cortex of adult male rats.

MATERIALS AND METHODS

In this study twenty male rats with 200±50 g weight were maintained on a 12-h light/dark schedule (lights on at 7:00 a.m.) and given ad libitum access to food and water.

All animals were randomly divided into two groups; Test group that treated with two weeks of treadmill running exercise and control group without any training program. Treadmill running exercise was performed between 09:00 and 10:00 a.m. Rats of test group ran for 60 min /day at 22 m/min, 5 days/week on treadmill and rats of control group, until the sacrifices were kept in their own cages.

After training period, all rats were deeply anesthetized and killed with rapid decapitation. The cerebral cortexes of brains were quickly removed, frozen with liquid nitrogen. ELISA assay was performed according to the manual of the Reelin ELISA kit (E92775Ra). All the data were represented as means ± SE using one-way analysis of variance with Tukey's Post-Hoc.

RESULTS AND DISCUSSION

Results

Results of present study showed that two weeks of treadmill running exercise had not significant effect on Reelin protein concentration in the brain cortex of test group as compared to control group (Fig. 1B).

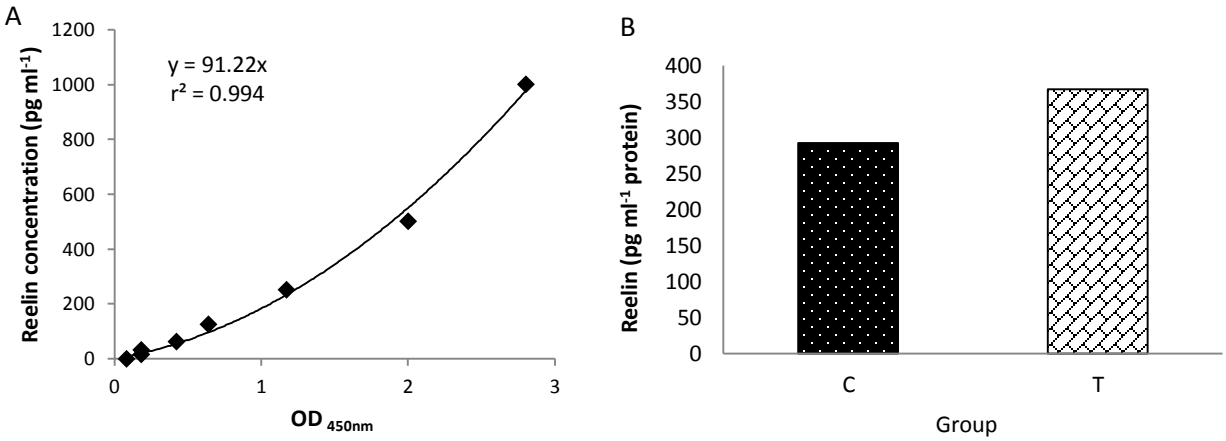

Fig. 1. Effect of two weeks of forced exercise on Reelin protein concentration in the cerebral cortex of adult male rats (mean ± standard error). (A) Representative standard curve obtained using the Reelin ELISA kit is shown. (B) Exercise could not change Reelin protein levels in the postnatal brain cortex of test group as compared to control group significantly ($P<0.05$)

Discussion

In this study, the Reelin protein levels in the brain cortex were assessed by ELISA method. Present study confirmed that treadmill running for two weeks could not affect synthesis of Reelin protein in the brain cortex of adult male rats. Results of this study are in agreement with the prior study which suggested that voluntary exercise cannot modify amounts of Reelin protein in the brain of adult healthy rats (Herring et al., 2011). Moreover, since Reelin has important role in dendritic spine formation and dendritic spine density (Niu et al., 2008; Pujadas et al., 2010), present study can be consistent with study of Faherty et al which showed that exercise had no effect on dendritic spine density in the brain cortex of adult rats (Faherty et al., 2003).

Previous study suggested that treadmill running exercise not only improves the muscle aerobic capacity but also increases plasticity-related proteins such as bdnf in the brain of adult rats (Liu et al., 2009). Previously showed that exercise has broad positive effects on the brain and Many central and peripheral growth factors, such as BDNF, IGF-1 and VEGF, are involved in this beneficial effects (Ang and Gomez-Pinilla, 2007; Cotman et al., 2007). Present study suggested that short-term treadmill runnig exercise could not affect cortical Reelin protein synthesis which is a plasticity related neuroprotein (Weeber et al., 2002).

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CONCULSION

This study suggested that two weeks of regular moderate exercise could not affect Reelin protein synthesis and secretion by GABAergic interneurons of cerebral cortex in the healthy adult rats.

If we substitute some values to a_i , α_i in multi-objective linear programming problem (3.1), it reduces into single objective LPP. This discussion also holds in the case as given by (Kanniappan and Thangavel ,1998). The same problem for integer solution was studied by(Bhargava and Sharma ,2003).

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