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BOOK OF ABSTRACTS

"Exercise is the Best Medicine"

Effect of Different Exercise Methods on Anxiety-Like Behavior and Cognitive Functions of Alzheimer's Disease.

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INTRODUCTION

Although exercise may have beneficial effect on neurodegenerative diseases, the effects of aerobic, resistance or combined (aerobic+resistance) exercise types on development of Alzheimer's Disease (AD) is not clear.

OBJECTIVES

To investigate the probable improving effects of aerobic, resistance and combined exercise methods on anxiety-like behavior and cognitive functions in an experimental AD model.

METHODOLOGY

An AD model has been demonstrated with a long-term D-galactose injection combined with ovariectomy (D-GAL+OVX). Female Wistar rats (250-340) g were divided into two groups as sham operated and D-GAL+OVX. D-galactose (100 mg/kg) or saline was administered by intraperitoneally to ovariectomized and sham-operated rats (n=8), respectively. Aerobic (AE; swimming) (1 hour/day), resistance (RE; climbing with weight on vertical ladder) and combined exercises (CE) (aerobic+resistance/ alternately) were performed for 3 times a week for 6 weeks. Some of the rats were sedentary. Anxiety-like behavior and cognitive functions were evaluated via holeboard test and object recognition test. At the end of experiments, serum samples were taken for cortisol measurements and brain tissue was removed

for immunocytochemical determinations. Hippocampal and cortical mRNA levels of Nerve Growth Factor (NGF), Brain Derived Neurotrophic Factor (BDNF) and Amyloid Precursor Protein (APP-695) were measured via RT-PCR. Immunocytochemical technique was used for evaluation of Amyloid Beta ($A\beta$), NGF, BDNF immunoreactive neurons.

RESULTS

Freezing time and serum cortisol levels were increased in OVX+D-GAL sedentary group ($p < 0.01$) compared with sham sedentary group, and decreased back with AE ($p < 0.05$). Deteriorated cognitive functions in OVX+D-GAL sedentary group ($p < 0.01$) were improved with all exercise types ($p < 0.05-0.001$). Decreased cortical and increased hippocampal NGF immunocytochemical scores of OVX+D-GAL sedentary group ($p < 0.01$) were increased by CE ($p < 0.05$). Increased APP mRNA levels in OVX+D-GAL sedentary group ($p < 0.05$) were decreased via CE ($p < 0.05$). Elevated $A\beta$ score in OVX+D-GAL sedentary group ($p < 0.001$) was decreased by RE and CE ($p < 0.01$). Increased hippocampal BDNF scores of sham operated AE ($p < 0.01$) and CE ($p < 0.05$) groups compared to sham sedentary group were observed.

CONCLUSIONS

Our results suggest that aerobic exercise via decreasing anxiety-like behavior and all exercise types via improving cognitive functions may have protective effects in development stage of AD. Resistance and combined exercise models may improve hippocampal APP695 mRNA level and $A\beta$ score that are important signs of AD. Furthermore combined exercise has beneficial effect on neuroplasticity via effecting cortical and hippocampal immunocytochemical NGF score. This is the first study recommending different exercise methods for reducing anxiety-like behavior and for improving cognitive functions of AD.

REFERENCES

1. Xiangdong Hua, Ming Lei, Yongjie Zhang, Jiong Ding, Qunying Han a, Gang Hu, Ming Xiao. Long-term D-galactose injection combined with ovariectomy serves as a new rodent model for Alzheimer's disease. *Life Sciences* 80, 2007;1897–1905
2. Marosi K, Bori Z, Hart N, Sarga L, Koltai E, Radak Z, et al. Long-term exercise treatment reduces oxidative stress in the hippocampus of aging rats. *Neuroscience* 2012;226: 21–8.
3. Neeper SA, Gomez-Pinilla F, Choi J, Cotman CW. Physical activity increases mRNA for brain-derived neurotrophic factor and nerve growth factor in rat brain. *Brain Res* 1996;726(1–2):49–56.
4. Gandy, S., Estrogen and neurodegeneration. *Neurochem.* 2003;Res. 28,1003–1008.
5. Yua F, Xua B, Son C, Ji L, Zhang X. Treadmill exercise slows cognitive deficits in aging rats by antioxidation and inhibition of amyloid production. *NeuroReport.* 2013; 24:342–347
6. R.C. Cassilhas, K.S. Lee, D.P. Venâncio, M.G.M. Oliveira, S. Tufik and M.T. de Mello. Resistance exercise improves hippocampus-dependent memory. *Braz J Med Biol Res.* 2012; Volume 45(12) 1215-1220.
7. Souza LC, Filho CB, Goes AT, Fabbro LD, de Gomes MG, Savegnago L, Oliveira MS, Jesse CR. Neuroprotective effect of physical exercise in a mouse model of Alzheimer's disease induced by β -amyloid_{1–40} peptide. *Neurotox Res.* 2013 ;24(2):148-63.