hyperactivity of LC neurons. The nucleus paragigantocellularis (PGi) provides the main excitatory inputs to LC and plays a pivotal role in opiate withdrawal. In the present study, the direct facilitatory role of PGi on opiate withdrawal-induced hyperactivity of LC neurons was investigated using a newly developed brain slice containing both LC and PGi. Methods: HRP retrograde neuronal tracing was used to verify the existence of both LC and PGi neurons in the developed slice. The spontaneous discharge rate and resting membrane potential (RMP) were recorded in LC neurons using whole cell patch clamp recording. Results: Results showed that the net discharge rate and the net RMP of LC neurons in slices containing both LC and PGi neurons are significantly higher than slices lacking intact (uncut) PGi inputs. Conclusion: Altogether, our results propose that increase in PGi-mediated excitatory transmission might partially facilitate the opiate withdrawal-induced hyperactivity of LC neurons.

Keywords: Locus coeruleus; paragigantocellularis; opiate withdrawal; rat

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Sleep Deprivation and Cognitive Impairments in Female Rats: The Beneficial Effects of Exercise

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Abstract: Inadequate sleep is a common problem in modern societies. Physical exercise has been suggested to attenuate the cognitive impairments induced by sleep deprivation

(SD) in male rats. Female rats are more vulnerable to the deleterious effects of SD on cognitive functions. The objective of the current study was to investigate the effects of physical exercise on learning and memory, LTP and the levels of BDNF mRNA and protein in the hippocampus of female rats following SD. Intact and ovariectomiezed (OVX) female Wistar rats were used in the present study. The exercise protocol was four weeks treadmill running and the multiple platform method was applied to induce 72 h SD. The cognitive functions were evaluated by using Morris water maze (MWM) and field potential recording in the CA1 area of the hippocampus. Quantitative RT-PCR and immunoblot analysis were used to evaluate the level of hippocampus BDNF mRNA and protein, respectively. Learning and short term memory of sleep-deprived OVX rats were impaired compared to the intact and the OVX groups in MWM ($p< 0.05$). Field potential recording data indicated that the induction and maintenance phase of E-LTP impaired in the sleep deprived animals compared to the other groups. Physical exercise alleviated the SD-induced behavioral performances and E-LTP impairments in both intact and OVX groups ($p<0.05$). Also, protein and mRNA expression of BDNF was significantly ($p<0.05$) decreased after SD in OVX rats in compared with other groups. Furthermore, sleep deprived OVX rats under exercise conditions had a significant ($p< 0.05$) up-regulation of the mRNA and BDNF protein. In conclusion, the regular exercise can improve the cognitive functions deficits in sleep-deprived female rats and exert a protective effect against hippocampus-related impairments induced by SD probably by inducing BDNF expression.

Keyword: Exercise, sleep deprivation, learning and memory, LTP and BDNF

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