effects of administration of GABA A receptor agonists in early life on cognitive functions of sleep-deprived male rats.

Materials and methods

In the present study, four groups of 10 male pups were selected after birth from their mothers. The first group was the control group (Normal saline recipient) - the second group received muscimol (500 µg/kg on days 7, 9, and 11) - the third group was sleep deprived - the fourth group received muscimol + sleep deprivation. Various behavioral tests were performed using open field tests, and elevated plus maze (EPM) in order to investigate anxiety-like behaviors in rats. The effect of stimulation of GABA-A receptors on cognitive performances in sleep-deprived rats was investigated using the Morris water maze, Y maze, novel object recognition, and passive avoidance memory tests. Then, after anesthetizing the animal, the hippocampus and prefrontal cortex of the rats were dissected after inducing sleep deprivation to measure antioxidant and oxidative stress factors.

Results

Our findings showed that stimulation of GABA receptors by muscimol in early life reduced anxiety-like behaviors in sleep-deprived animals.

Stimulation of GABA receptors by muscimol in early life reduced anxiety-like behaviors in the Mu+SD group significantly ($P<0.05$) compared to the SD group. Sleep deprivation decreased learning and short-term spatial memory, while stimulation of GABA receptors in early life prevented the decrease in spatial learning. Also, sleep deprivation and muscimol consumption in early life impaired spatial memory, but this reduction is less in the Mu+SD group compared to the SD group. Stimulation of GABA receptors in early life and sleep deprivation in adolescent rats impaired novel object recognition memory, while the effect of GABA receptor stimulation is stronger compared to sleep deprivation. Stimulation of GABA receptors in early life and sleep deprivation have no significant effect on the percentage of frequency in Y-maze. Sleep deprivation caused impairment in passive avoidance memory, while stimulation of GABA receptors in early life had no significant effect on passive avoidance memory. Stimulation of GABA receptors by muscimol in early life caused a relative increase in antioxidant factors (SOD and GPx) and a relative decrease in MDA in the hippocampus and prefrontal cortex of sleep-deprived rats.

Conclusion

The results of the present study showed that according to the results of behavioral tests, stimulation of GABA receptors in early life prevents anxiety-like behaviors in adolescent rats. Stimulation of GABA receptors by muscimol in early life also caused a partial improvement of some cognitive functions such as learning and spatial memory, or aggravated cognitive disorders such as novel object recognition memory. Also, the use of muscimol in early life has no effect on some cognitive functions such as passive avoidance memory and periodic percentage in sleep-deprived rats. Our study emphasized the role of stimulation of GABA receptors by muscimol in reducing oxidative stress caused by sleep deprivation through increasing antioxidant factors (SOD and GPx) and decreasing MDA in the hippocampus and prefrontal cortex of sleep-deprived rats.

Keywords: Anxiety-like behaviors, Cognitive functions, Muscimol, Sleep deprivation