PT703

Sleep under exposure to dim light of 10 lux for one night could decline one’s brain activation during working memory task: one evidence from fMRI study

Seung-Gul Kang1, Ho-Kyong Yoon2, Chul-Hyun Cho3, Sooonwook Kuon1, Young-Min Park4, Eun-Il Lee5, Leen Kim2, Heon-Jeong Lee*6

1 Department of Psychiatry, Gil Medical Center, Gachon University, School of Medicine, Incheon, Korea; 2 Department of Psychiatry, Korea University College of Medicine, Seoul, Korea; 3 Department of Anatomy, Korea University College of Medicine, Seoul, Korea; 4 Department of Psychiatry, Ilsan Paik Hospital, Inje University College of Medicine, Goyang, Korea; 5 Department of Preventive Medicine, Korea University College of Medicine, Seoul, Korea

*Corresponding author.

This study was conducted to investigate the effect of the exposure to dim light during sleep on the brain activation while conducting tasks requiring working memory. 23 young healthy participants were examined in this study. The participants were instructed to sleep in a polysomnography room with no light exposure on the first night and under a dim light condition of 5 lux or 10 lux on the second night. After each of the first and the second night, the participants underwent the functional magnetic resonance imaging (fMRI) scan for the n-back task. Statistical parametric maps of brain regions showed more activation in the right inferior frontal gyrus (p FWE-corrected = 0.014) before exposure, compared to the post exposure to 10 lux light during the n-back task, although the change of the response accuracy after the light exposure was not significant in the n-back task. The decreases of fMRI activity in right inferior frontal gyrus (p FWE-corr = 0.033) and left frontal gyrus (p FWE-corr = 0.010) areas were more significant during the 2 back task rather than 1 or 0 back task in the group exposed to the light of 10 lux. To our knowledge, this is the first report on the decline of brain activation using the fMRI during N back task after sleep with an exposure to dim light. The dim light exposure might influence the brain function related to cognition although we could not feel the significant impairment in the subjective symptoms.

Keywords: dim light at night, working memory, fMRI, brain activation

Abstract

Background: Urban childhood environments may be related to neuropsychiatric disorders. In this China-US collaborative study, we aimed to explore the underlying mechanisms of gene and childhood environment effects on brain function and neuropsychiatric risk. This leverages on dramatic urbanization and rural-urban migration since the 1980s in China. Here, we examined episodic memory encoding and retrieval of aversive and neutral pictures in individuals with different rural-urban childhoods.

Methods: e examined subjects who were currently living in urban cities and have similar gender, education and current social economic status, but have had different urban or rural childhoods. In particular, we studied subjects who moved to cities from rural areas after age 18 (117 subjects) and those who have always lived in cities (90 subjects). In the episodic memory paradigm scanned in a 3T GE MRI, subjects rated whether blocks of neutral or aversive International Affective Pictures were indoors or outdoors in the encoding session, and whether the pictures have been seen before in the retrieval session. Data were analyzed in Statistical Parametric Mapping 12.

Results: Both subject groups had similar demographic and behavioral results. In the encoding and retrieval tasks, subjects revealed stronger activation when processing aversive relative to neutral pictures in hippocampus, amygdala, putamen and cortex. (p<0.001, uncorrected). Rural childhoods was associated with relatively increased activation in neutral and aversive conditions at hippocampus, amygdala, and frontal cortex in encoding and retrieval. These effects were accentuated in the aversive minus neutral contrast during encoding.

Discussion: Childhoods in rural and urban environments appear associated with physiological differences in the neural processing of picture scenes. The childhood environment effects were accentuated in the encoding of aversive pictures at the hippocampus, amygdala and frontal cortex. These may relate to differing neuropsychiatric vulnerabilities of rural and urban childhoods. 