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Low Power, Low Frequency Electromagnetic Field Improves the Daytime Sleep Quality

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Introduction

The human brain can detect, absorb, and respond to low-level, low-frequency electromagnetic fields (EMF) [1]. A big proportion of daytime working people can benefit from afternoon nap that regarded a potent behavioral strategy minimizing sleepiness, fatigue and impairments of cognitive and physical functioning [2]. So, it is important to determine whether nap's efficacy can be increased by exposure to low-level EMF falling in the frequency range of slow waves (1Hz-4Hz) because these waves are generated by the brain during the deep sleep stage. The aim of the present study is to compare the effects of exposure to EMF (0.004 μT) of two frequencies, 2Hz and 8Hz, for testing whether such exposure can modify spectral EEG power densities in delta and theta ranges during stages 2 and 3 of NREM sleep.

Subjects and Methods

Eight male and six female volunteers were recruited among university students. 1-st stage of EEG recordings started with the first 5-min interval without any interventions. For the stage 2, an EMF inductor provide periodic stimuli for 45 min. An EMF emitting device ("ECOSleep CUBE" Skolkovo Innovation Center, Moscow, Russia) was placed at the distance of 700 mm from the participant's head to generate 0.004μT EMF around the head.

The Fast Fourier Transform was applied to compute power spectra densities for 5 derivations (Fz, F4, Cz, Pz and O2) in order to calculate absolute spectral power densities (μV2) for each of the 16 frequency bandwidth (0.50-1.49 Hz, 1.50-2.49 Hz…). These 16 single-Hz power densities were averaged on each of 30-s intervals of EEG records and ln-

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transformed. In the present report, the amounts of sleep stages (N1, N2, N3) were analyzed in 5-10 min intervals of each 50-min record.

The action of the sham exposure did not demonstrate significant changes in 2Hz and 8Hz/ 0.004μT during the first 30 min of nap (Figure 1). For the remaining 20 min, amount of stage 3 sleep, amount of the sum of stages 2 and 3 continued to build up under the 8Hz/0.004μT exposure and, especially, under the 2Hz/0.004μT exposure. When the analysis was limited to these 20 minutes, the differences indicating a higher amount of deep sleep and higher power densities in delta and theta ranges were confirmed for the 2Hz/0.004μT exposure.

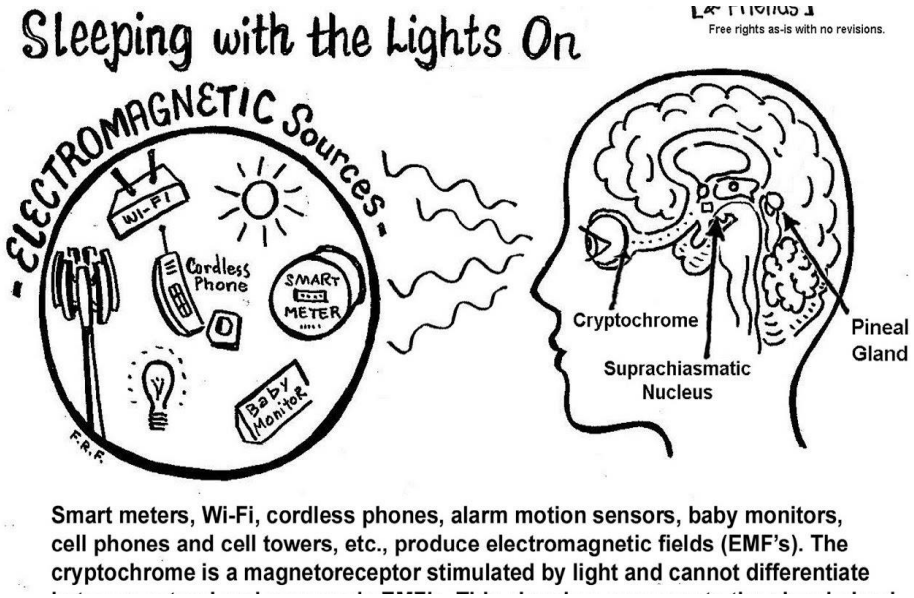

Figure 1. Effect of electromeganetic force on brain function via Electro-Encephalogram (modified from, (https:// www.radiationresearch.org/research/emf-and-poor-sleep-quality-the-mechanism-explained/ accessed December 20, 2020).

Conclusion

The results suggested that low power EMF in delta and theta ranges (1Hz-8Hz) is able to control and induce the stage N3 of a human daytime sleep.

Acknowledgments

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