

FULL TEXT LINKS

[Basic Clin Neurosci](#). 2021 Nov-Dec;12(6):849-860. doi: 10.32598/bcn.2021.1204.2. Epub 2021 Nov 1.

Comparing the Effects of Long-term Exposure to Extremely Low-frequency Electromagnetic Fields With Different Values on Learning, Memory, Anxiety, and β -amyloid Deposition in Adult Rats

Nafiseh Faraji ¹, Iraj Salehi ¹, Akram Alizadeh ^{2 3}, Arash Pourgholaminejad ⁴, Alireza Komaki ¹, Masoumeh Taheri Azandaryani ¹, Reihaneh Sadeghian ^{5 6}, Zoleikha Golipoor ^{1 7}

Affiliations

PMID: 35693151 PMCID: [PMC9168822](#) DOI: [10.32598/bcn.2021.1204.2](#)

[Free PMC article](#)

Abstract

Introduction: Extremely Low-Frequency Electromagnetic Fields (ELF-EMFs) have gathered significant consideration for their possible pathogenicity. However, their effects on the nervous system's functions were not fully clarified. This study aimed to assay the impact of ELF-EMFs with different intensities on memory, anxiety, antioxidant activity, β -amyloid (A β) deposition, and microglia population in rats.

Methods: Fifty male adult rats were randomly separated into 5 groups; 4 were exposed to a flux density of 1, 100, 500, and 2000 microtesla (μ T), 50 Hz frequency for one h/day for two months, and one group as a control group. The control group was without ELF-EMF stimulation. After 8 weeks, passive avoidance and Elevated Plus Maze (EPM) tests were performed to assess memory formation and anxiety-like behavior, respectively. Total free thiol groups and the index of lipid peroxidation were evaluated. Additionally, for detection of A β deposition and stained microglia in the brain, anti- β -amyloid and anti-Iba1 antibodies were used.

Results: The step-through latency in the retention test in ELF-EMF exposure groups (100, 500 & 2000 μ T) was significantly greater than the control group ($P < 0.05$). Furthermore, the frequency of the entries into the open arms in ELF-EMF exposure groups (especially 2000 μ T) decreased than the control group ($P < 0.05$). No A β depositions were detected in the hippocampus of different groups. An increase in microglia numbers in the 100, 500, and 2000 μ T groups was observed compared to the control and one μ T group.

Conclusion: Exposure to ELF-EMF had an anxiogenic effect on rats, promoted memory, and induced oxidative stress. No A β depositions were detected in the brain. Moreover, the positive impact of ELF-EMF was observed on the microglia population in the brain.

Highlights: ELF-EMFs have gathered significant consideration for their possible pathogenicity. ELF-EMFs' effects on the nervous system's functions were not clarified yet. Positive impact of ELF-EMF was observed on the microglia population in the brain.

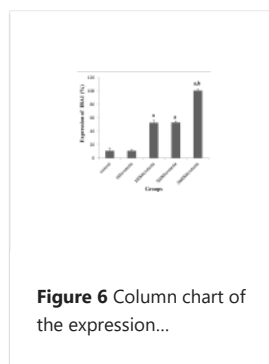
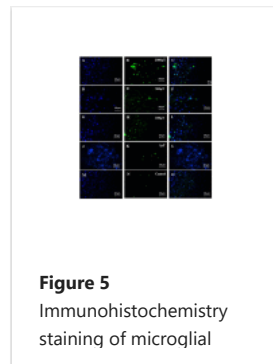
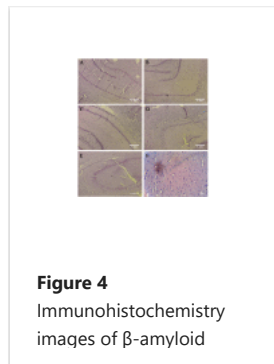
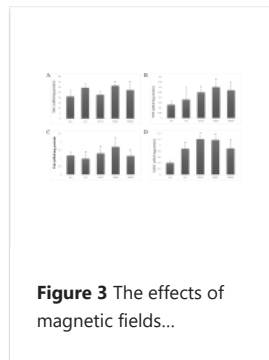
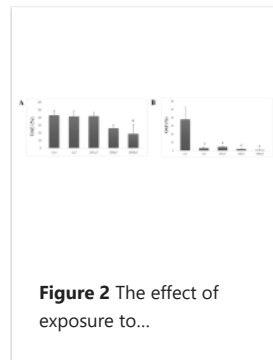
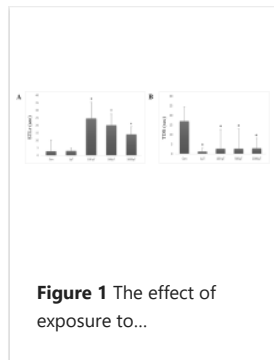
Plain language summary: ELF-EMFs effects on human health are a considerable concern. Studies revealed the adverse effects of ELF-EMF in neurological disorders such as Alzheimer's Disease (AD). Anxiety could be an early manifestation of AD. There is a correlation between occupational exposure to ELF-EMF and AD. Recently the researchers interested in the study of the effects of ELF-EMFs on the human body. Some studies examined the molecular mechanisms and the influence of ELF-EMFs on the biologic mechanisms in the body. Also, Microglia act in the Central Nervous system (CNS) immune responses; over-activated microglia can be responsible for devastating and progressive neurotoxic consequences in neurodegenerative disorders. This study aimed to evaluate the memory, anxiety,

antioxidant activity, β -amyloid deposition, and frequency of the microglial cells exposed to microtesla (μ T) and 2000 (μ T) ELF-EMFs.

Keywords: Anxiety; Magnetic field; Memory; Microglial cell; Oxidative stress; β -amyloid.

Copyright© 2021 Iranian Neuroscience Society.

Figures



Related information

[MedGen](#)

LinkOut - more resources

Full Text Sources

[Europe PubMed Central](#)

[PubMed Central](#)