

EFFECTS OF ELECTROMAGNETIC FIELDS ON COGNITIVE PERFORMANCE AND WAKING EEG

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Little is known about the non-thermal effects of pulsed radio frequency radiation. Electromagnetic fields (EMF) such as those emitted by mobile phones may interfere with neuronal activity and therefore alter brain functioning. Previous studies showed consistent effects of EMF exposure on the human non-REM sleep EEG. Moreover, EMF altered the EEG and regional cerebral blood flow during waking (Huber et al. J Sleep Res 2002; 11: 289-295). The present study investigated the effect of pulse modulated and continuous wave EMF exposure on cognitive performance and subsequent waking EEG.

Following a baseline EEG recording, 24 healthy male subjects were exposed for 30 min to (1) a pulse modulated (PM) EMF signal, approximating the spectral content emitted by GSM mobile phones (900 MHz; 1 of 8 slots active), (2) a continuous wave (CW) EMF consisting of the 900 MHz carrier frequency only, or (3) a sham exposure with the antennae turned off. The two active conditions were applied at the same peak specific absorption rate (SAR) level of 1 W/kg. Each subject was exposed to each condition according to a double-blind, crossover design. During exposure, subjects had to perform cognitive tasks (simple reaction time, two-choice reaction time, N-back), each presented twice in a fixed order. Waking EEG (3 min eyes closed; 3 min eyes open) was recorded immediately following exposure and at time points 30 min and 60 min later. Artifact free 2-s EEG epochs were subjected to spectral analysis. Spectra were investigated \pm 5 Hz centered on the alpha-peaking baseline. Data were analyzed with repeated measure ANOVAs and paired t-tests or non-parametric tests.

Neither field condition did affect reaction times in any cognitive task. However, the PM EMF exposure but not CW exposure led to a time-dependent increase during the 30 min of exposure in accuracy in the 3-back task ($p < 0.01$). EEG-analysis revealed effects on waking EEG power spectra (derivation C3A2) in the eyes closed condition. Power in 10.5-11 Hz range was increased 30 min after PM EMF exposure and decreased at 14 Hz 30 min after CW exposure compared to sham exposure ($p < 0.01$). Together with previous observations the present results corroborate the notion that pulse modulation is crucial for EMF-induced alterations in brain physiology.

ELECTROMAGNETIC FIELDS AFFECT BRAIN FUNCTION DURING AND AFTER EXPOSURE.

Radio frequency; pulse modulation, mobile phones

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