

Project NEMESIS: Double-Blind Study on Effects of 50Hz EMF on Physiological Parameters During Sleep in People Suffering from Electrical Hypersensitivity

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Abstract: A double-blind study was performed in order to investigate an effect of 50Hz electric and magnetic fields on subjective sleep quality and physiological parameters during sleep in people suffering from Electrical Hypersensitivity Syndrome. The results presented in this article refer to effects of 50Hz EMF (25-250V/m and 2-8 μ T respectively) on physiological parameters.

INTRODUCTION

The difficulty in finding a correlation between electric and magnetic fields (EMF) and effects in humans stands in contrast to the rising numbers of case reports related to the "Electrical Hypersensitivity Syndrome" (EHS). EHS is a phenomenon with a very complex and ambiguous etiology. People suffering from EHS display a variety of non-specific health symptoms. Sleep disturbances are among the most frequently reported. The influence of 50Hz EMF on subjective sleep quality and objective physiological parameters was studied in a double-blind experiment.

METHODS

The double-blind experiment was conducted in the homes of subjects suffering from EHS. The testing of subjects in their home environment renders practical results and allows including realistic confounding factors of an EMF effect.

Center of gravity (sleeping position), heart rate and heart rate variability (measures related to sleep stages respectively) were measured using a device designed for indirect actigraphy (Dormograph) [1]. The Dormograph sensors under the bedposts take up shifts of the center of gravity caused by movements, breathing and heartbeat. Subjective sleep parameters and confounding factors were measured using a diary.

A battery powered field generator induced a 50Hz EMF (80-160 V/m, 2-6 μ T). The B-field coil was positioned under either the right or the left side of the mattress in order to see, whether the subjects unintentionally move away from the provocation field (null-hypothesis: H_0). The EMF was switched according to a double-blind schedule.

RESULTS

A robust linear regression method was used to test the hypothesis of a link between the physiological parameters measured during the night and field exposure on/off. The testing of a behavioral reaction (moving away from the B-

field coil during field-provocation) showed a significant result: The sleeping position of six out of 35 subjects changed significantly in nights with EMF-provocation compared with sham-nights. The probability to achieve six significant results in 35 tests by chance is $p=0.007$. Although six subjects showed a significant reaction, there was no significant overall effect for the whole test group.

The test of the effect on the eight a priori heart parameters rendered a p-value for each of the parameters. The distribution of the averaged p-values of each subject was used to test the deviation from the uniform distribution (Wilcoxon: one-sided, median=0.5) assumed for no effect (H_0 =no deviation). There was no significant overall effect of the EMF-provocation on the heart parameters related with sleep stages ($p=0.433$). The a posteriori analysis of the combined influence of the EMF-provocation from night_n and night_{n-1} showed a significant effect: $p=0.009$.

DISCUSSION

The results from the test of the sleeping position of the subjects suffering from EHS showed, that there might be a small sub-group of people with the apparent ability to detect weak 50Hz-EMF either consciously or unconsciously (EMF-Sensitivity). The lack of a significant overall effect in the behavioral reaction indicates, that EHS is useless for predicting a true EMF-Sensitivity.

EMF-exposure during four hours in the night does not influence the heart parameters related with ratio, offset and intensity of sleep stages. The a posteriori analysis of the combined influence of night_n and night_{n-1} indicates that there might be a combinatory effect, which could be related to the significant effect on subjective parameters (sleep quality and emotional state in the morning) [2].

REFERENCES

- [1] C.H. Mueller, C. Schierz, H. Krueger, "Effects of Extremely-Low Frequency Electric and Magnetic Fields on Physiological Sleep Parameters and Sleep Quality in Humans", in *Proceedings of the Intl. Workshop on Electromagnetic Fields and Non-Specific Health Symptoms*, Graz, Austria, September 19-20, 1998, pp. 82-91.
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