Provocation study on subjects with self reported EHS:

The NEMESIS Project

Christopher H. Mueller
Institute for Hygiene and Applied Physiology IHA
ETH Zurich, Switzerland
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Structure of NEMESIS Project

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Part I: Field Study

- Case Reports Interviews
- Psychological Questionnaires
- Project NEMESIS
- EMF-Perception Experiment
- Double-Blind Provocation Study in the Homes of EHS Patients
Hypothesis (Field Study)

Exposure to 50 Hz EMF of 80-160 V/m and 2-6 μT respectively during 4 hours in the night affects sleep quality, physiological parameters and behavior in people suffering from EHS.
Subjects (Field Study)

Selection criteria:

- EHS attributed to 50Hz EMF sources
- Successful EMF-mitigation
- Healthy (asymptomatic)

n=54 (m=21; f=33)
Age: 17-76y (mean=47.3y)
Parameters (Field Study)

**INPUT**

- **EMF**
  - 50Hz; 80-160 V/m; 2-6 μT

- **Schedule**
  - Double-Blind
  - Sham / Exposed

- **Confounders**
  - indoor temp. and humidity, weather, number of test night

**OUTPUT**

- morning questionnaire
- Seismosomnography SSG

**Subjective sleep parameters**
- Soundness of sleep

**Emotional Status**
- Pleasure, Arousal

**Physiological sleep parameters**
- Inter-beat-interval (IBI), heartrate variability (HRV)

**Behaviour**
- Center of gravity

**Effect?**
Setup in the subjects‘ homes

Environment sensor

Diary

Conductive Fabric and Coil

EMF-generator

Dormograph

25-200 V/m
2-6 μT
Position of Magnetic Field Coil

EMF-generator

EMF

Ø

Dormograph Center of Gravity

X

Y

Bed

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Results (sleep quality)

- Exposure to a 50 Hz EMF of 80-160 V/m and 2-6 μT respectively during 4 hours in the night affected subjective parameters (soundness of sleep, well being in the morning) in subjects with EHS.
  \[ p=0.042 \]

- Sleep quality not affected \( (p=0.535) \)

- Positive correlation between EMF-exposure at night and subjective parameters in the morning.
Analysis of the Results („positive effect“)

Positive vs. Negative Correlation

rank order

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p=0.1 p=0.2 p=0.5
Results (physiology / behavior)

- No overall effect of exposure to 50 Hz EMF of 80-160 V/m and 2-6 μT on all heartbeat-parameters combined  
  \( p = 0.433 \)

- Significant behavioral effects  
  \( p = 0.007 \)

- EMF-Sensitivity-Effect measured  
  \( p = 0.018 \)

- Strong indication of an EMF-effect on sleep stages
Position of Center of Gravity

VP15: $p<0.001$

VP13: $p=0.017$

VP26: $p=0.025$
Part II: EMF Perception

Psychological Questionnaires

Project NEMESIS

Case Reports Interviews

EMF-Perception Experiment

Double-Blind Provocation Study in the Homes of EHS Patients
Hypothesis (Laboratory Experiment)

There are subjects who are able to perceive a 50 Hz EMF of 100 V/m and 4 μT (discern between „field on“ and „field off“)
Subjects (EMF Perception)

Selection criteria:

- Group 1: Subjects with EHS attributed to 50Hz EMF sources (n=49, 30 female and 19 male subjects)
- Group 2: Controls (n=14, 2 female and 12 male subjects)
- Healthy (asymptomatic)
Parameters (EMF Perception)

**INPUT**

- **EMF**
  - 50Hz, 100V/m, 4μT
- **Schedule**
  - Double blind schedule
  - sham / exposed
- **Confounders**
  - Duration of test

**OUTPUT**

- **questionnaire**
- **Direct EMF-Perception** (score)
- **Difference between perception of magnetic field and electric field components**
- **Difference between subjects with EHS and Controls**

**Effect?**
Setup in the Lab

- Magnetic field coil
- Conductive wallpaper (E-field)
- 100 V/m
- 4 μT
- Questionnaire
Results: EMF Perception

- Number of subjects with statistically significant results exceeding the expected number for a chance result: \( p=0.037 \)

- No difference in the accuracy of the EMF-judgements between electric and magnetic field provocation: \( p=0.9 \)

- No difference in the accuracy of the EMF-judgements between the subjects with EHS controls: \( p=0.7 \)
Synthesis: Can EHS be measured?

Synthesis Project NEMESIS

Subjective Parameters

EMF-Perception

Research
EMF, Sleep, Noise

New Hypotheses

Physiological Parameters

Behavior
Approach

- Average of the p-values of all a-priori hypotheses
- Test the hypothesis with Wilcoxon rank test

„There is an objective measure of Electrical Hypersensitivity, if the distribution of the averaged p-values deviates from the expected symmetrical distribution around 0.5.“
Averaged p-Values per Subject (all results)

\[ \text{Averaged p-value} \]

\[ \text{Rank of the subject} \]

\[ p=0.042 \]
Conclusions Project NEMESIS

- Hypersensitivity to Electricity can be measured.
- Hypersensitivity to Electricity is not individually stable over time (level of sensitivity varies).
- EHS does not seem to be a prerequisite for the ability to consciously perceive EMF and vice versa.