SEARCH FOR EFFECTS OF 45 HZ MAGNETIC FIELDS ON LIVER TRIGLYCERIDES IN MICE

Dietrich E. Beischer, et al

Naval Aerospace Medical Research Laboratory
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Extremely low frequency electromagnetic fields play a considerable role in military and civilian use of electric power and in communication systems. The present study is part of a series of investigations conducted at NAMRL to examine biological effects of such fields.

Liver triglycerides in mice exposed to a 45 Hz magnetic field for 24 hours were not significantly different from control values. No differences in body weight, liver weight or liver water content were detected either.

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Dietrich E. Beischer and Robert J. Brehl

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Approved by

Ashton Graybiel, M.D.
Assistant for Scientific Programs

Released by

Captain N. W. Allebach, MC USN
Commanding Officer

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Naval Aerospace Medical Research Laboratory
Pensacola, Florida 32512

SUMMARY PAGE

THE PROBLEM

Extremely low frequency electromagnetic fields play a considerable role in military and civilian use of electric power and in communication systems. The present study is part of a series of investigations conducted at NAMRL to examine biological effects of such fields.

FINDINGS

Liver triglycerides in mice exposed to a 45 Hz magnetic field for 24 hours were not significantly different from control values. No differences in body weight, liver weight or liver water content were detected either.

ACKNOWLEDGMENTS

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Experiments reported herein were conducted according to the principles enunciated in "Guide for Laboratory Animal Facilities and Care" prepared by the Committee on the Guide for Laboratory Animal Resources, National Academy of Sciences--National Research Council.

INTRODUCTION

Beischer, Grissett and Mitchel (1) found an indication that the fat transport in human subjects may be influenced by exposure to extremely low frequency (ELF) magnetic fields. After exposure to a magnetic field of 1 Oersted at 45 Hz for one day the serum triglycerides increased significantly from their normal values for a period of a few days. In further search for possible bioeffects of ELF magnetic fields the triglyceride storage in the liver of mice was studied. It was found that no changes take place after a one day exposure of the mice to a 45 Hz magnetic field of 1 Oersted field strength.

Subjects and Procedure

One hundred forty 8-week old, virginal female white mice (Strain CD-1, Charles River Mouse Farms, Inc., Wilmington, Mass.) were received in two shipments of 70 each, earmarked for identification and acclimated in the vivarium for 3 weeks prior to exposure to the magnetic field. Purina Laboratory Chow and water were available ad libitum both prior to and during the experiment.

Seventy mice were chosen using a table of random numbers and exposed for 24 hours to a 45 Hz magnetic field with a field strength of 1 Oersted measured by a Bell-620 gauss meter. The field was generated by a pair of Helmholtz coils (60 cm square and spaced 30 cm apart). Immediately following exposure 10 mice were chosen from a table of random numbers and sacrificed by rapid decapitation. On each subsequent day, 10 more mice were randomly selected and sacrificed. The livers were removed, rinsed in saline, weighed, quick frozen, then freeze-dried, powdered and weighed. Several samples from each liver were extracted with isopropanol and glycerides measured photometrically as 3,5-diacetyl-1,4-dihydrolutidine after the glycerine was oxidized to formaldehyde.

The remaining 70 mice were sham-exposed controls with the coils not activated. However, the procedure was the same as for the exposed mice. For all mice body weight at the time of sacrifice, liver wet weight, liver dry weight and liver triglyceride content were measured. The water content of the liver and the ratio of liver weight to body weight were calculated. Statistical significance of all data was evaluated by Student's t test.

RESULTS

The results of the triglyceride determination are displayed in Figure 1. There was no significant difference ($p > .10$) between the values for the exposed and control animals during the time period studied. Furthermore, there was no significant difference between exposed and control animals in liver weight, liver water content or body weight. No abnormal behavior, gross pathology or other abnormalities were noted in

any of the animals studied. Food was noted in the stomach of each animal at the time of sacrifice and this fact was reflected in the generally low liver triglyceride levels. Short starvation periods increase the triglyceride level in the liver drastically.

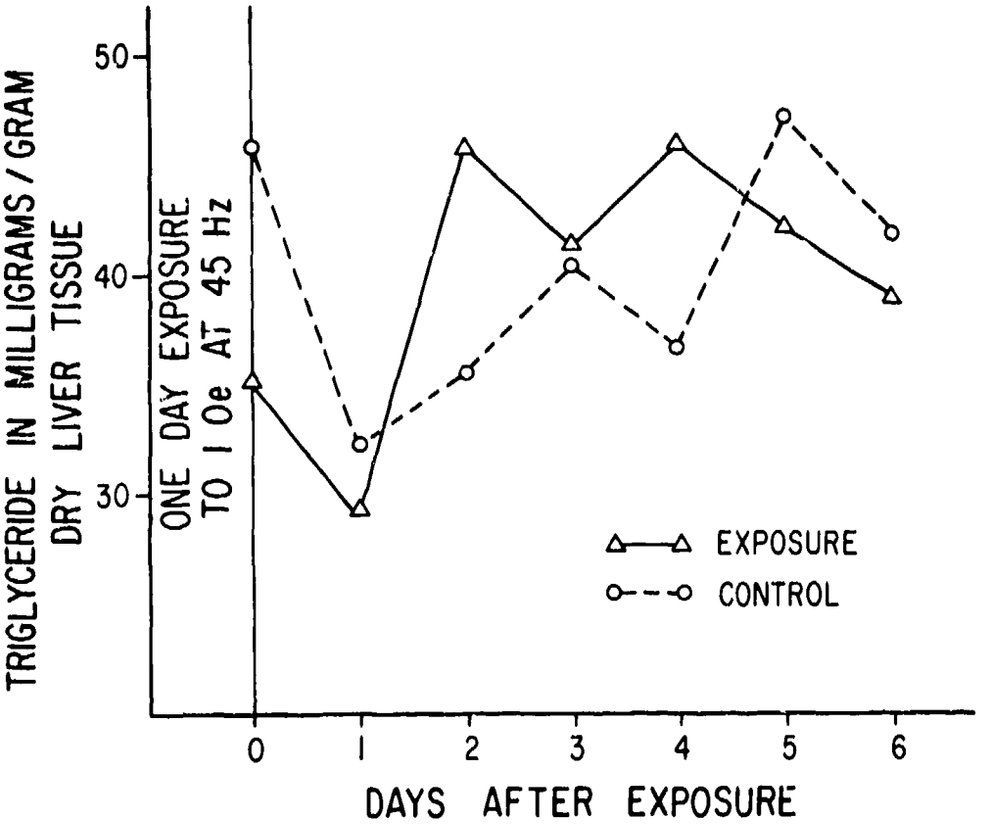

Figure 1

Mean triglyceride content of the liver of mice exposed to a magnetic field of 1 Oersted and 45 Hz (solid line) and unexposed control animals (dashed line) during a time period of 7 days starting after the exposure of the experimental animals. No significant effect of the field was observed. Every point of both curves represents the average of data for 10 animals.

DISCUSSION

At present only first tentative steps are made to assess the possible influence of a low frequency electromagnetic environment on animals and man. Since such effects, if at all existing, are expected to be of a subtle nature, only very well controlled laboratory experiments will help solve the problem. In the present experiment a reasonably large number of animals assigned to the two groups on a random basis,

identical procedures with the exception of the exposure of the experimental group, and ad libitum food supply at all times have all contributed to assure that the results are minimally influenced by artifacts.

In the present study which deals with a very specific situation - short term exposure (1 day), low field strength (1 Oersted) and laboratory environmental conditions - no effects of the field were observed. We feel that such "negative" results should be reported to form a base from which a further search under varied environmental conditions can be conducted.

REFERENCES

1. Beischer, D. E., Grissett, J. D., and Mitchel, R. E., Exposure of man to magnetic fields alternating at extremely low frequency. NAMRL-1180. Pensacola, Fla.: Naval Aerospace Medical Research Laboratory, 1973.