Static EMFs Control Diabetes

A Chance Finding Leads to a Breakthrough

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In a startling new paper, researchers at the University of Iowa medical school are reporting that static electric and magnetic fields (EMFs) can control diabetes in laboratory mice.

"Exposure to EMFs for relatively short periods reduces blood sugar and normalizes the body's response to insulin," says Calvin Carter, one of the leaders of the research group. "The effects are long-lasting, opening the possibility of an EMF therapy that can be applied during sleep to manage diabetes all day." Carter is a post-doc in the lab of Val Sheffield at the university's Carver College of Medicine. Sheffield is a former Howard Hughes Medical Institute (HHMI) investigator.

The new findings appear in *Cell Metabolism*, a highly regarded journal. The paper is open access.

A number of different strains of free-roaming, adult mice were exposed to a combined 3 mT (30 G) magnetic field and a 7 kV/m electric field for 30 days. To the team's "surprise," they found that fasting blood-glucose levels were significantly reduced by 33%-43% among those mice that had been bred to mimic type 2 diabetes, compared to unexposed controls. Non-diabetic mice showed no significant changes.

In the search for possible mechanisms, the researchers observed that the static EMFs modulated the levels of reactive oxygen species (ROS) in the liver of the mice. When ROS were chemically removed from the liver, the effects of the fields were no longer observed. (In other instances, EMFs have been shown to increase ROS; here's one example.)

"We've looked at various parameters and found that the fields reported are optimal for this application," Carter told *Microwave News* in an e-mail exchange. "But as you can imagine, more research is needed," he wrote.

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One intriguing finding is that they only saw the effect when the mice were exposed to *both* electric and magnetic fields. Following exposures to only static magnetic fields, the effect reversed with blood glucose levels and glucose tolerance worsening "significantly." Static electric fields alone had no significant effect.

Sheffield commented, in a separate exchange, that they have not investigated time-varying fields.

The new study indicates that EMFs alter the balance of oxidants and antioxidants in the liver, improving the body's response to insulin, according to Sunny Huang, an MD/PhD student and the co-lead author of the paper. This effect is mediated by small reactive molecules that seem to function as "magnetic antennae," the team suggests.

The Iowa researchers warn that much work remains to be done. "Studies in large mammals and humans are needed to test safety and efficacy of this noninvasive modality," they advise.

Pure Serendipity

The path to the discovery was pure serendipity, says Huang. To practice her lab techniques, Huang borrowed some mice that Carter had exposed to EMFs in a separate study of animal behavior.

"It was really odd because normally these animals have high blood sugar and type 2 diabetes, but all of the animals exposed to EMFs showed normal blood sugar levels," Huang says. "I told Calvin, 'There's something weird going on here.'" This led Carter to investigate further.

There has long been speculation that EMFs could be used to treat diabetes. Some 40 years ago, Eugene Findl wanted to follow up some early indications. But funding was hard to find and progress stalled.

Jerry Phillips at the University of Colorado, Colorado Springs, was delighted to see that the Iowa experiments were made possible by domestic grants. "This is a well-funded, innovative and well-designed study from a group in the United States," he said in a Skype interview. "Historically, there's rarely been money for such work from EMF programs."

Phillips did EMF/RF research for more than 25 years, but had to stop when funding dried up. He now teaches. In the past, he has developed curriculum for, among other topics, diabetes education.

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