Fertil Gynecol Androl. January-December 2023 ; 3(1):e137085. https://doi.org/10.5812/fga-137085.

Published online 2023 October 17. **Letter**

Effect of Magnetic Fields on Women's Health

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Received 2023 April 22; **Revised** 2023 August 26; **Accepted** 2023 August 29.

Keywords: Magnetic Fields, Women's Health, Pregnancy, Fertility

Dear Editor,

Nowadays, public health is threatened by exposure to magnetic fields (MFs). There are numerous studies in the literature concerning the effects of MFs on biological systems. Many of these effects may adversely impact human health, particularly for women during pregnancy and fertility. As electronic devices become increasingly prevalent, pregnant women are inevitably exposed to the dangers of MFs. These MFs can affect all biological systems, from cells to human organs, as their frequency and intensity are often more significant than Earth's geomagnetic field (1). Therefore, the impact of MFs on fertility, pregnancy process, and fetal growth presents a significant and invigorating challenge, underscoring its utmost importance. The MFs are classified into static magnetic fields (SMF) and electromagnetic fields (EMF). Based on frequency, EMFs are classified into three groups: Low ($<$ 300 Hz), moderate ($>$ 300 Hz to $<$ 10 MHz), and high ($>$10 MHz to $<$ 300 GHz). Moreover, there are three categories of SMFs based on intensity: weak ($<$ 1mT), moderate (1 mT to 1 T), and strong ($>$ 1T). The effect of MFs on organelles, cells, tissues, and generally the human body is very unpredictable as biological window effects are defined for MFs according to frequency and amplitude. Depending on the purpose of an MF exposure, the impacts can be either beneficial or harmful (2).

Influence of magnetic fields on pregnancy: Exploring birth complications and maternal health

Biological systems may be directly or indirectly affected by MFs. For example, an MF can directly influence the movement of charged particles inside a cell, which leads to a change in the permeability of the cell membrane. One of the indirect effects of MFs on cell activity is increasing the concentration of free radicals that cause oxidative stress. Several studies have shown that oxidative stress decreases female fertility in animal models. On the other hand, reactive oxygen and nitrogen species (ROS/RNS) are among the free radicals whose concentration is augmented by MFs (3). These molecules are essential in a wide range of signaling pathways. The imbalance between them and the antioxidant defense affects the maintenance of a viable pregnancy, leading to abortion. Longini et al. showed that spontaneous abortion significantly rose in women with low plasma levels of ascorbic acid (vitamin C) and α-tocopherol (vitamin E). Moreover, premature rupture of the fetal membranes results from collagen damage in the chorioamniotic sac. A recent study showed that ROS is an important pathogenic factor that damages collagen. Consequently, exposure to MFs exacerbates this damage by raising free radicals, especially ROS (4).

1. Effect of Magnetic Fields on Embryonic Development: Investigating the risk of MF radiation has recently received significant attention due to growing concerns about its potential health effects. Numerous studies have researched this subject and have provided compelling evidence of the adverse consequences of MF exposure on various aspects of human health.

One area of particular concern is the impact of MFs on fetal development. Research has revealed a correlation between MF exposure and fetal weight gain, leading to intrauterine growth retardation. This condition can have long-term implications, resulting in mental and physical impairments in affected individuals. The delicate developmental stages of the fetus make it especially vulnerable to the potential hazards posed by MF radiation. Moreover, the relationship between MFs and the development of diseases has been extensively studied.

Evidence suggests prolonged exposure to MF radiation may increase the risk of cancers, including childhood leukemia. The electromagnetic fields emitted by various sources, such as power lines, household appliances, and wireless devices, have been linked to the onset of certain types of cancer.

In addition to cancer, MF exposure has been associated with an elevated risk of cardiovascular diseases. Studies have demonstrated a potential connection between high MF levels and the occurrence of heart conditions, including an increased incidence of arrhythmias, hypertension, and an overall decline in cardiovascular health. Furthermore, the immune system can be impacted by MF radiation. Research has indicated that exposure to MFs may disrupt immune system function, leading to immune system disorders in infants. This interference with the normal immune response can make infants more susceptible to infections, allergies, and other immune-related ailments.

It is important to note that while the evidence regarding the health effects of MF radiation is accumulating, further research is still needed to understand the extent of these risks fully and to establish reliable safety guidelines. However, the current body of knowledge raises concerns about the potential harm associated with excessive MF exposure, particularly during the critical stages of development. As a result, precautionary measures and prudent use of technology that emits MFs are increasingly advocated to minimize potential health risks (5).

2. Effect of Magnetic Fields on Menstruation: Polycystic ovary syndrome is the most common complex endocrine disorder that affects approximately 20% of women of reproductive age, leading to infertility and psychological problems in many cases (6). Dysfunction of follicles in polycystic disease may occur in two stages: Follicular growth and selecting a follicle as a dominant follicle. Recent studies indicated that MFs can disrupt the maturation process of the dominant follicle, which leads to the formation of cysts (7, 8). On the other hand, MFs affect the nervous system and cause an imbalance between neuroendocrine and gonadotrophic hormones, such as luteinizing hormone (LH) and follicle-stimulating hormone. Studies showed that 150 kHz EMF increased serum levels of LH (9, 10).

3. Conclusion: The effective rate of MF exposure on a woman's health depends on MF type, intensity, frequency, and distance from the source. The effect of MFs on biological systems needs to be better understood, and it is necessary to observe safety constantly. Observing the maximum distance from the field-producing sources, especially in pregnant mothers, is crucial to protect the fetus. Some potential areas of work and future research related to the effects of MFs on women's health are mentioned here.

Reproductive Health: Future studies could delve deeper into the specific impacts of MF radiation on women's reproductive health. These evaluations may involve investigating the potential effects of MF exposure on fertility, menstrual health, hormonal balance, and the overall reproductive well-being of women.

Pregnancy Outcomes: Further research could focus on unraveling the potential implications of MF radiation on pregnancy outcomes. This area of research might involve studying the relationship between MF exposure and pregnancy complications, such as preterm birth, gestational diabetes, preeclampsia, and other adverse outcomes that could affect both the mother and the developing fetus.

Menopause and hormonal changes: Understanding the influence of MF radiation on menopause and hormonal changes in women could be an area of future exploration. Researchers may investigate whether MF exposure is associated with the onset, severity, or progression of menopausal symptoms and hormonal imbalances that can occur during this stage of life.

Breast health: Future studies might examine the potential links between MF exposure and breast health in women. This could involve investigating whether there is an increased risk of breast cancer or other breast-related conditions associated with prolonged exposure to magnetic fields.

Mental health: The impact of MF radiation on women's mental health could be another area of future research. Studies may explore potential associations between MF exposure and mood disorders, anxiety, depression, and cognitive function in women.

Long-term effects: It would be beneficial to conduct longitudinal studies on the long-term effects of MF radiation on women's health. Research could provide insights into the cumulative impacts of prolonged exposure and help evaluate the potential risks over extended periods.

Protective measures: Future work may focus on developing and evaluating strategies to mitigate the potential risks of MF exposure for women. These studies could involve exploring the effectiveness of shielding techniques, evaluating the impact of reducing exposure through lifestyle changes or technology usage modifications, and assessing the efficacy of protective devices or materials.

Footnotes

Authors' Contribution: Study concept and design, search, drafting of the manuscript: S. R. R. and M. A. Critical revision of the manuscript: A. Z. and M. A. All authors read and approved the final manuscript.

Conflict of Interests: The authors certify that they have no affiliations with or involvement in any organization or entity with any financial or non-financial interest in the subject matter or materials discussed in the manuscript.

Funding/Support: It was not declared by the authors.

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