

## Editorial

# Interaction of Electromagnetic Field – Biological System and Three Important Diseases: Cancer, Diabet and Cardiac Diseases

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## EDITORIAL

Many laboratory studies and epidemiological studies report that EM fields cause serious health problems. People are exposed to electric and magnetic fields ranging from high-tension lines to all kinds of domestic and industrial electrical appliances, earth's magnetic field and MR [1].

In recent studies, it is claimed that electromagnetic fields change bidirectional interactions among the nervous system, hormones and the immune system. Its effects on DNA, RNA and protein synthesis, cell division, properties of cell surface, ion input-output such as Ca and Na from the cell membrane, ion connection, signal transmission (neurotransmitters, hormones, enzymes), ion transport and activation of certain enzymes have been studied [2]. With the impact of EM fields, body atoms and molecules may lose the electrical balance between them, biochemical activities may be affected and electrical structure in the communication of cells and tissues may be disrupted [3].

ELF affects the operation of immune system cells, disrupts the immunity and increases the frequency of tumor cases [4]. Childhood cancers, especially childhood leukemia, adult cancers, depression, suicide cases, cardiovascular diseases, reproductive dysfunctions, developmental disorders, immunological modifications, neurobehavioral effects and neurodegenerative diseases increase compared with the normal population [5].

The results of long-term interaction with ELF EMF can be evaluated under three main headings according to experimental and epidemiological studies as follows: cancer cases in general, cardiac outcomes and diabetes [6].

It is reported that about 2-2,25% of childhood leukemia cases in the world arise out of electromagnetic fields. This is about two times the normal population [7]. It is found that about 10-15% of cancer cases are related to EM fields with 0-300 Hz frequency [7]. Other cancers associated with EMF include leukemia, nervous system tumors, lymphoma, and lung cancer. In children, distance

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to these fields is important and it should be 50 m from high-tension lines. Critical magnetic flux density should be 0.2  $\mu$ T [2].

It is demonstrated that 50 Hz frequency fields that are exposed in daily life increase brain tumors, leukemia in males and acute myeloid leukemia. Also, many epidemiological studies reported increased cancer incidence in residents living around high-tension lines or workers at high-tension lines [8].

Savitz et al., examined cardiovascular disease mortality associated with occupational magnetic field in 140000 electrical workers. They observed a higher mortality due to arrhythmia or acute myocardial infarction in workers who are exposed to high magnetic field for a longer time [9].

In studies conducted on electrical workers in Sweden and Italy, it is reported that no cardiovascular risk of low magnetic fields was observed [10]. According to Savitz's findings, however, deaths are possible as a result of myocardial infarction and arrhythmia due to exposure at  $\mu$ T level for many years [9].

Furthermore, in some large prospective cohort studies, it is accepted that heart disease develops in a few subsequent years with decreases in specific components of HRV [11].

Previously, cardiac problems due to exposure to electric and magnetic fields were studied. It was observed that short-time or single exposure to magnetic fields up to 8T does not cause chronic problems, but cardiac arrhythmias and cardiac damage occur as a result of long-term (at least 5-6 years) exposure to much less intense magnetic fields at mT (mili Tesla) and  $\mu$ T (micro Tesla) levels.

In fields larger than 0,3 T, a sudden increase occurs in T wave amplitude, it rapidly disappears as the exposure ends, it is not observed in following days, and no change is observed in other components of EKG. It is thought that such T wave amplitude is associated with congruence of electricity potential generated especially by aortic blood flow in fixed MA on the EKG record. Such changes in the EKG return to normal after getting out of MA.

According to Savitz's findings, deaths are possible as a result of myocardial infarction and arrhythmia due to long-time exposure at  $\mu\text{T}$  level [9]. Furthermore, in some large prospective cohort studies, it is accepted that heart disease develops in a few subsequent years with decreases in specific components of HRV [10].

Although negative cardiovascular effects of low intensity MA are mentioned in some studies above, it cannot be compared with intense MA because the risk of increase in negative effects and development of sudden deaths is high as the intensity increases.

Diabetes Mellitus is increasing globally. According to the World Health Organization, total diabetic population was 30 million in 1985 (0,6% of total population, which increased to 171 million in 2000 (2,8% of population) and is expected to increase to 366 million in 2030 (4,5% of population). The patient population increases in insufficient insulin dependent Type I diabetes, Type II diabetes that cannot effectively use the insulin produced, and Type III diabetes induced or intensified with exposure to electromagnetic fields (Brittle Diabetes). Accordingly, one of the reasons for diabetes disease which is increasing in the global population could be these areas. Studies that claim the foregoing are being conducted.

In recent years, it is accepted that a kind of diabetes diseases defined as Type III diabetes (Brittle Diabetes) is triggered with exposure to ELF EM fields. According to this study, blood glucose level suddenly increases when approaching electromagnetic fields and returns to normal values when moving away [12]. However, Type II Diabetes can only occur with long-term exposure to these areas.

Current data on the association of environmental electromagnetic pollution and glucose regulation in diabetic patients are based on several case reports [12]. According to the data, environmental electromagnetic pollution and such environment increases blood glucose level. Diabetes incidence was found high in those who are exposed to environmental electromagnetic pollution fields. It is demonstrated that insulin secretion decreases by 30% in high electric environment in insulinoma cell culture and a disruption in insulin structure and decrease in receptor connection occurs in hepatocyte cultures [13]. It is found that 5 Tesla static magnetic field increases blood glucose level in the rats [14]. Chater Sihem et al., observed that blood glucose level is induced in female rats that are exposed to 128 mT magnetic field one hour a day for 10 days [15].

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