

# Evaluation of Magnetic Field Intensity of Electricity Power Lines on Health in Zahedan Province, Iran

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## ABSTRACT

**Background:** Evaluation of the effects of magnetic fields caused by electricity power lines on humans showed that one hour of irradiation even in low intensity fields leads to impairment of perception, cognition, and memory and is a known risk factor of leukemia in children.

**Aim:** To evaluate intensity of magnetic fields of electricity power lines in different town areas is important.

**Method:** In this descriptive-analytic cross sectional study, magnetic field intensity was measured in different town areas using teslameter TES-1392 device made in United States. To measure intensity of magnetic fields, cause by electricity currents, measurements were performed in different points in each street and mean values were reported. Measurements were conducted in concentric circles and field intensity range around a definite source and averaging were performed. Afterwards, results were analyzed with SPSS ver. 20 software.

**Results:** Mean magnetic field intensities measured in different streets in Zahedan was 1.27 mG. In addition, highest measured intensity is 6.7 mG which belongs to high power electricity power lines of the area and lowest measured intensity is 0.1 mG. Moreover, Zahedan streets were divided into 5 areas and magnetic field intensity of these areas were compared using ANOVA test in SPSS 20 which revealed no significant difference ( $P>0.05$ ).

**Conclusion:** In this study, magnetic field intensities in different areas of Zahedan were compared with recommended values by International Commission on Non-Ionizing Radiation Protection (ICNIRP). Considering allowed values for magnetic fields, irradiation of normal people is much below ICNIRP recommended values. Additionally, assessment of electrical field intensity is recommended to achieve a comprehensive study.

**Key words:** Magnetic field, Teslameter, Electricity Power Lines.

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## INTRODUCTION

Nowadays, electricity production and its growing trend is an important indicator of industrial and economic development of countries. Due to the importance of electricity production in sustainable development, electricity industry experienced a significant progress in last two decades both in terms of production and consumption. Consequently, the effects of electrical and magnetic fields caused by electricity power line on the health and hygiene of living things, especially humans<sup>1</sup>.

Magnetic fields are important non-ionizing rays existing both naturally and artificially in the nature, work place, and human living environment<sup>2,3</sup>. International Agency for Research on Cancer affiliated with World Health Organization announced risk of carcinogenesis in humans when exposed to these fields<sup>4</sup>. Some studies have demonstrated that individuals exposed to magnetic fields present symptoms of depression, paranoia, obsessive compulsion, interpersonal relationship sensitivity, anxiety, aggression, and neurosis<sup>5</sup>. Other studies proved that risk of leukemia is higher in children living near to electricity power lines<sup>6</sup>.

Also, due to importance of this topic, intensity of magnetic field in neonatal ward incubators and Hospital of Semnan University of Medical Sciences were assessed and compared with international standards. In addition, a

study in this field was conducted by Davinpor et al. in the United States<sup>7</sup>.

In the Netherlands, the effect of exposure to very low frequency electromagnetic fields on the incidence of cancer was evaluated. Results of this study suggested a significant association between lung, breast, and brain cancer in male patients suffering from leukemia and magnetic fields<sup>8</sup>.

Researchers concluded in another study that one hour of irradiation even in low intensity magnetic fields impairs perception, cognition, and memory so that chronic occupational exposure to such fields increases the risk of brain tumors<sup>9</sup>. Additionally, some investigators believe that magnetic fields above  $0.4 \mu T$  increases the risk of leukemia in children two-fold<sup>10</sup>.

International Commission on Non-Ionizing Radiation Protection (ICNIRP) and National Research Institute (NRI) of the United States insist of the serious problem of magnetic fields and its adverse effects on the health of people in the society as a major environmental hazard<sup>11</sup>. The allowed range of occupational irradiation and allowed range of irradiation to ordinary people are determined by ICNIRP and presented in Table 1<sup>12</sup>.

It is a long time that the effects of electrical and magnetic fields on living things are under investigation of researchers and definite conclusion is not possible in most cases, due to long-term nature of studies and gradualness of field impacts and judgments are all based on findings on laboratory animals<sup>13</sup>. In Felix et al. study on assessment of magnetic field intensity with very low frequency in LCD computer monitors and its health consequences, the

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results suggested no significant relationship between exposure to such fields and health complications<sup>14</sup>.

Though, it is noteworthy that overexposure to magnetic fields are harmful. Thus, it is vital to measure exposure and level of contamination with magnetic fields in residential areas so that, in case of facing values above standards, necessary measures take place to reduce potential consequences. The objective of this study is to measure magnetic field intensity in residential areas in Zahedan.

**METHOD**

This is an analytic cross sectional study in which magnetic fields caused by electricity power lines in Zahedan have been measured and evaluated. Magnetic field measurements were performed using teslameter TES-1392 device with measurement accuracy of  $\pm 0.05 mT$  in field intensity ranging from 0.1 mG to 1999 mG.

Prior to measurement initiation, calibration of the device was validated according to the instruction. In these measurements, range measurement switch should be adjusted so that intensity of magnetic field can be measured with highest accuracy. For this purpose, the device was first set at lowest range and field intensity is measured. If magnetic field intensity is above the preset range, a vertical line appears on the left side of the device monitor. In this case, measurement range of the device should be adjusted higher. In low range, the device is able to measure magnetic fields with 0.1mG intensity. If magnetic field with higher intensities were present, higher ranges should be used.

This device reports measurements of magnetic field intensity in mG or  $\mu T$ . Since the direction of magnetic fields were unknown, teslameter sensors measured the magnetic field in vertical and horizontal aspects.

Magnetic field intensity was performed at different distances from the source in concentric circles, field intensity range is defined around the source, and finally

averaging was performed. Magnetic field intensity was measured at desired areas by considering horizontal distance from streets at the door of houses and electricity power lines by the teslameter device. Highest value was considered for each point.

Duration of residency of participants in this study was less than 24 hours a day. To evaluate level of exposure of individuals to magnetic fields, intensity of the fields at specified distances were selected based on purposed distances<sup>15</sup>.

Finally, measured values of magnetic field intensity in different streets of Zahedan by teslameter TES-1392 were entered on the map presented in Google Earth software and the results were analyzed using SPSS 20.

**RESULTS**

Results of measurement of environmental distribution of magnetic fields of Zahedan according to instantaneous field peak are depicted in figures 1 to 5 showing that mean magnetic field intensity is 1.27mG which is much below 1000 mG limit. Magnetic field intensity in different streets in Zahedan is reported in mG which are inserted on different points in the map. Moreover, Zahedan streets were divided into 5 areas and the difference in magnetic field intensity of these areas were analyzed using ANOVA test in SPSS ver. 20 which showed no significant difference ( $P < 0.05$ ).

Table 1: Maximum allowed intensity of magnetic fields

Radiation field		Intensity of magnetic field (mG)
Radiation worker	8 hours	5000
	Short periods	50000*
	Limb irradiation	250000
Ordinary people	Less than 24 hours a day	1000
	Some hours a day	10000

\*Maximum of two working hours every day.

Chart 1. Comparison of mean magnetic field intensity in different areas of Zahedan

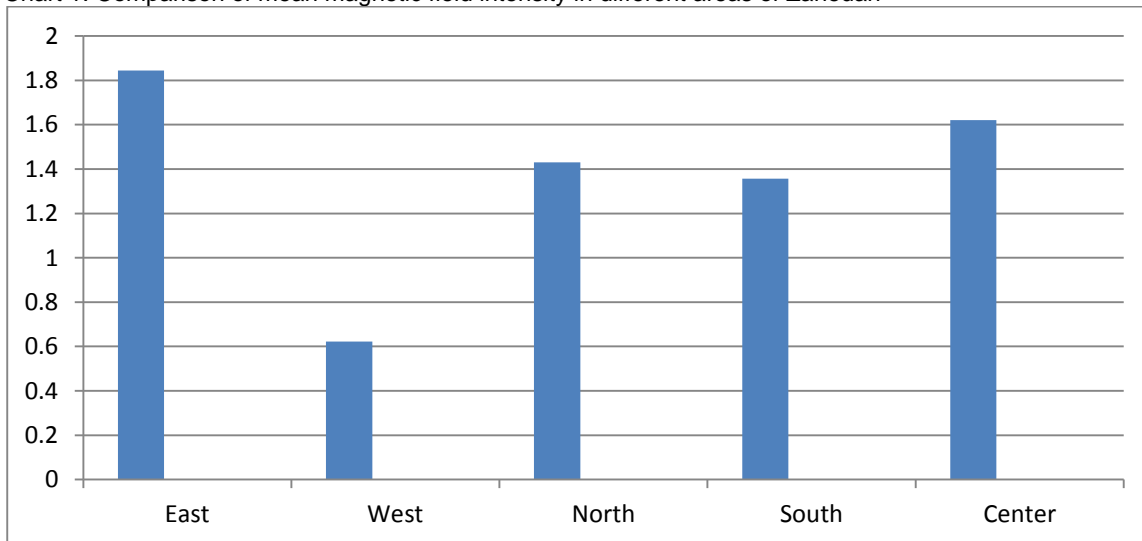


Fig.1: Mean magnetic field intensity in different locations in North and Center areas in mG



Fig.2: Mean magnetic field intensity in different locations in South area in mG



Fig. 3: Mean magnetic field intensity in different locations in East area in mG





Fig. 4: Mean magnetic field intensity in different locations in West area in mG



**DISCUSSION**

International Commission on Non-Ionizing Radiation Protection (ICNIRP) has announced 10000 mG as the allowed limit presented in the table. No difference was observed in measurement of magnetic field intensity in horizontal and vertical axis in different points in the streets in Zahedan and the mean intensity of 1.27mG was reported. Moreover, highest exposure to magnetic field was 6.7mG which belongs to high power electricity lines of the area and the least exposure was measured 0.1mG. Results of this study prove that magnetic field intensity in all distances and different locations were below standard allowed values which is consistent with the findings of Felix. Hence, this study does not predict any problems in terms of magnetic waves in this area. Nonetheless, following the performed studies in this regard which show that some effects of such fields may be observed when exposed to amounts above standard. Consequently, dealing with these issues are crucial and by increasing the distance, the intensity of the magnetic field might be lessened which is in consistency with the findings of Karpovise et al. study. More comprehensive studies are suggested to evaluate the effects of magnetic fields and non-ionizing radiations on the health of residents in these areas. Considering the prevalence of complications such as leukemia and cancer risk associated with exposure to magnetic fields, evaluation of magnetic fields in all residential areas is vital. Moreover, to reduce the intensity of magnetic field, it is vital to keep allowed distance. Additionally, it is necessary to measure the intensity of electrical fields in different residential areas in Zahedan.

**CONCLUSION**

Since age factor is no considered in standards of exposure to such fields and just a maximum allowed amount is reported that the measured value should not pass, the measured values in most assessed locations is below standard limits.

According to the allowed intensity for magnetic fields announced by ICNIRP, maximum allowed value is 6.7mG

which is much above the measured values in different locations in residential areas. This shows that magnetic fields caused by electrical power lines in these areas does not lead to any problem regarding magnetic fields. Also, increased magnetic field intensity in some locations in due to high power electricity lines which reveals the effects of high power lines, though this increase does not pass standard limits.

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