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A Study on assessment of Electro Magnetic Field Radiation in various parts of Chennai Metro city.

Subhashini S¹, Prabakaran J², T.Deepaa³, Kishore. V³

Affiliation : 1Assistant Professor, Department of Community Medicine, MMCRI, 2 Associate Professor, Department of Community Medicine, MMCRI, 3 MBBS students, MMCRI, Chennai.

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***Author for correspondence:** Dr.J.Prabakaran, Associate professor, Department of Community Medicine, Madha Medical College & Research Institute (MMCRI), Kovur, Chennai- Pin 600128. E-mail: prabakaranpro@gmail.com.

ABSTRACT

Background: Electromagnetic fields (EMF) are present everywhere in our environment. Everyone is exposed to EMF radiation both at home and at work. This may lead to direct and indirect effect on our health. **Objectives:** To measure electromagnetic waves in various parts of Chennai; To propose protective measures to minimize the EMF risk. **Methods:** Type: cross-sectional Study. Location: commercial, residential and educational institutes of various parts of Chennai. Duration of the study: January and February 2018. Sampling Method: Simple Random Sampling method was followed. Information Collected: The EMF values were collected using Gaussmeter (5Hz to 3500MHz). Electric fields (E) are created by differences in voltage. Magnetic fields (H) are created when electric current flows. Both E and H values are measured in each area using the equipment. Threshold kept for this study: Electric Filed-40V/m, Magnetic field-0.4μT. **Results:** The average E value was 169.73V/m and 2.71V/m at 3 cm from the source. The Highest E values recorded in fluorescent light (2000 V/m) and 500V/m in induction electric stove, UPS-Inverter 400 V/m, water heater 486V/m. The highest H value was recorded in AC stabilizer (31.39μT) and 21.17μT at hair dryer, 8.12μT metro train, 7.45μT in MRTS train, 7.41μT in water heater, 5.88 in iron box. The residential areas near high tension electric line reported high E and H values (at 25 Meter: 223V & 1.23μT, 50 meter: 195V, 0.93μT; 100 meter: 90V, 0.53μT). The two wheeler seat area had 20 V & 9.52μT. Most of the mobiles (oppo, Le, vivo etc.) discharge 26V & 0.6μT at 3 cm and become 0 at 15-30cm. **Conclusion:** All the electrical equipment, electrical wires had some amount of E&H values. Hence it is advised to stay away from these gadgets as far as possible.

Key Words: Electromagnetic fields, EMF, Gaussmeter, Chennai

INTRODUCTION

Advancing technology is a boon or bane?

Modern technologies have immensely improved our lives and allow us to stay connected with people all over the world; however it has greatly increased our daily exposure to harmful radiations. Electromagnetic fields (EMF) are present everywhere in our environment, although invisible to the human eye¹. Electric fields created by differences in voltage exists even when the device is switched off whereas magnetic fields are created only when the device is switched on. However, both electric and magnetic fields are strongest close to their origin and rapidly decrease at greater distances from the source. An EMF created by all electric, magnetic and wireless fields of energy occurs by two different ways natural and man-made. As a part of normal bodily functions, there exists a small amount of electric current in human body. For example: Electric impulses transmitted when nerves relay signals and electric activity of heart. The much exposures to electric and magnetic

fields (EMFs) comes from man-made technology due to increasing electricity demand, ever-advancing technologies and changes in social behavior², when compared to natural EMFs. Everyone is exposed to EMF radiation both at home and at work, from generation and transmission of electricity, domestic appliances like microwave oven, fluorescent lamps, hair dryer, vaccum cleaner etc... and industrial equipment, to telecommunication and broadcasting. There exists two types of EMF radiation exposure, firstly the Low-level radiation, also called non-ionizing radiation, is sent out from appliances like microwave ovens, cellphones, Wi-Fi routers, powerlines and MRIs and secondly the High-level radiation, called ionising radiation sent out in the form of ultraviolet rays from the sun and X-rays from medical imaging machines. Low and high frequency electromagnetic waves affect the human body in different ways. Electromagnetic waves alter brain electroencephalographic activity and cause disturbances in sleep³, difficulty in concentration, fatigue, headache⁴

and increase reaction time in a time-dependent manner⁵. They increase the resting blood pressure⁶ and reduce the production of melatonin⁷. Scientists estimate that the average daily exposure to manmade EMF radiation is 100 million times higher than it was in previous generations. In 2011 the World Health Organization (WHO) named mobile phone radiation as a possible carcinogenic, alerting the globe to the potential health risks posed by electromagnetic fields. EMF exposure cannot be recognized as entirely safe because of weak scientific evidence that exposure may pose a leukemic hazard.

Objectives: To measure electromagnetic waves in various parts of Chennai; To propose protective measures to minimize the EMF risk.

MATERIAL & METHODS

A cross-sectional Study was conducted at commercial, residential and educational institutes of various parts of Chennai. The duration of the study was during the months of January and February 2018.

Sampling Method: Simple Random Sampling method was followed.

Information Collected: The EMF values were collected using Gaussmeter (5Hz to 3500MHz). **Electric fields (E)** are created by differences in voltage. **Magnetic fields (H)** are created when electric current flows. Both E and H values are measured in each area using the equipment.

Threshold kept for this study: Electric Filed-40V/m, Magnetic field-0.4μT

Figure 1: Gaussmeter to measure EMF values



Method of data collection:

The information was collected by medical students and entries done using Google Sheets. The measurements were done in random areas and equipment. The measurement was done within 3cm, 30cm, 1m for small equipment/machines and 25m, 50m, 100m for big instruments like mobile towers, high tension electrical line etc.

Data Analysis:

The saved information at Google Server was downloaded in the form of Microsoft Excel and analysis made.

RESULTS

The EMF values measured in 50 areas in different locations in Chennai. (Table 1)

The average E value was 169.73V/m and 2.71V/m at 3 cm from the source. All the electrical equipments, electrical wires had some amount of E&H values. The Highest E values recorded in fluorescent light (2000 V/m) and 500V/m in induction electric stove, UPS-Inverter 400 V/m, water heater 486V/m and lowest is 0 V/m which were centre of house or open area with no electrical line near. The highest H value was recorded in AC stabilizer (31.39μT) and 21.17μT at hair dryer, 8.12μT metro train, 7.45μT in MRTS train, 7.41μT in water heater, 5.88 in iron box. The H values were reducing when we go away from the source. The residential areas near high tension electric line reported high E and H values (at 25 Meter: 223V & 1.23μT, 50 meter: 195V, 0.93μT; 100 meter: 90V, 0.53μT). The two wheeler seat area had 20 V & 9.52μT. Most of the mobiles (oppo, Le, vivo etc.) discharge 26V & 0.6μT at 3 cm and become 0 at 15-30cm.

DISCUSSION

We delighted to present our EMF test findings in Chennai. Most of the areas or equipment are constantly emit high level of waves. The International guidelines for EMF exposure was developed by the International Commission on Non-Ionizing radiation protection (ICNIRP). These guidelines are based on the findings done over many years of research. The international EMF project has been established to assess health and environmental effects of exposure to static and time varying electric and magnetic fields in the frequency range 0-300GHz. The International Agency for Research on Cancer(IARC) of the World Health Organization on May 2011 reviewed key studies on the topic and characterized exposure to radiofrequency radiation associated with mobile phone use as Group 2B carcinogen- i.e. possibly carcinogenic to humans⁸. IARC decision on mobile phones was based mainly on two sets of case-control human studies- the Hardell group of studies from Sweden^{11, 12, 13, 14} and the IARC Interphone study^{9, 10}. Studies carried out in Sweden indicate that those who begin using either cordless or mobile phones regularly before age of 20 have greater than fourfold

Table 1. EMF values around equipment (E-Electric field(v/m) and H- Magnetic field (μ T))

Equipment	3cm		30cm		1m	
	E	H	E	H	E	H
Television	90	0.7	14	0.3	10	0.1
Computer	21	0.6	9	0.04	7	0.01
AC (stabilizer)	49	31	13	1.36	10.1	0.18
Fluorescent light	2000	1.9	2000	0.13	13	0
Hair dryer	350	21	120	1.36	10	0.17
Laptop	9	2.2	9	0	10	0
Iron box	161	5.9	50	0	14	0
UPS-Inverter	400	10	300	8.7	75	1
Air cooler	357	1.4	57	0.05	24	0
AC	45	2.8	32	1.1	25	0.02
Mobile	26	0.6	9	0	7	0
Induction Electric	500	0	310	0	18	0
Table fan	60	2.3	54	2	22	0.11
Refrigerator	10	0.6	10	0.02	0	0
Scooter	20	9.5	32	2.47	9	0.14
Auto analyser Lab	10	0.7	9	0	9	0
	25m		50m		100m	
	E	H	E	H	E	H
Metro train	104	8.1	89	7.42	11	6.6
MRTS train	200	7.5	70	2.96	8	1.2
High Tension line	223	1.2	195	0.93	90	0.53

increased risk of ipsilateral glioma. The brain tissue of children has higher conductivity due to thinner skull bone and so higher absorption from RF-EMF than for adults^{15, 16, 17}. The developing brain is more sensitive to toxins¹⁸ and it is still developing until about 20 years of age. Mobile phone usage is widespread among children and adolescents. The greater absorption of RF energy per unit of time, the greater sensitivity of their brains, and their longer lifetimes with the risk to develop a brain tumor leaves children at a higher risk than adults from mobile phone radiation. EMFs cannot damage DNA or cells directly but cause cancer by reducing the levels of the hormone melatonin. Research states that children had a 70% greater risk for leukemia when living within 650 feet of power lines than children living 2,000 feet away or more¹⁹. Exposure to radiations from magnetic field above a certain level (possibly around 16mG) during pregnancy is strongly associated with miscarriage risk²⁰. Due to serious impact of microwave leakage, FDA (Food and Drug Administration) sets strict limits on it for the manufacturers. Eyes are especially vulnerable to microwaves as they lack the blood vessels to dissipate the heat and cellular stress²¹. The telecommunication and electronics industry have a major conflict of interest against consumers becoming aware of health effects from

EMF exposure. There is no direct evidence showing that certain sources of EMF exposure are safe.

Conclusion and Recommendation:

Most of the places where we live have higher level of EMF radiation. It isn't realistic to avoid all man-made EMFs, but there are simple steps which can be followed to minimize the exposure to harmful radiation. Mobile phones can be placed away from our body, minimize mobile internet usage and use earphone for calling purpose always. Avoid using mobile phones in areas of poor signal coverage as it emits more radiation while trying to setup a call during low network signal. Children should not be allowed to use mobile phones as their bodies are not developed enough to provide enough resistance to EMF radiation when compared to adult. So, from same source children's body will absorb higher dosage of radiation than an adult. Special attention should be paid to keep away cell phones and all electronics from children's play and sleep area. The UPS or inverter can be placed away from us. Keep the bedroom clear of as many EMFs as possible as technologies can affect your sleep as well as DNA. Avoid halogen and fluorescent lighting.

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