Spectrum of Engineering Sciences
ISSN (e) 3007-3138 (p) 3007-312X Volume 4, Issue 4, 2026

INVISIBLE THREATS IN MODERN TECHNOLOGY: THE HARMFUL EFFECTS OF ELECTROMAGNETIC WAVES ON HUMAN LIFE

Ameer Amanullah Sanjrani[*1], Zaheer Ahmed Wassan[2], Muhib Aleem[3], Attaullah Sahito[4], Ahmed Asghar Memon[5], Aaqib Qadeer[6]

[*1,2]*Information Technology Center, Sindh Agriculture University Tandojam Hyderabad Sindh, Pakistan*
[3,5]*Department of Computer Science and Related Studies, Hyderabad Institute for Technology and Management Sciences*
[*1,4]*Department of Computer Science and Information Technology, The Shaikh Ayaz University, Shikarpur*
[6]*University of North America*

[*1]ameer.sanjrani38@gmail.com

DOI: https://doi.org/10.5281/zenodo.19808386

Keywords
Electromagnetic waves, mobile phone radiation, digital health awareness, effects on human health, biological effects of electromagnetic waves

Article History
Received: 01 March 2026
Accepted: 08 April 2026
Published: 27 April 2026

Corresponding Author: *
Ameer Amanullah Sanjrani

Abstract
Many people do not fully recognize the potential effects of electromagnetic wave exposure because these waves cannot be touched, smelled, or seen. However, human beings are constantly surrounded by a vast spectrum of electromagnetic radiation. A common question is how something invisible can be harmful. This concern has become more significant due to the rapid expansion of modern technological devices, particularly mobile phones, which have become an essential part of daily life. Although electromagnetic waves are widely used in communication, radio, television, infrared systems, microwave technology, ultraviolet applications, and many other fields, growing research has raised concerns about their possible harmful effects across different frequency ranges. Despite these concerns, people often focus mainly on the benefits and efficiency of these technologies while paying less attention to their potential risks. Therefore, the main objective of this research is to investigate the harmful effects of electromagnetic waves, recommend suitable preventive measures, and develop a website and Android application that can help individuals easily understand and protect themselves from electromagnetic wave exposure.

1. INTRODUCTION

Electromagnetic radiation (EMR) is an inherent component of the natural and technological environment, and its presence has increased significantly with the rapid advancement of modern communication and electronic systems. Based on its energy and ability to ionize atoms or break chemical bonds, EMR is broadly classified into ionizing and non-ionizing radiation. Ionizing radiation, including high-energy ultraviolet (UV), X-rays, and gamma rays, possesses sufficient energy to alter atomic structures and induce biological damage. Prolonged or excessive exposure to such radiation has been strongly associated with adverse health outcomes, particularly skin-related disorders, including burns and an increased risk of skin cancer due to solar UV exposure. In contrast,

non-ionizing radiation, which is emitted by widely used technologies such as mobile phones, wireless communication devices, household appliances, and transportation systems, operates at lower energy levels and does not directly ionize atoms. However, the exponential growth in the use of these technologies has led to continuous and widespread human exposure, raising concerns regarding potential long-term health and environmental effects [1]. Although non-ionizing radiation is generally considered less harmful than ionizing radiation, emerging studies suggest that prolonged exposure may contribute to biological changes, necessitating further investigation. Given the extensive integration of electromagnetic-emitting devices into daily life, it is essential to critically examine both the beneficial applications and the potential risks associated with EMR exposure.

Electromagnetic waves are generated by the interaction of electric and magnetic fields that vary with time and propagate through space. These fields are oriented perpendicular to each other and also perpendicular to the direction in which the wave travels. The wavelength and frequency of electromagnetic waves are closely related, where frequency is commonly expressed in hertz (Hz). In a vacuum, electromagnetic radiation travels at the speed of light, while its speed may slightly decrease when passing through air or other media due to interaction with particles. An electric field is produced when voltage is present, and its strength increases as the voltage level rises. Similarly, changing electric fields can generate magnetic fields, resulting in the continuous propagation of electromagnetic waves. Once current starts flowing, a magnetic field is created; the larger this is, the stronger the force field. Even without current, there is an electric field. If this current is flowing, the intensity of the electric field remains constant, while the strength of the force field changes depending on energy usage. Waves of magnetic force are everywhere in our environment. However, this field is not visible to the human eye. The field of magnetic force waves is generated due to the natural accumulation of electricity in the clouds, during thunderstorms due to the accumulation of electricity in the air. Fish and birds use the Earth's power field to determine direction, giving compass needles extreme direction from north to south. Apart from fields generated by natural sources, there are also fields created by human sources in the spectrum. For example, X-rays cannot detect if a bone is broken due to a sports injury. Low-frequency magnetic fields are associated with the flow of electricity coming out of each socket. In addition, various high-frequency radio waves are used to transmit information, whether through TV antennas, radio stations, or mobile stations.

Among the most frequencies or wavelength of the associated electromagnetic field (EMF) determines its characteristics. The body is affected differently by fields of different frequencies. Magnetic force waves can be seen as sequences of highly regular waves moving at the speed of sunlight. The wavelength indicates the difference from one wave to another, while frequency only shows the number of oscillations or cycles per second. Additionally, wavelength and frequency are inherently linked; with the shorter wavelength, in result it has the higher frequency. Swinging a long rope attached to a door handle while keeping your hand at the free end can be a useful comparative illustration. A large wave can be created by slowly moving it up and down, whereas many small waves can be created with rapid movements. The length of the chord remains constant, so the more waves are created (higher frequency), the closer they are to each other (shorter wavelength). By using wavelength and frequency, another important property of the magnetic field can be determined: the calculation of the magnetic flux per unit area of the wave, which is carried by particles known as quanta. Compared to low-frequency (long-wavelength) fields, high-frequency (short-wavelength) wave quanta carry more energy. Some magnetic waves have a maximum energy per quantum that requires the strength to break the bonds holding atoms together.

This property is present in cosmic rays, X-rays, and gamma rays emitted by hot objects, and all of these are collectively called 'ionizing radiation'. Fields of low quanta that can break chemical bon ds are called "non-ionizing radiation “as shown in Figure 1.

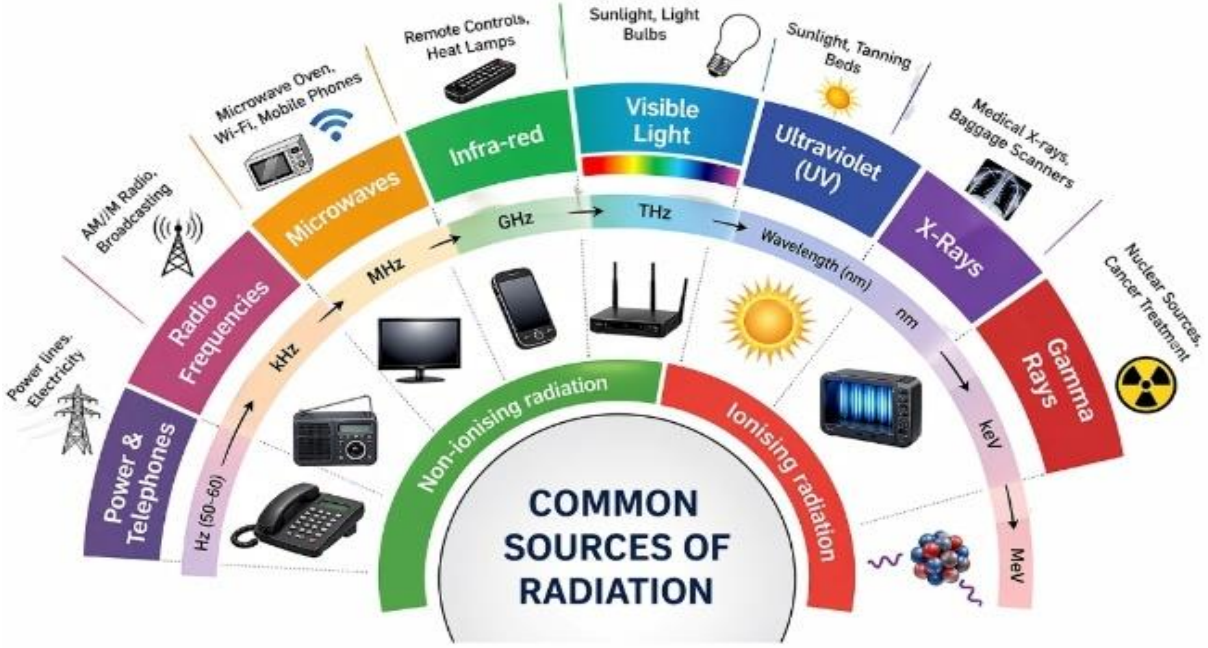

Figure 1 Applications of Electromagnetic Waves in Everyday Life, with Mobile Phones Located within the Spectrum

Electricity, microwave, and radiofrequency fields are sources of magnetic force fields that are an essential part of the unreal industrial world. These sources are located at relatively large wavelengths and low-frequency variations of the spectrum, and their quanta cannot break chemical bonds. Once given a positive or negative charge, electric fields are created. They exert force on other charges in that field. Volts per meter (V/m) is the unit of measurement of electric intensity. Any charged wire has the ability to create a corresponding force field. Even if there is no electric current, this field still remains. The electric field increases with voltage at a certain distance from the wire. The strongest electric field is found near the charge or decreases. Metals and other conductors are extremely effective shields.

Other materials that provide shielding effects include trees and construction materials. As a result, walls, structures, and trees reduce the electric fields of power lines within the house area. After burying the power wires underground, the electric fields on the surface are almost unnoticeable. The magnetic field is generated when electric charges move. In the analysis of the magnetic force field, scientists usually define a related quantity instead of the strength of the force, called flux density (measured in microteslas, μT), which is measured in amperes per meter (A/m). The force field is created only once, unlike electric fields. When a device is turned on, electric current flows. The top most field of force strength i.e. electric and magnetic fields have the strongest effect when near their source and it rapidly weaken as the exposure reduces by move away from one side to another.

Common materials, such as those used for wall construction, do not seem to block magnetic fields. Nowadays, mobile or cellular phone units are an important component of modern telecommunications. In many countries, more than half of the population uses mobile phones, and the market is growing rapidly. In 2014, there were estimated to be more than 6.9 billion subscriptions worldwide. Mobile phones are the most reliable or sometimes the only phones for

people in various regions. Considering the wide range of portable users, it is necessary to examine, evaluate, and track any likely effects on the health. However; the mobile phones use antennas called fixed base stations to transmit electromagnetic waves. Differences in magnetic fields, radio waves, and in principle radiation effect because of rays can break chemical bonds or ionize within the body due to radiations.

Mobile phones are low-power frequency transmitters that operate between frequencies of 450 to 2700 megahertz, and their maximum output varies from zero to one kilowatt per pair. Once the phone is turned on, it only transfers power. As the distance from the telephone increases, the radiation quickly decreases, and the user's exposure to radio frequency also decreases. If someone uses a portable part of their body at a distance of 30 to 40 centimeters, such as for texting, using a 'hands-free' device, or using the internet, the exposure to the phone's radio frequency fields is much lower than holding it to their head. Along with taking advantage of 'hands-free' devices, which keep the mobile phone away from the body during calls, that eliminate the potential exposure by limiting the duration of calls. Using the phone in a place with good reception makes the phone transmit at lower power, thus reducing exposure as well. It has not been proven that using professional devices is useful for reducing exposure to radiofrequency fields.

Because there is a possibility of radio frequency transmissions interfering with some electro-medical devices and navigation systems, in practice cell phones are generally prohibited in hospitals, schools, petrochemical industries and airplanes. Last two decades, several research studies are conducted to scrutinize and observe whether cell phones poses a harmful health hazards or not. Currently, there is no evidence that portable use has negative effects on health. The primary way radio frequency energy affects the body is through tissue heating. Most radiofrequency energy emitted by mobile phones operating at these frequencies is primarily absorbed by the skin and other superficial tissues, with little to no meaningful rise in temperature in the brain or deeper organs. Numerous investigations have examined whether such exposure affects brain activity, cognitive function, sleep patterns, and other key physiological markers in healthy individuals. Overall, findings suggest that radiofrequency exposure below the threshold that causes tissue heating does not offer convincing evidence of adverse health effects. In addition, existing analyses do not confirm a cause-and-effect relationship between magnetic field exposure and self-reported symptoms commonly described as electromagnetic hypersensitivity. Epidemiological research examining brain cancer and the use of mobile phones has been linked to potential semi-prepared risks of radiofrequency energy exposure. However, since the widespread use of mobile phones did not occur until the early 1990s, current medical studies cannot assess that cancer, which appears over a short period, as many cancers do not show up for several years when interactions related to growth affect the junction rectifier. Nevertheless, research on animals does not find any cumulative cancer risk associated with semi-prepared RF radiation.

Apart from case-control studies and prospective cohort studies that study various health characteristics among people, the largest retrospective study to date has been completed or is ongoing. The International Agency for Research on Cancer (IARC) developed Interphone, a case-control study for adults, to determine whether there is any link between the use of mobile phones and malignant cancers of the head and neck in adults. According to information collected jointly from thirteen collaborating countries, the international comprehensive investigation found that there was no accumulated risk of brain tumors or other tumors from portable use over a 10-year risk period.

No consistent trend was observed of increased risk with longer use, or consistently increases risk. However, some studies have suggested a possible overall rise in brain cancer risk among individuals with the very highest cumulative phone-use hours. The researchers noted that these findings should be interpreted carefully because potential errors and different forms of bias weaken the reliability of the results and limit any firm causal conclusion.

On this basis, IARC placed radiofrequency electromagnetic fields in Group 2B, meaning they are considered possibly carcinogenic to humans. This category is applied when a causal connection is viewed as plausible, but chance, bias, or other confounding influences cannot be ruled out with sufficient confidence.

According to the author, in the past half-century, there has been a significant increase in the discovery and use of equipment and tools for inflated medical applications for military, commercial, and entertainment purposes, which emit various types of ionizing radiation energy. This includes microwaves, radio waves, ultraviolet, infrared, and actinic rays, all of which are classified in the wave spectrum of magnetic forces. Many magnetic force waves with specific frequencies, power levels, and exposure times can cause biological effects or harm, supported by various biological and physical factors [2]. Although devices that use or emit electromagnetic waves provide useful benefits to humans, uncontrolled and excessive radiation emission can also pose a danger to individuals. Currents will flow through the body at low, high, and microwave frequencies. The flow of these currents generates heat, which can cause thermal damage. Apart from the Earth's electric fields, static magnetic pulses generated by lightning are stable in components of low natural frequency fields. All living beings exist in the invisible cage of such waves and electromagnetic pulses within these fields. Understanding the health effects of radiation exposure is undoubtedly the most challenging and problematic. Wherever the radiated field of E and H fields is brought down completely in a different way below safe levels, household appliances create a controlled environment that gets sealed and shielded. The average Specific Absorption Rate (SAR) for an entire person is 0.08 W/kg, which is also their highest SAR, 6 W/kg. This study examined and presented the biological effects (EMI) from electromagnetic fields on people near household appliances. According to information, electromagnetic frequency between 30 to 300 megahertz is widely used, especially in transmission. This frequency is used in TV, Wi-Fi, and radio. The harmful effects of radiofrequency waves have been well documented since the 1970s and 1980s, when the intensity of electric and magnetic components was standardized by ANSJ 82, 88, and 89 INIRC NRPS (these standards also apply to the author's country). The purpose of study is to examine the consequences of RF waves of higher frequency and intensity than the permissible limits on blood parameters and changes in rodent activity. From the experimental group, twelve and fifteen out of a total of 27 rare individual mice of each gender were used as witnesses. They kept the animals in cages that were specially designed for dead radiofrequency rays, which have a frequency of 144 megahertz and an intensity of twelve. The experimental cluster supplies 5 W/piece [3]. Numerous issues have been documented regarding the non-thermal effects of magnetic field waves, including the effects of low-frequency electric fields on humans and the mechanism of interaction between the body and low-intensity magnetic fields in biology. In addition, convenient applications have been approved, and the experimental testing of temporary magnetic fields that cause cytomembrane distortions has also been conducted [4]. Many issues have been reported regarding the non-thermal effects of magnetic field waves, including the effects of low-frequency electric fields on people and the mechanism of interaction between the body and low-intensity magnetic fields in bioscience. Additionally, practical uses have been approved, and experimental tests of transient magnetic fields have been conducted, which cause cytomembrane distortions. Under extremely high-frequency (EHF) radiation, an increase in the electric charge of the human nucleus has been observed; this effect is described for high-expressed spherical (right-handed) polarization. Currently, the objective of reading to explain the effects of radio frequency on the mechanics of radio frequency and the magnetic attraction waves on living organisms is generally not yet established, but the responsibility for biological effects in bands does not create much doubt. The study of the polarization properties of radio frequency and its effects on cellular biological components is highly interesting. It is possible to believe that the

polarization properties of the magnetic field (linear, proper) determine the frequency and energy parameters of the cell's response or determine them when performing left circular polarization [5]. More research is needed on the use of mobile phones, portable computers, and the risk of brain cancer, because the use of mobile phones is increasing and there has been a lack of awareness about using them for fifteen years, even though there is no evidence linking them to an increased risk of brain tumors. The World Health Organization has encouraged further research on this cluster, especially considering the recent use of portable devices in children and the potential duration of exposure. Currently, there are many studies on potential health effects in children and adolescents.

The main contribution of this research study are as follows:

1. To observe and study the harmful consequences of electromagnetic waves on human health.

2. Compare the previous methods to analyze and identify effects and create awareness.

3. Proposes an Android-based application and website for preventive measures against electromagnetic waves.

2. Related Work

People's understanding of the risks of the magnetic power of activity motivates researchers to investigate this subject thoroughly. The effect of magnetic power waves on the head, eyes, and body has been the subject of many previous studies. According to researchers in this literature, wireless LAN and mobile phones emit such magnetic power waves that pose a significant threat to human health. The propagation of magnetic power waves through the human skull, the behavior of monopole antenna beam patterns in front of a person's head, and the combined behavior of two antenna elements in a head-front and reflector position are the three primary aspects of the analysis reviewed in this paper [6]. According to the report, the technology may have a dynamic structure with a system for structural adjustment. Its stability is ensured by the continuous operation of various bodily systems. Temperature, insulator constant, magnetic permeability, electrical ohmic resistance, electric voltage, electric current, and other physical properties of biological tissues are all affected by changes in the body's physical parameters. One of the most important and successful strategies for size measurement is to continuously study the data on the displayed features. Currently, this issue has been successfully addressed primarily with the help of a radiometer based on radio-physical analysis methods, which analyze the magnetic fields created and destroyed by size. Experimental research findings have shown that in the radio thermometry wave band, unlike infrared thermal imaging, real-time data on temperature fluctuations in more deep and dynamic layers beneath the skin is obtained, and it also helps in studying the effects of temperature on the functionality of skin layers in terms of protective and thermal stabilization. Tight clothing, covering hair, and low keratotic skin all affect the luminous levels of cardboard radios. Collected information shows that standard diagnostic procedures and detailed information are often very beneficial in the areas of surgery, injury, medical care, treatment, and alternative medicine [7]. At different frequencies of 900 megacycles per second, 1.5 GHz, and 1.9 GHz, the polarization-related component of the magnetic (EM) wave increases the maximum temperature of the human eye in relation to the specified absorption rate (SAR). In particular, the comparison of near-field and far-field exposure is associated with the increase in temperature in the eye. Differences are also noted regarding the maximum temperature increase in the lenses of adult and child eye models. [8]. The troublesome magnetic force waves of the setting pose a challenge to body of the human being, which is somewhat related to the compatibility of magnetic force. To better understand the biological effects of magnetic force waves, this article created a three-media model of the physical body. It also examined the conditions of energy loss in different media and, consequently, the relationships between events

and reflected magnetic force waves. As a result, the theoretical expressions were duplicated and the coefficient for each layer was created according to research methodology. Finally, since a detailed discussion of the magnetic force setting was provided, specific absorption rate results are presented here. [9]. Due to portable exposure, public concern about the potential health effects of electromagnetic (EM) waves has increased in recent years. This has led many public institutions worldwide to establish safety protocols. The main focus of this work is to investigate or study the effects of using mobile phones at 900 and 1800 megacycles per second on human health. The finite-difference time-domain (FDTD) method is used to determine the specific absorption rate (SAR) of mobile phones absorbed in the brain. The International Commission on Non-Ionizing Radiation Protection (ICNIRP) has set a minimum SAR limit of four W/kg. When this limit is exceeded, it affects human health because it can cause cell membrane polarization reversal, dynamic changes in brain waves, and disturbances in the brain's chemical balance and DNA damage [10].

According to the author, the aim of this study is to examine the effects of gigahertz per second (GHz) (f = 37) and low-intensity terahertz (THz) frequencies (f = 0.89 THz, P = 1.5 mW/cm²) on the in vitro propagation resistance of human erythrocytes (7 GHz, P = 2.7 mW/cm²). The levels of peroxide supermolecular oxidation (POL) of products such as malondialdehyde (MDA) and dialdehydes dyne (DD) were used to measure erythrocyte hemolysis. Erythrocyte hemolysis was calculable in hypotonic saline. The combined effects of gigahertz rays and magnetic field waves on supermolecular oxidation and the persistent section of red blood cell resistance are presented. This likely indicates a cooperative inhibitor. In structural states, the effects of low-energy optical maser radiation were tested repeatedly at a frequency of f = 200 + 450 Hertz. The purpose of the survey was to collect blood (average age: twenty years) [11]. If you are exposed to magnetic force waves for a specific period, you may experience headaches or, in worse cases, brain cancer. Scientists know that the thermal effects of radiation can be biologically harmful to the human body because it contains 65 to 70 percent water and the electrolytes as well as ions. Energy of radiation discharged most rapidly from the mobile devices can interact with the body and, due to the displacement of ions and electrolytes, can interfere with the body's natural healing processes [12]. The analysis of how magnetic waves travel around a safe enclosure was conducted using MATLAB. In addition, the significance of magnetic shielding and the effects of a secure enclosed space were revealed using MATLAB. During their operation, all electronic devices generate magnetic waves. Magnetic shielding is responsible for this. All devices are safeguarded so that they can function properly in an electronic environment. Apart from this, magnetic shielding reduces dangerous effects on human life. The biggest drawback of the physicists' cage design is the presence of holes. The holes are closed for input/output connectivity, ventilation, relaxation, etc. [13]. The biological effects of pulsed electric power have been actively studied so that it is possible to control Einstein cells and induce the death of malignant cells. The results of the analysis enabled the authors to advance a method for high-power concentrating, which causes cancer cells to be destroyed. This technique involves an egg-shaped non-circular reflector and a deflected cooperative antenna [14]. At frequencies of 915 and approximately 0.45 GHz, the specific absorption of the magnetic field in the frame is determined through 3D finite element analysis of heat transfer. The objective of this analysis is to determine whether the leakage of the magnetic field in living tissue is harmful to organisms. It is possible to simulate microwave radiation. Using the finite element method (FEM) in our system allows us to examine the specific absorption of magnetic fields as well as heat flow in multi-rate organs of living tissue. The magnetic wave flux of the system was generated like a small strip and placed at a distance of five centimeters from several living tissue model bodies. The exposure time was 1800, supported by the leakage between the previous 100 W power [15].

This study examines how the specific absorption rate (SAR) in the head is affected by different

angles of liner-polarized mobile exposure, which may be related to the social control of user safety. Since it is the most accepted method, the moment technique is used to determine the electric field in the head [16]. Over the past few decades, electromagnetic (EM) energy has become a common part of our daily lives, and the public continuously pays attention to issues related to wave magnetic forces affecting human safety. Experiments have been conducted to determine safety requirements and electric emissions by directly studying human cells, which pioneered the effects of radiation exposure in cell cultures in medical specialties. [17]. With the rapid expansion of wireless communications, many residents living near boundary zone antennas are now very concerned about the possible impact on the framework of electromagnetic field formed by base station, probes and antennas. It also calculates the specific absorption rate with temperature that is varying for a multilayer of human tissue and model demonstrates simulations of exposure to non-ionizing radiation [18]. Conductors are used in the ORCAD machine model along with losses because the circular equation of flat wave propagation is parallel to the circuit equations for waves on the conductor. To replicate the experiment, a 10-meter distance is taken between the station of the antenna and the multi-layer human tissue model for frequencies of 2450 MHz and 915 MHz. The data, PSPICE was primarily used to calculate SAR and the associated temperature rise.

3. Methodology

The study of the harmful effects of electromagnetic waves on human life existence forms the basis of the methodology. To clarify preventive measures against the effects of electromagnetic waves, an Android-based application and website are developed, connected to a database using SQL Server 2000 on the backend and using PHP on the frontend. To create a secure and fast database, write guidance on security measures and post it online, which will raise awareness about the negative effects of electromagnetic radiation. The preventive principle concludes with examples of the dangers of electromagnetic waves, which need to be considered in any strategic preventive principle. It is recommended to find measures to prevent potential injuries, but there is no guarantee that they will be exact.

The relationship between electromagnetism and life has been a subject of attraction and debate for about four hundred years. Considering everything, today the interest in this relationship is at a new level. The internal magnetic phenomena in the body are not at all passive, and evidence suggests that, unlike what was previously thought as mere trivial by-products of biochemical reactions, they play an important role in many physiological processes. The background of the Earth's magnetism is an important environmental factor for all living beings, and whether living organisms can experience it has long been a question, to which the answer has been given not negatively but with a positive response. Both the source in the universe and the planet itself create the background of magnetism related to the Earth. The medical use of magnetism is increasing and is soon expected to safely spread to important areas. However, there is more than these things. The current environment has been completely polluted due to sources of semi-synthetic particle radiation, the frequency and extent of which have not yet been heard. Due to human activities, the background magnetism of the world may have changed more than other natural physical properties of the Earth, such as the soil, water, or atmosphere. Currently, evidence indicates that the present disturbed magnetism will pose a threat to environmental health. Humans are almost unaware of the disasters caused by pollution they have created. **shown in Figure 2**.

Figure 2 Illustration depicting widespread mobile phone usage in an urban environment, highlighting public concerns about potential health risks associated with prolonged exposure to electromagnetic radiation, particularly among vulnerable groups such as children and pregnant women

All mobile phones emit a type of radiation known as an electro-magnetic force (EMF), which travels through the house in the form of waves of electric and magnetic energy. 'Ghost' magnetic force is displayed by various types of magnetic energy, which are classified according to their wavelength and frequency. Different technologies use different radiation frequencies. Broadcast antennas emit various microwave and radio waves, which collectively measure a type of magnetic energy known as radiation or frequency (RF). The range of specific frequencies (RF) generally includes frequencies from 3 kHz to 300 gigacycles per second (300 GHz). RF energy is used for radio and television, mobile communications, GPS devices, telecommunications services, and satellite communications, as well as by police and fire departments. Non-communicative sources of RF energy include radar, microwave ovens, and industrial applications. Ionized and non-ionized compounds are widely found in the spectrum. The term "non-ionizing radiation" describes a type of electromagnetic radiation that does not have sufficient energy to remove associated leptons from atoms or molecules. Microwaves, radio waves, cell phones, wireless networks (WiFi), power lines, and resonance imaging are examples of non-ionizing radiation sources. As shown in Figure 3, some ranges of electromagnetic waves that are commonly used in our daily lives are illustrated.

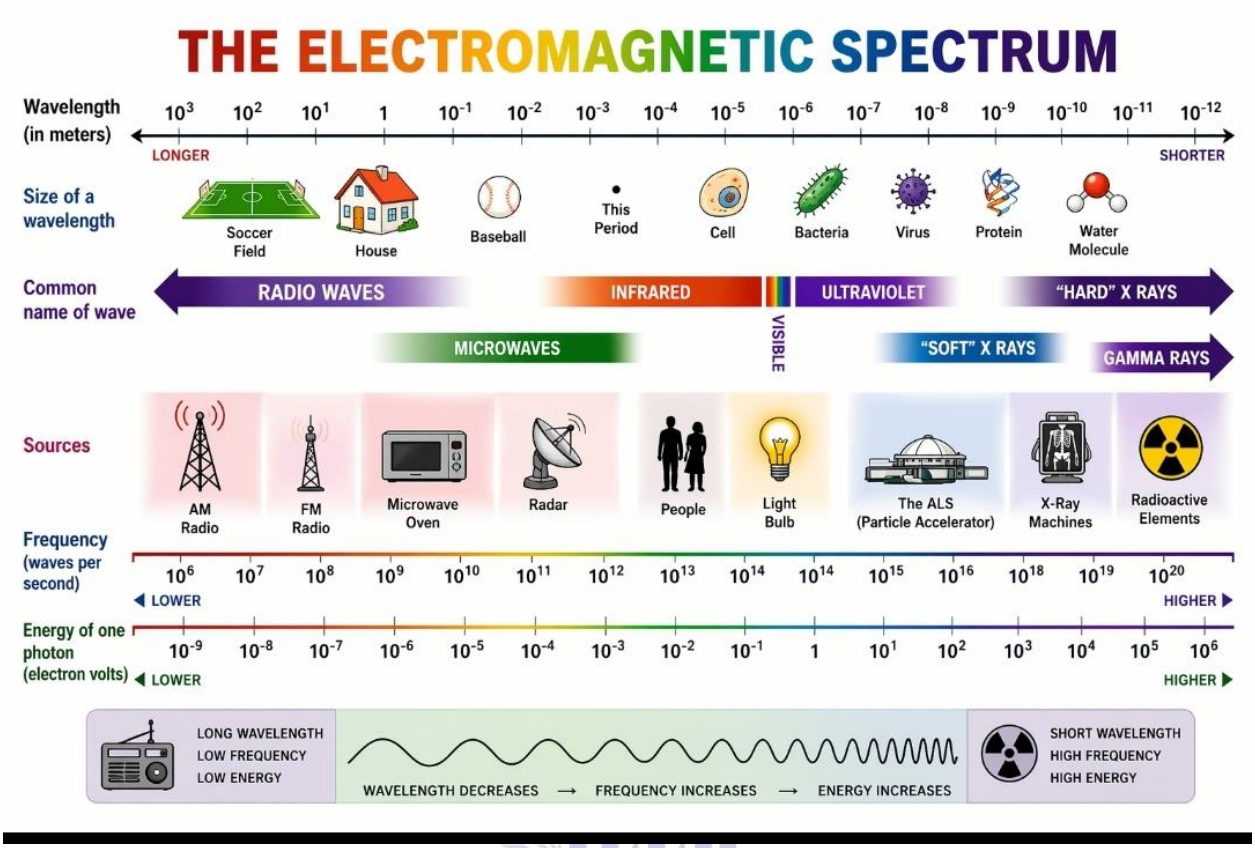

Figure 3 Illustration of the electromagnetic spectrum showing the range of frequencies and wavelengths, from radio waves to gamma rays, along with their typical sources and applications

According to numerous studies, high-frequency magnetic fields can affect the level of stress in cells and influence cellular regulatory systems (Tockelov and Gutzheit, 2004). According to Cotgreave (2005) and the United Nations organization's (2006) analytical program on RF fields, thermal shock proteins are considered important indicators of cellular stress and are also considered potential indicators of the biological effects of high-frequency magnetic fields. The World Health Organization established it to confirm those effects, such as the need for a top-priority analysis (2006 agenda analysis for RF fields), because HSP expression has been guided as an early indicator of stress response and a potential biomarker for exposure to magnetic fields. It has been observed at increased frequencies that magnetic fields change the expression and/or phosphorylation of HSP in human cells (Kwee et al., 2001; Leszczynski et al., 2002). To resolve these conflicting findings, further research on the thermal shock response to high-frequency magnetic fields is recommended, as other investigations do not support the same conclusions (Cotgreave 2005). Relatively extensive research showing changes in expression or phosphorylation status when restricted in high-frequency magnetic fields has supported the theory that overexpression of HSPs may also be an indicator of contact with magnetic fields on cells (Leszczynski et al., 2002; Miyakoshi et al., 2006; De Pomerai et al., 2000). However, according to Delaware Pomerai et al. (2000) and Dawe et al. (2006), their observations may possibly not be supported due to the effects of heat. The possibility has been considered that high-frequency radiation magnetic fields can interact with biological structures and damage proteins through mechanisms unrelated to heat (De Pomerai et al., 2000). A major factor behind this

result is the resonance frequency of such weak bonds that maintain the biologically active three-dimensional shape of proteins. When these bonds break, proteins can denature, which in turn activates the heat shock protein (HSP) pathway. On the other hand, although solid experimental evidence is still lacking, there is considerable public concern about the negative effects of electromagnetic fields (EMFs)—especially on reproduction. This concern mainly arises from the fact that EMFs are ubiquitous, and more people encounter them daily. For example, one study noted that high-intensity microwave exposure increases fetal death in early-stage pregnant mice (Nawrot et al., 1985). Another study found that such exposure caused the formation of micronuclei in the red blood cells of mouse offspring (Ferreira et al., 2006). Meanwhile, research on human amniotic cells showed a significant increase in HSP70 protein levels (Kwee et al., 2001). Today we live on a planet with a population of nearly 6.8 billion people, and by the end of 2012, the number of mobile phone subscriptions was expected to reach around 6 billion. Yet, surprisingly, no one has really tried to investigate how mobile phone radiation can affect people's health, particularly those with diabetes—a group that may be especially sensitive. Diabetes has become an increasing challenge, posing a threat to economies and communities, especially in developing and middle-income countries. In fact, it is predicted that four out of every five people with diabetes will live in such countries. At the same time, these are the very places where telecommunications and mobile subscription rates are increasing by as much as 117% each year. Diabetes is already a major cause of disease and premature death worldwide. Non-communicable diseases associated with diabetes are responsible for the majority of deaths globally. The International Diabetes Federation estimates that by 2030, the population with diabetes will rise to 435 million. Given these trends, there is a strong reason to explore this issue and gather evidence on how mobile phone radiation can affect community health—especially for people living with diabetes.

4. Results

Results and discussion about the proposed analysis regarding The study of the harmful effects of electromagnetic waves on human life. The main source through which electromagnetic wave effects occur is currently cell phones. The number of cell phone technologies is increasing day by day, thus everyone puts themselves at great risk. The following figure shows to what extent people sleep with their cell phones, which is given in Table 1.

Table No. 1: The ratio how much people sleep with their cell phones

Total	65%
Men	67%
Women	64%
Age	
18-29	90%+
30-49	70%+

50-64	50%+
65+	34%+

Mobile phones and their effect on male fertility: Cellular technology is partly related to our standard of living, and its use is not limited to simple communication—it also includes news, sharing photos, and using high-resolution internet. At the same time, with advancements in this technology, the number and frequency of electromagnetic waves emitted are gradually increasing, and sufficient questions are not posed about their effects on health. Our body functions like parasitic antennas that receive these waves and convert them into electrical and magnetic fields. The thermal effects of mobile phone radiation at this level are negligible, yet additional types of biological interactions are considered as non-thermal effects.

The male reproductive system is a highly compartmentalized and sensitive biological system that requires the integration of internal and external factors to function properly. The electric currents generated by phone radiation alter the hormonal (endocrine) microenvironment necessary for the environment and sperm production. Initially, sperm cells are electrically active, and therefore their sensitivity to mobile phones and the associated electromagnetic waves can affect their motility, structural changes, and viability.

Damage to the cell membrane, glutathione deficiency, and cellular stress have been proposed as mechanisms through which radiation causes harmful effects on cells, and it can also affect male fertility. Evidence of such effects from animal studies and in vitro experiments often differs from human in vivo experiences. However, it is extremely important to impose strict regulations on the newly increased power density of mobile phone radiation and to conduct human in vivo research to study its negative effects on fertility, as shown in Figure 4.

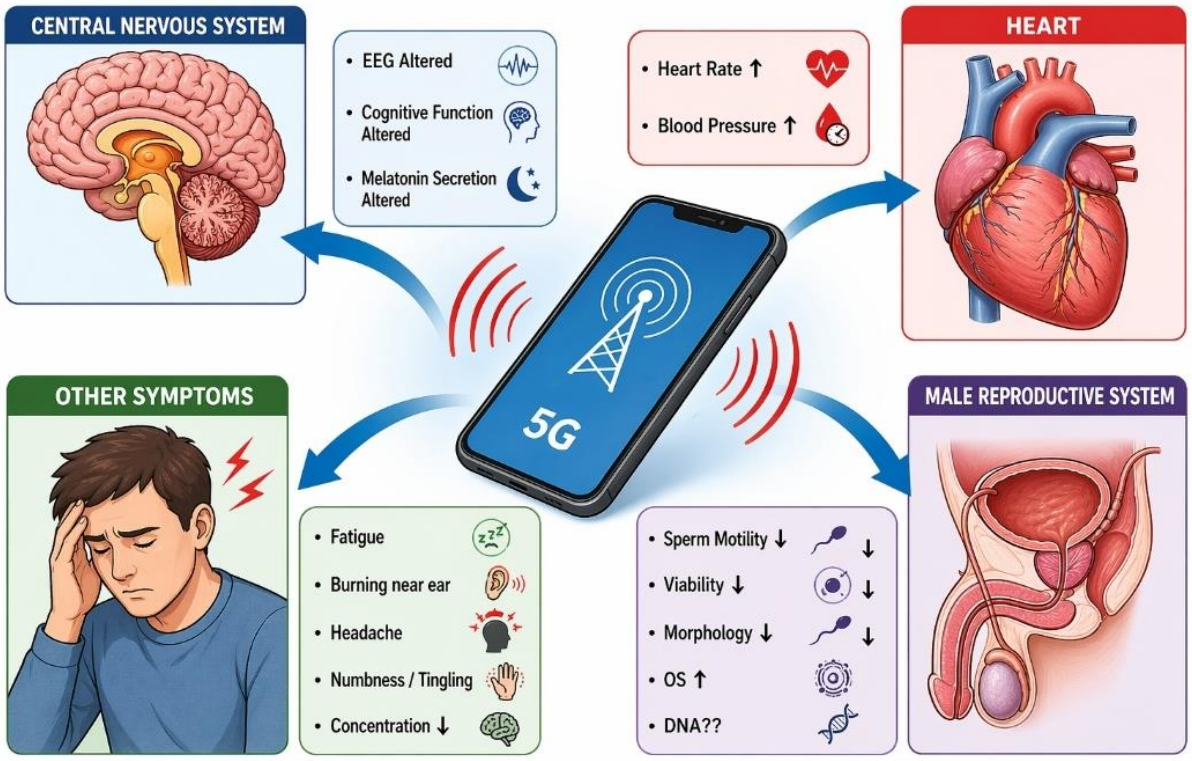

Figure 4 Schematic illustration of potential biological effects associated with exposure to electromagnetic waves (EMWs) from mobile devices (e.g., 5G), highlighting impacts on the central nervous system, cardiovascular function, male reproductive health, and commonly reported symptoms such as fatigue, headaches, and reduced concentration

Exposure to electromagnetic waves (EMWs) may influence several subcellular processes within the body. One proposed effect is a disturbance in cell membrane potential along with increased calcium loss, which can lead to calcium imbalance and reduced protein kinase C (PKC) activity. This reduction may subsequently affect various enzymes, ion pumps, membrane channels, and structural proteins, eventually contributing to programmed cell death, or apoptosis. Radiofrequency electromagnetic waves (RF-EMWs) may also stimulate the formation of reactive oxygen species (ROS) by disrupting NADH oxidase activity associated with the mitochondrial membrane. Elevated ROS levels can alter PKC function, damage proteins and DNA, activate heat shock proteins, and promote apoptosis. In addition, heat shock proteins are reported to increase in response to non-ionizing radiation and oxidative stress. Their elevated expression may impair sperm metabolism, disrupt the blood–sperm barrier, and interfere with the normal elimination of defective sperm cells through apoptosis. The genotoxic effects of RF-EMW exposure on sperm are therefore thought to occur either indirectly through ROS generation or directly through clastogenic damage such as chromosome breakage.

4.1. General Body Effects

There has been significant development in understanding how radiation from mobile phones can affect normal bodily functions. Numerous studies have examined the responses of various body tissues to radiation exposure. Changes in the central nervous system, vascular system, and effects on specific tissues have been investigated. In electroencephalogram (EEG) samples, sleep

patterns, and neuroendocrine functions, fluctuations were observed, and increased mobile phone use was found to reduce cognitive function and the secretion of certain hormones.

It has also been shown that contact with mobile phones increases blood pressure and heart rate. Similarly, the radiation from electromagnetic waves can alter the function of Leydig cells and Sertoli cells, leading to a decrease in hormone secretion and thus preventing cell growth. In addition, many mobile phone users have reported difficulty concentrating, increased fatigue, frequent headaches, as well as burning in the ears and a tingling or numbness in open cells. Therefore, it is evident that the effects of mobile phones extend beyond immediate contact, and when these effects accumulate, they can have a significant impact on the user's health and well-being, as shown in Figure 5.

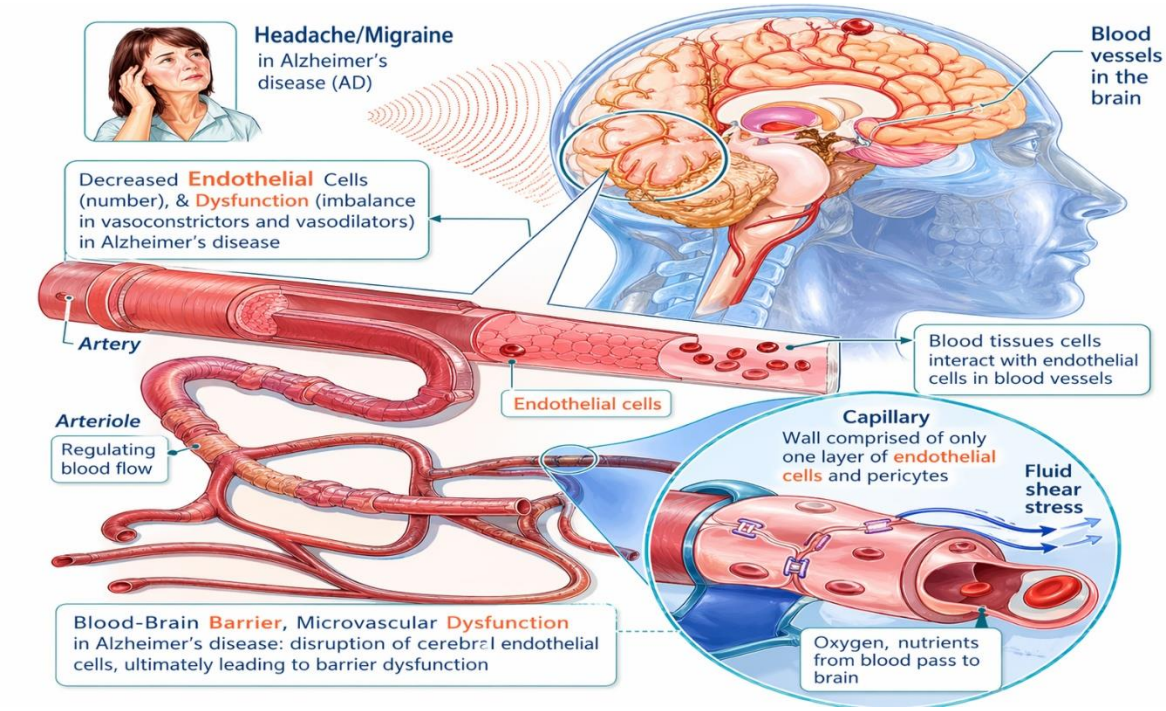

Figure 5 Illustration of cerebral microvascular structure and blood–brain barrier function, highlighting endothelial cell dynamics, capillary interactions, and their role in regulating blood flow and nutrient exchange, with relevance to neurological conditions such as Alzheimer's disease

Radiofrequency electromagnetic waves released from mobile phones may adversely influence the vascular system, the central nervous system, and male reproductive health. In addition, it can also affect local fabric. Custom-made by Maker 2009.

4.2. Integrity deoxyribonucleic acid defects

DNA carries the hereditary instructions that regulate the essential functions of sperm cells. When this genetic material is harmed by internal or external factors, it is often linked to reduced sperm quality, decreased fertilization potential, and unfavorable pregnancy outcomes. Spermatozoa also possess only a weak capacity to repair single-strand or double-strand DNA damage. Genetic injury and strand breakage are considered among the important biological effects that electromagnetic waves may induce in different tissues. A considerable number of studies have investigated whether electromagnetic wave exposure can damage sperm DNA. For example, Aitken and colleagues reported that exposing male mice to radiofrequency electromagnetic fields for seven days produced measurable damage in both the nuclear DNA and mitochondrial genome of sperm collected from the reproductive tract. De

Iuliis et al. used the TUNEL assay to demonstrate that the increase in defects in sperm DNA integrity under the influence of electromagnetic radiation is positively correlated with the specific absorption rate (SAR) to which they were exposed.

In contrast, Falzone et al. used the TUNEL assay and carefully observed that there were no significant defects in sperm DNA integrity when exposed to electromagnetic radiation. Similarly, another study by Agarwal showed that the effect of electromagnetic radiation on in vitro sperm cells was not different. The key takeaway from the studies mentioned above is that DNA damage caused by electromagnetic radiation is significant. However, this damage could be the cumulative result of continuous repeated exposure and may not be detected after short-term exposure. Furthermore, the differences in conclusions reported in the above studies could be due to variations in the frequency of electromagnetic radiation and SAR applied.

4.3. Effects on Leydig cells

Under the influence of gonadotropic hormones, Leydig cells known as the cells that open the male gland are responsible for the secretion of androgens. In fact, fifty-seven percent of the body's androgenic hormones are found in Leydig cells. The secretion of androgenic hormones is necessary to initiate and sustain gametogenesis. Leydig cells are generally recognized for their ability to withstand the effects of radiation at various experimental levels. However, a study conducted on animals observed an impact on EMW performance in Leydig cells. There is still disagreement regarding the findings of the study.

4.4. Effects on the Sterol cells and blood-testis barrier

The blood–testis barrier (BTB) is a specialized structural barrier that separates the blood and lymphatic circulation from the seminiferous tubules. At the microscopic level, it is created mainly by tight junctions between adjacent Sertoli cells. Its key role is to shield developing germ cells from immune attack and to stop immunogenic materials from escaping from the male reproductive system.

A related concern is whether the damaging effects reported for cellular electromagnetic radiation on biological barriers could also compromise BTB stability. Only a limited number of studies have explored this issue, and both used electric field strengths much higher than those produced by modern mobile phones. In a study by Wang et al., rats were exposed to electric fields of 200 and 400 kV/m. The findings showed noticeable structural changes in Sertoli cells: the cells became swollen, their nuclei shifted toward the center rather than remaining near the base, and the number of cellular extensions increased with closer intercellular connections. Cytoplasmic granules and vacuoles were also observed. Although the overall amount of vimentin, an intermediate filament involved in maintaining the cytoskeleton, did not significantly change, the vimentin filaments became progressively shorter after one to two hours of exposure and returned to normal length after six hours. Such alterations in vimentin organization may influence Sertoli cell shape, weaken tight junction architecture, and consequently disturb the integrity of the BTB, as illustrated in Figure 6.

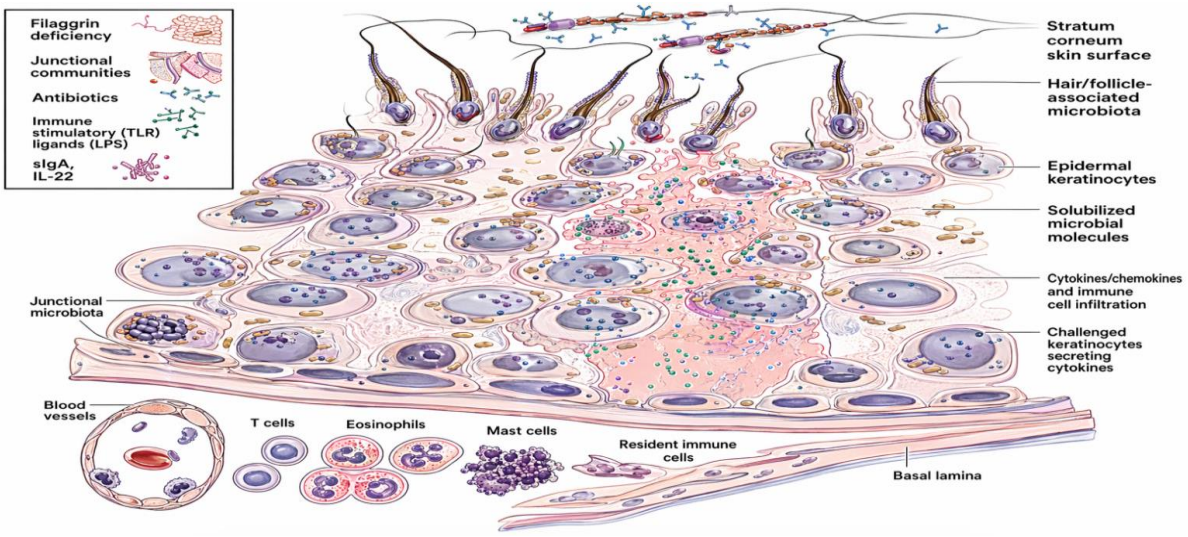

Figure 6 The pathological effects of cell phone on various cellular components of testes

4.5. Effects on the hypophysis

The pituitary gland releases follicle-stimulating hormone (FSH) and luteinizing hormone (LH), which regulate gametogenesis and ovarian steroidogenesis. The effect of electromagnetic wave levels on gonadotropins has been studied in humans and animal models. De Seze et al. examined the concentrations of pituitary hormones FSH and LH in 21 healthy men after exposure to radio waves emitted by a 900 MHz mobile phone (2 hours daily, 5 days a week, for one month) and found no effect. However, in their study, the duration of exposure to radiofrequency radiation was probably not long enough to cause any significant effect. Other studies have also shown that the gonadotropins of the pituitary gland did not change in humans or animals exposed to mobile phones.

On the other hand, Fang and their colleagues' recent report showed that the pituitary glands of mice exposed to high electromagnetic waves (200 kV/m) exhibited advanced ultrastructural imbalances, including changes in swollen mitochondria, expanded Golgi bodies, and scattered lysosomes. As the duration of exposure and the energy of the electromagnetic waves increased, mitochondrial vacuolation, formation of myelin figures, expansion of smooth endoplasmic reticulum, presence of various secondary lysosomes, and clump-like aggregation of heterochromatin in the nuclear membrane could be observed. Overall, no study has shown that the energy of cellular electromagnetic waves negatively affects the secretion of pituitary gonadotropins.

Even though the intensity of the electric field used in the above zoological study was higher than that of today's mobile phones, it is important to note that radiation at this level can cause significant damage. Therefore, every possible effort should be made to ensure that there is no further increase in the levels of radiation and the strength of the electric field found in today's mobile phones.

4.6. Thermal effects on male generative organs

The testis relies primarily on conduction through the skin rather than blood flow to regulate temperature; this is an important factor for the effect of heat from radiofrequency electromagnetic waves (RF-EMW). Since the testis is an organ located on the surface of the body, it can absorb more energy from electromagnetic waves compared to other organs. For optimal gametogenesis in the human male reproductive system, a temperature 2°C lower than the normal body temperature is required, and an increase in testicular temperature is known to be a detrimental factor for sperm production.

Some authors have shown that intense exposure to electromagnetic waves can have a direct effect on the seminiferous tubules due to increased ovarian temperature. They exposed rats to frequencies of 0.45 GHz (30 W/kg), 1.7 GHz (50 mW/cm²), and 2.45 GHz (44 W/kg), respectively, and demonstrated altered microstructure of the seminiferous tubule epithelium and imbalanced semen parameters such as sperm count and sperm structure. However, the electromagnetic wave energy used in these studies is much higher than the energy emitted by modern mobile phones.

According to recent reports, the thermal effect of electromagnetic waves emitted by mobile phones is negligible, especially at commercial Specific Absorption Rate (SAR) below 2 W/kg. It is estimated that only SAR values exceeding 4 W/kg may cause a 1°C temperature increase. Yan et al. conducted animal studies on mice in which sensitive electronic temperature sensors placed near the mice's heads and testes were used to take precise measurements of skin and testicular temperatures. The authors noted that after six hours of exposure to electromagnetic waves from cellular phones at an SAR of 0.80 W/kg, the temperature of the heads of the experimental group was not different from that of the control group, and the testicular temperatures of both groups were nearly the same. Therefore, at this stage, there is no clear evidence indicating a thermal effect of mobile phone radiation on the human body.

4.7. Non-thermal effects of cellular phone radiation

This result is still under investigation and involves a large variety of metabolic pathways. The main mediator of these pathways is the aerobic stress. However, it has been found to also be involved in direct injury from RF-EMW (Figure 07).

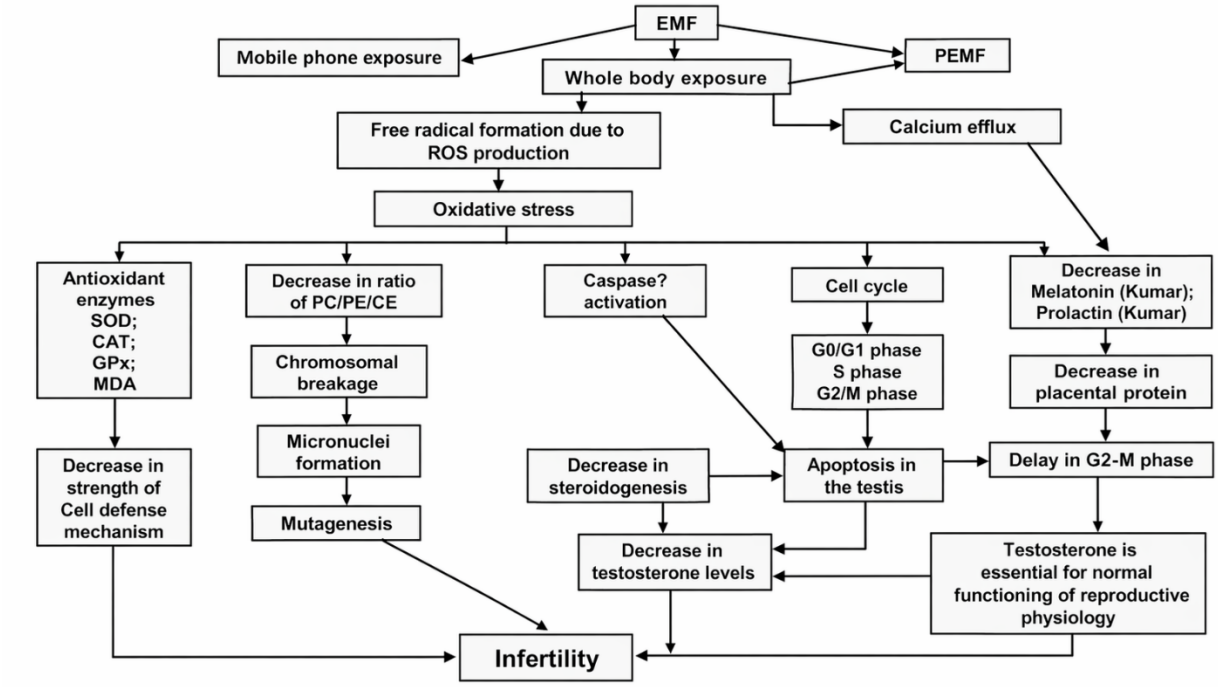

Figure 7.Proposed mechanistic pathway illustrating the biological effects of radiofrequency electromagnetic wave (RF-EMW) exposure, including reactive oxygen species (ROS) generation, oxidative stress, cellular and hormonal disruptions, and their potential link to reproductive impairment and infertility

This study examined the possible adverse effects of electromagnetic radiation on human health. Growing concern has been raised about the potential hazards associated with wireless radiation. The World Health Organization has identified mobile phone radiation as possibly carcinogenic to humans. In addition, several European studies have suggested that individuals who use mobile phones heavily for more than ten years may face a greater risk of developing brain cancer. It has also been reported that those who begin using mobile phones during adolescence could have a substantially higher likelihood of later being diagnosed with brain tumors. Experimental research has further explored the impact of wireless radiation on sperm cells. In one such investigation, researchers collected two sperm samples from a healthy donor and exposed only one of them to mobile phone radiation. The exposed sample showed a much faster rate of cell death and considerably greater mitochondrial DNA damage than the unexposed sample.A number of investigations have also explored a possible association between mobile phone use and breast cancer. Some reported cases involved young women who regularly kept their phones inside their bras and later developed unusual lumps in the same areas where the devices had been placed, despite having no prior history of breast cancer. In response to these concerns, it has been argued that the United States should consider precautionary measures similar to those adopted in other countries. Nations such as Russia, the United Kingdom, and Canada discourage or restrict children's mobile phone use, while France and Belgium have prohibited the sale of mobile phones intended for very young children. Likewise, France, Finland, Israel, and the European Environment Agency have recommended more cautious use of mobile devices. Certain cities, including Toronto, have also imposed restrictions on Wi-Fi use in some public spaces, and several municipalities in the United States have taken steps to regulate wireless radiation exposure. These developments support the argument that a more precautionary public health approach may be needed. Microwave ovens are another common source of concern because they are widely used in homes, restaurants, kitchens, and other daily environments. Some users worry about the possibility of radiation leakage during operation. However, according to Health Canada, limited microwave leakage from a properly maintained appliance does not pose a health risk. The most common causes of leakage are damaged or worn door seals, poor maintenance, dust buildup, or prolonged misuse. Microwave ovens operate by using radiofrequency energy at a specific microwave frequency to heat food. When this energy is absorbed by water molecules in food, the molecules vibrate and produce heat. Unlike X-rays or gamma rays, microwaves do not make food radioactive. They are designed to remain inside the oven while it is operating, and microwave generation occurs only when the door is shut and the appliance is switched on. There is no convincing evidence that microwave ovens used correctly create health hazards, although broken or altered units may leak radiation and cause harm. In many cases, injuries associated with microwaves are more often caused by steam or overheated food than by radiation itself. Earlier concerns also existed about interference with pacemakers, but modern pacemakers are generally shielded against such external electrical effects. People who still have concerns are advised to consult their physicians. At airports in the United States, the Transportation Security Administration uses body scanners that rely on millimeter-wave technology for screening passengers. These systems emit very low levels of radiofrequency energy toward the body. The waves pass through clothing, reflect from the skin and concealed objects, and are then captured to generate an image. These scanners do not use X-rays or other high-energy radiation, and the amount of radiofrequency energy involved is far lower than that emitted by a mobile phone. The Food and Drug Administration has stated that no known health effects have been identified from these scanners. Passengers who do not wish to use them are generally allowed to choose an alternative screening procedure.

Mobile phones and cell towers communicate by transmitting and receiving radio waves, and this has led to ongoing questions about whether such

signals may contribute to cancer risk. Researchers generally rely on two major study approaches to investigate these issues. Laboratory-based studies expose animals or cells to physical or chemical agents, including radiofrequency energy, to determine whether harmful biological effects or cancer may result. Although such experiments do not always translate directly to humans, they allow researchers to control variables carefully and investigate mechanisms in detail. Human studies, by contrast, compare cancer rates or health outcomes between exposed and unexposed populations. These studies are often more difficult to interpret because many other factors may influence the results. Taken individually, neither laboratory studies nor studies in humans are usually sufficient to establish whether radiofrequency radiation causes cancer in people. For this reason, scientists generally consider evidence from both types of research together. Most laboratory and animal studies have not provided clear proof that radiofrequency exposure increases cancer risk, although some have reported biological effects that might be relevant to cancer development. Occupational studies involving workers exposed to radiofrequency radiation, such as those working with radar systems, antennas, or radio equipment, have not consistently shown a clear rise in cancer risk. Many studies have specifically examined the relationship between mobile phone use and cancer. While one large study suggested a possible association, most research has not confirmed a definite link. Even so, questions remain regarding the quality of some studies and whether they were capable of detecting subtle long-term effects. Organizations around the world continue to evaluate these risks. The International Agency for Research on Cancer, which operates under the World Health Organization, has concluded that the evidence linking radiofrequency radiation to cancer in humans and animals is limited. On that basis, it classified radiofrequency radiation as "possibly carcinogenic to humans." This judgment was influenced in part by findings related to certain brain tumors in mobile phone users. IARC described the evidence as limited because the available findings are inconsistent and many studies have methodological weaknesses. Other agencies, such as the U.S. Environmental Protection Agency and the National Toxicology Program, have not formally assigned radiofrequency radiation a cancer classification.

In biological systems, the most clearly established effect of radiofrequency exposure is heating, often referred to as the thermal effect. Very high levels of radiofrequency radiation can raise tissue temperature to harmful levels. If concentrated on one part of the body, it may lead to burns or tissue injury, and exposure involving the eyes may contribute to cataract formation. By contrast, non-thermal effects at low exposure levels remain less certain. Accidental exposure to very high levels of radiofrequency energy, such as in radar-related incidents, has resulted in serious injuries. Some people exposed to microwave pulses from radar systems have reported hearing clicking sounds, a phenomenon often known as RF hearing, though it does not appear to produce long-term health consequences. Concerns have also been expressed about fertility problems among workers exposed to low-level microwaves over long periods, but large-scale studies have generally not confirmed such effects. Beyond brain cancer, additional health concerns have been raised regarding mobile phone radiation. These include oxidative stress, altered brain activity, hearing-related effects, reproductive problems, and possible influences on the development of neurons in the brain. Some recent animal studies have suggested that exposure during pregnancy may affect brain regions such as the hippocampus and cerebellum in offspring. For example, research involving pregnant mice exposed to such radiation reported offspring with greater hyperactivity, weaker memory, and delayed brain development. Other researchers have also presented findings suggesting possible links with brain tumors, breast cancer, reproductive effects, and altered neuronal development. Concerns have also been expressed about heavy technology use in children. South Korean researchers have described a condition referred to as "digital dementia," in which excessive use of technology may be associated with underdevelopment of the right side of the brain. Reported features include weaker listening ability, reduced attention span,

limited eye contact, lower empathy, and difficulties in emotional expression. In addition, mobile phone use has been associated in some studies with increased glucose metabolism in the brain. Research from the National Institutes of Health has suggested that elevated glucose activity in certain brain regions may be relevant to neurological disorders such as Alzheimer's disease. A recent investigation of 4G technology further indicated that radiation may influence neural activity not only in brain areas nearest the phone but also in more distant regions, including the opposite hemisphere. Finally, increasing attention is being given to the possible health effects of living near mobile phone towers. In countries such as India, reports have associated residence near such towers with symptoms including sleep problems, diarrhea, vomiting, and other illnesses. These concerns, together with evidence relating wireless radiation to oxidative stress, have intensified debate in this area. Oxidative stress is considered important because it disturbs the normal redox balance within cells and can damage DNA through the production of free radicals and peroxides, processes that may contribute to the development of cancer.

4.8. A particular risk with youngsters

Children face specific dangers

Current wireless safety standards were not specifically developed with children's protection in mind. During pregnancy, placing wireless devices close to the abdomen may be risky because the fetus is particularly sensitive to radiation exposure. This vulnerability does not end after birth, as children continue to be more susceptible to wireless radiation than adults. Their brains are still maturing, their skull bones are thinner and softer, and their bodies contain a higher fluid content, all of which can increase radiation absorption. Since brain development continues until around early adulthood, children may absorb radiation more deeply into brain tissues, with even greater absorption reported in the skull's bone marrow. The periods of greatest sensitivity are considered to be pregnancy, infancy, and early childhood. The International Agency for Research on Cancer, in its 2011 assessment of radiofrequency fields, reported that average radiofrequency energy deposition in some regions of children's brains may be about twice that found in adults, and substantially higher in the skull bone marrow. Similarly, a 2008 France Telecom study found that peak specific absorption rate values in brain models of children aged five to eight were roughly double those observed in adult models. Concerns of this kind have also influenced policy decisions in some countries; for example, Belgium introduced legislation restricting the design, promotion, and sale of mobile phones intended for children aged seven years or younger. In July 2012, the American Academy of Pediatrics wrote to the U.S. Federal Communications Commission, requesting a formal review of radiation standards for mobile phones and other wireless products. The letter noted that the FCC had not reassessed its cell phone radiation limits since 1996 and emphasized that children may be especially affected by environmental exposures, including radiation from wireless devices. The concern extends beyond mobile phones alone, because any device with wireless connectivity can emit microwave radiation when its network functions are active. Such products include cordless DECT phones and their base stations, baby monitors, Wi-Fi routers, laptops, tablets, wireless speakers, internet-enabled music devices, and wearable products such as fitness trackers.

4.9. FCC laws

Currently, at present, FCC exposure regulations for wireless radiation are often criticized as being insufficiently protective against possible long-term developmental effects in humans. Although the FCC continues to classify current radiofrequency exposure levels from mobile phones as safe, some researchers argue that these thresholds may not fully reflect biological risks. In addition, many users do not realize that compliance testing is typically performed with phones held a short distance away from the body, whereas in everyday practice people often place devices directly against the head, lap, or abdomen. For this reason, safer usage habits are frequently recommended, such as

using speaker mode, maintaining some distance from the body, or relying on a headset during calls.

4.10. Phones as a possible risk to health

From the perspective of EHT (Environmental Health Trust), we consider cell phone radiation to be a potential health hazard for the many reasons mentioned above. The biological effects of wireless radiation have been observed in humans in various ways. Therefore, EHT believes that this research should not only be shared with the public, but also that safe ways of using technology devices should be suggested. In our culture, when environmental health risks recently arise, rather than assuming that these devices are completely safe, it is always better, from a precautionary standpoint, to make decisions to avoid the costs that may occur.

4.11. Warning signs and lack of action

The World Health Organization (WHO) has already classified mobile phones as 'possibly carcinogenic'—in the same category as lead, engine exhaust, DDT, and jet fuel. Likewise, press conferences have been held on Capitol Hill regarding this issue, but after presenting the research, no concrete objectives were set to reduce wireless radiation. Informing people about the risks of these devices and how to keep themselves safe is just the first step in the fight. Ultimately, you reach a stage where the government has to intervene and set strict regulations for serious health risks for our current and future generations.

The electromagnetic field (EMF) generated by electronic devices has remained a matter of public concern. Although no study has proven that using these devices causes brain damage, some people report headaches or localized heating when using mobile phones. The purpose of this study was to determine the effects of radiofrequency electromagnetic fields on human electroencephalography (EEG). A single-blind, randomized test was used in this study. Ten healthy individuals were exposed to electromagnetic fields from cordless phones and wireless routers emitting at 900 MHz and 2400 MHz. For each condition, each subject underwent three trials of one hundred seconds each. The subject's EEG was also measured when they wore a measured cap (Farabloc) that blocks any electromagnetic frequencies above a thousand MHz. Cordless phones or wireless routers did not produce any significant changes in the subjects' EEG compared to the baseline. Our findings suggest that daily use of wireless communication devices, such as mobile phones and routers, has little effect on short-term brain electrical activity.

This research focuses on the harmful effects of electromagnetic waves on human life. Here are some screenshots of the website uploaded on the Internet, as shown in Figure 8, and screenshots of the Android-based application and snapshots of its readings are shown in Figures 9 to 11.

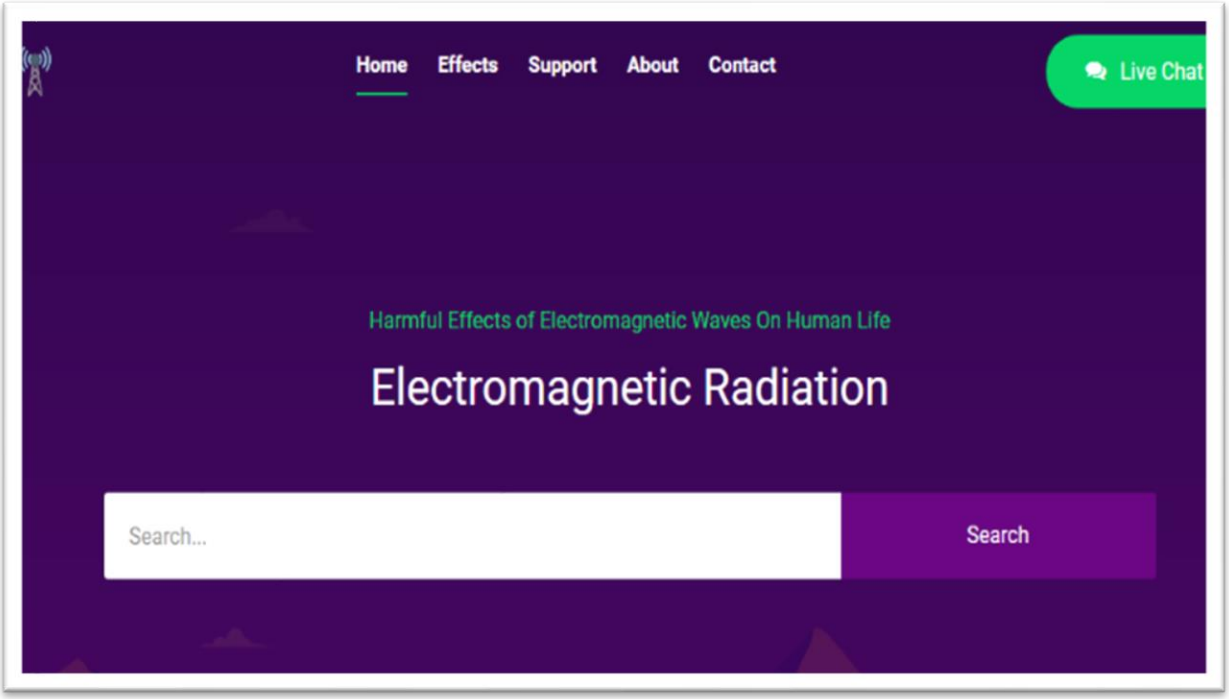

Figure 8 Shows some screen shots of website uploaded on internet

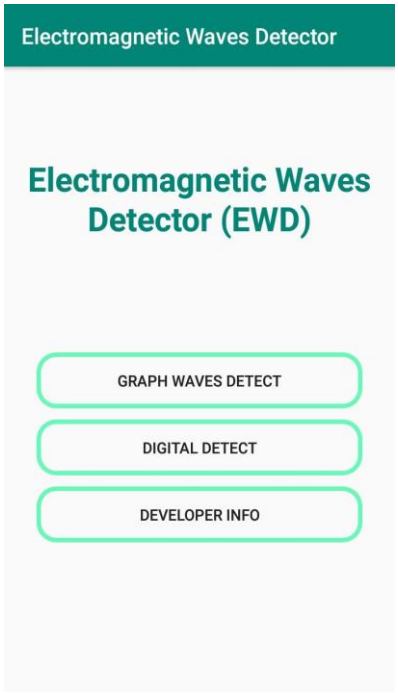

Figure 9 Main menu of Android Application

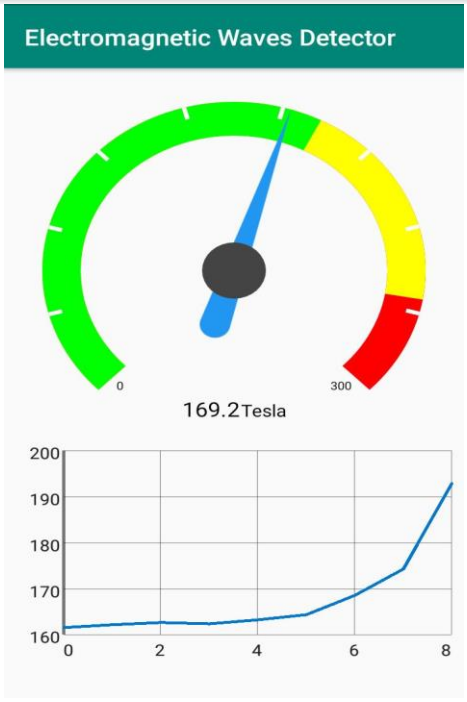

Figure 10 Application showing graphical detection of the metal

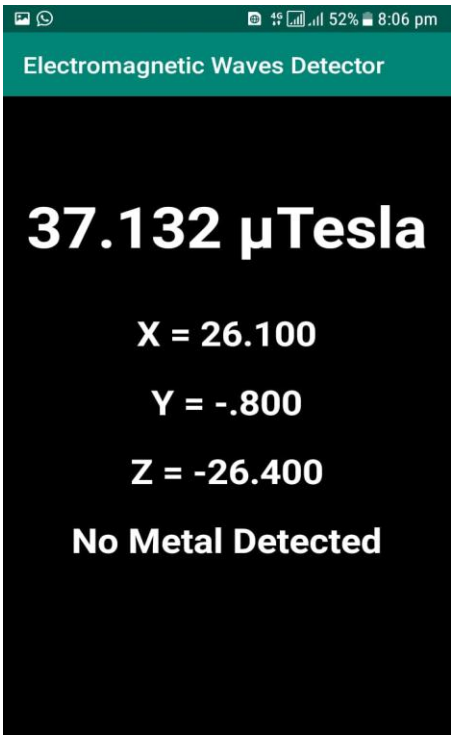

Figure 11 Application showing no metal detection

5. Conclusion

This study examined in detail the harmful effects of electromagnetic waves on human life, particularly the waves generated by commonly used devices such as mobile phones. The findings indicate that although electromagnetic waves are

extremely useful in modern life, excessive and long-term exposure can have negative effects on human health. According to this analysis, exposure to electromagnetic waves can affect various bodily systems, including muscular, reproductive, and cellular systems. According to this analysis, exposure to electromagnetic waves can affect various bodily systems, including the muscular, reproductive, and cellular systems. Observed effects include potential DNA damage, oxidative stress, decreased sperm quality, disturbances in sleep, headaches, and reduced concentration ability. Children and pregnant women may be more vulnerable due to their developing biological sensitivity. The study also emphasizes the importance of awareness and taking careful precautions. The developed Android application can assist users, provide information, and guide on how to use electronic devices safely. Finally, careful assessment is recommended, along with extending long-term research and increasing public awareness about the safe use of technology that emits electromagnetic waves.

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