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EFFECT OF MOBILE PHONES ON HUMAN BODY

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ABSTRACT

The cell phone is one of the greatest inventions created by man. Before, we only used the telephone, now we have the cell phone to use for communication on the go. However, like any other good thing, there is always something negative. There are potential health issues that come from frequent use of a cellular phone. Exposure to electromagnetic radiation is almost inevitable, now that mobile phones are everywhere. Even young children use phones. Some of us even sleep with our phones under our pillows. Despite the fact that there are negative effects on the nervous and reproductive systems, cell phones are still used daily. Yes, it is good that every day, mobile technology is changing. Then again, the exposure also changes, and we do not know whether it is good or bad. Various studies indicate that the emissions from a cell phone can be extremely harmful, causing genetic damage, tumors, memory loss, increased blood pressure and weakening of the immune system. The fact that this radiation is invisible, intangible, and enters and leaves our bodies without our knowledge makes it even more intimidating. Global System for Mobile Communications (GSM) and Code Division Multiple Access (CDMA) are the two most prevalent second generation (2G) mobile communication technologies. This paper discusses on the analysis conducted to study the effect of electromagnetic radiation of two mobile phone technologies with different frequencies and power level via experimental works. The experiment was conducted in a laboratory using 10 human volunteers. The period of operation is 10 minutes as the talking time on the phone. Electroencephalogram is used to monitor and capture the brain signals during the experimental analysis for 10 minutes' interval. The result shows that mobile phone serving GSM has the larger effect on brain compared to mobile phone serving CDMA. The effect of mobile phone radiation on human health is the subject of recent interest and study, as a result of the enormous increase in mobile phone usage throughout the world (as of June 2009, there were more than 4.3 billion users worldwide). Mobile phones use electromagnetic in the microwave range. Other digital wireless systems, such as data communication networks, The WHO have classified mobile phone radiation on the IARC scale into Group 2B - possibly carcinogenic. That means that there "could be some risk" of carcinogenicity, so additional research into the long-term, heavy use of mobile phones needs to be conducted. Some national radiation advisory authorities have recommended measures to minimize exposure to their citizens as a precautionary approach. The rapidly evolving mobile phone technology raised public concern about the possibility of associated adverse health effects. The current body of evidence is summarized addressing epidemiological studies, studies investigating adverse biological effects, other biological effects, basic mechanisms and indirect effects. Currently, the balance of evidence from epidemiological studies suggests that there is no association between mobile phone radiation and cancer. This finding is consistent with experimental results. There is some evidence for biological effects, which, however, are not necessarily hazardous for humans. No basic mechanisms of biological effects have been consistently identified yet.

KEYWORDS

GSM, CDMA, 2G, Electromagnetic Radiation, EEG, Mobile phone, hand-held Cellular telephone, Microwaves, non-ionizing radiation, radiation risk.

INTRODUCTION

A cell phone is basically a type of radio. It is like a two-way walkie-talkie. Unlike the walkie-talkie, in which you either talk or listen, you can talk and listen at the same time. There are also other functions like a three-way call, call holding and voice mail. There are two types of systems for cellular phones: Analog and digital. Older phones are considered analog while newer phones are digital. Cellular phones are cellular because they have a cellular system whenever calls take place. This is to ensure that the call is coming from a valid paying customer.

Safety is a legitimate concern of the users of wireless equipment, particularly, in regard to possible hazards caused by electromagnetic (EM) fields. There has been growing concern about the possible adverse health effects resulting from exposure to radiofrequency radiations (RFR), such as those from mobile communication devices. Mobile communication is where signal is transferred via electromagnetic wave through radio frequency and microwave signals. This signal produces electromagnetic radiation in the form of thermal radiation that consists of harmful ionizing radiation and harmless non-ionizing radiation. When using mobile phone, electromagnetic wave is transferred to the body which causes health problems especially at the place near ear skull region where they are known to affect the neurons.

HOW DO CELL PHONES WORK?

The invention of the mobile phone sprouted from the telephone, invented by Alexander Graham Bell in 1876. Wireless communication, meanwhile, is rooted to Nikolai Tesla's radio in the 1880s. The two inventions were just combined to form what we know as the cell phone.

The cell phone works by transmitting to a base station at one frequency once a person makes a call. The signal then is transmitted to the main telephone network either through cables or radio link with a different frequency. Another base station will send the signal to the mobile phone of the person being called. Both cell phones transmit incoming and outgoing signals with different frequencies so that they won't interfere with each other, unlike the walkie-talkie. The base stations continuously transmit the signals to both phones. Both phones will only transmit the radio waves until one phone cuts off the call.

HOW ARE PEOPLE EXPOSED?

The energy produced by mobile phones is very low. The energy is usually just 0.6 watts; five times lower than that of a flashlight. Whenever a person makes a call, signals are transmitted back and forth to the base station. Obviously, people are exposed to the radio waves from the transmission.

From the cell phone tower antenna, the energy is released horizontally with some downward scatter. This energy decreases the farther it gets from the antenna. This makes the level of exposure to radio waves on the ground lower than the level near the antenna. Exposure to radio waves coming from tower antennas is very unlikely, or at least minimal. The power levels are just too low and the placements of the antennas are high above ground level. Besides, signal transmission is sporadic, instead of constant.

Of course, there are domestic cellular antennas that are mounted on rooftops. It is possible that people with such antennas get higher exposure. However, there are safety guidelines to follow and if the amount of energy released by the antenna goes beyond the limit, access to the area is limited. Between a mobile phone and a base station antenna, the latter produces more radio wave energy, with an amount comparable to a light bulb. Thanks to its position, the public is relatively safe from exposure. The phone signal is not the only exposure the public must be aware of. There is also a potential health risk when cell phones emit electromagnetic energy, which depends on the frequency of the phone. Frequency is the measure of waves of electromagnetic energy that pass in a given period of time. The electromagnetic energy coming from phones is similar to the energy coming from microwave ovens and TV channels. This frequency is called nonionizing. The good thing is, it is not strong enough to damage chemical bonds, tissue or a person's DNA.

THE CELL PHONE PROBLEM

- **ELECTROMAGNETIC RADIATION**

Whenever cell phones are turned on, they emit electromagnetic radiation, even if they are in stand-by mode. Areas of the body near the phone are exposed to harmful radiation. There are several side-effects that come from the exposure:

- Blurry vision
- Rare brain cancers
- Fatigue
- Memory loss
- Headaches
- Nausea
- Neck pain
- Leukemia
- Enzyme changes
- Increased risk for heart conditions
- Birth defects
- Changes in metabolism
- Increased risk for Alzheimer's disease
- Neurological hormone changes linked to impaired brain function

Studies say that people who sleep with cell phones near them have poor REM sleep, resulting in bad memory and difficulty in learning. This is because the radiation from the phone impairs the production of melatonin.

Electromagnetic radiation is emitted from the phone's antenna, circuitry and battery, and it can cause several harmful effects on the body. Studies have shown that microwave energy from phones can penetrate the brain. Scientists say that 70% of people have several changes in brainwaves because of cell phone signals. The U.S. Government has set guidelines for manufactures to follow, but they are not enough. People are still at risk, as more than 2,000 research studies around the world have confirmed.

- **RADIOFREQUENCY (RF) EXPOSURE FROM CELL PHONES**

Radiofrequency produces non-ionizing radiation and makes up the electromagnetic spectrum with x-rays and gamma rays, which are ionizing electromagnetic radiations.

We can find radiofrequency in:

- Telephones, radios, televisions, cell phones
- Industrial processing
- Radar and microwave ovens
- Medical therapies

Cell phones use electric power to create signals to connect with base station towers and other transmission towers. What makes cell phones a unique radiofrequency source is that the transmitter is near the head of the user. There can be health problems from radiofrequency absorption into the head or any other part of the body.

Radiofrequency radiation can cause thermal energy. The human skin cannot easily detect the heat from cell phones. Therefore, users can absorb significant amounts of radiofrequency without being aware of it. High exposure can damage eyes.

Radiofrequency radiation, if low-level in amount, can cause non-thermal effects. Long exposure to low-level radiofrequency can affect the nervous system and other components of the immune system of small animals. For humans, the effect is not that clear. There are studies, however, that show differences in cognitive functions in cell phone users. Changes happen in reaction time and memory. Other health effects include migraines and sleep disorders.

Other researches also suggest that radiofrequency can be a cancer promoter in animals, but there is not enough evidence that radiofrequency can cause cancer in humans. Only a few studies have been done and results have been inconsistent about possible cancer effects of radiofrequency exposure from cell phones.

HEALTH RISKS

- **CANCER**

There have been many studies on cell phones and cancer. However, they yield conflicting results.

Most studies are done to see the relationship between cell phones and brain tumors. Some studies say that there was a slight increase in the rate of brain tumors since the 1970s, but cell phones were not available during the 1970s.

One study concludes that there is no link between cell phones and brain tumors, after following more than 400,000 cell phone users. Another study found a link between cell phones and cancer of salivary glands, but the small number of participants with malignant tumors may contribute to the study's unreliability. There is also a study that shows that there is a possible risk of glioma (a brain tumor) for heavy cell phone users, but it also claims that there is no increased risk of brain tumor in its conclusion.

The International Agency for Research on Cancer, a part of World Health Organization, agreed that there is limited evidence that cell phone radiation is a carcinogenic, after evaluating several researches on the possible link between cell phones and brain tumors. The group, however, classified radiofrequency as possibly carcinogenic.

Still, no one knows whether cell phones are carcinogenic or not. Despite several studies that are still ongoing, there is no convincing evidence that cell phones increase cancer risk. However, it is advisable to limit cell phone use, or at least keep it away from the head.

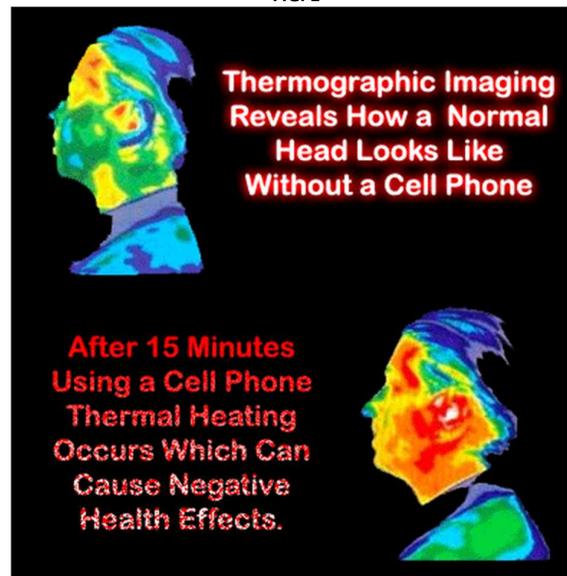
- **EFFECTS ON THE NERVOUS SYSTEM**

A new study shows that cell phone use has an effect on brain activity. Cell phone use can boost the metabolism of brain glucose in specific areas. However, Nora Volkow, a researcher, said that they still do not know whether it is harmful or not. She said that since brain cells use sugar for energy, glucose metabolism is a direct indicator of brain activity. There is about a 7% rise in glucose metabolism in the brain area that is closest to the phone. The increase happens when a phone is used for 50 minutes. Volkow's study also shows that the brain is sensitive to electromagnetic radiation, but she notes that more research is needed.

The study was done with the help of 47 healthy volunteers. They placed cell phones on the ears of the volunteers who underwent PET scans. Volkow and her team measured the metabolism of glucose in the brain. Although there was no difference between the "on" and "off" condition of the phones, they found that there was a 7% increase of metabolism. The most affected areas were the orbitofrontal cortex and temporal pole, which involve memory and other cognitive skills.

There are more studies needed to further explore the effects of cell phone use on the nervous system. However, Volkow said that children must not frequently use cell phones since their skulls are thinner.

FIG. 1



● REPRODUCTIVE HEALTH

The Environmental Working Group found 10 studies that say there are changes in male fertility when men are exposed to cell phone radiation. Men who put their cell phones in their pockets or hang them on their belts have lower sperm counts and/or have less active sperms. Studies link the problem to exposure to cell phone radiation. Findings say that 15% of couples of reproductive age are infertile, half of which are linked to male fertility. The consistency of recent studies increases the possibility that cell phone radiation contributes significantly to reproductive health problems. Studies were done in many ways. Some studies were done by comparing sperm counts and sperm health between men who put their phones in their pockets and those who put phones elsewhere or who did not use phones at all. Men who carry a phone in their hip pocket have 11% fewer active sperm than those who keep their phone elsewhere. All studies show that there is a significant correlation between cell phone radiation and sperm health. They also show that the amount of radiation exposure is directly proportional to the changes.

There are no published studies that talk about the effect of cell phone radiation on reproductive health in women. This kind of study is more difficult to carry out because it requires invasive methods. However, recent articles said that cell phone radiation might be impedimental to the development of a fetus in rats. The Yale University School of Medicine agrees on this finding. University of California-Los Angeles researchers said that cell phone exposure during and after pregnancy has effects on the behavior of the child. Unlike studies on male fertility, more studies are needed to show any link between cell phone radiation exposure and female reproductive health.

● PSYCHOLOGICAL AND SOCIAL EFFECTS

Studies have shown that cell phone use can negatively affect self-esteem. In 2005, a study titled "Cyber Psychology and Behavior" show that younger people who are outgoing but have self-esteem issues are most likely to develop addictive cell phone use behaviors. Cyber-bullying is also linked to low self-esteem.

Cell phone use also affects the diversity of a person's social life. A study by Pew Internet Project and the University of Pennsylvania discovered that 6% of US citizens believe they do not have significant relationships in their lives. The study also found that social networks of cell phone users are 12% larger than those of non-cell phone users.

Cell phone use can also affect a person's behavior toward people who are physically present near him or her. A 2008 article in The Open Communication Journal says that the responsive nature of answering a phone call creates a sense of obligation to the phone itself and it outweighs the sense of obligation to people near the user. Phone use, therefore, lessens the ability of the user to communicate with those around them when he or she is more focused on the phone.

CELL PHONES AND CHILDREN'S HEALTH (CHILDREN'S EXPOSURE IS GREATER THAN ADULTS)

Studies show that children are at greater risk than adults. According to a study in the Electromagnetic Biology and Medicine journal, children absorb more cell phone radiation than adults. It is because children have thinner and small skulls than adults, meaning their bone marrow absorbs ten times more radiation than adults'.

Although this finding does not tell us whether phones are more dangerous for children or not, it does show that we need a higher level of caution with children regarding cell phone use until more studies are done.

In Sweden, a 2008 study from the University Hospital in Orebro shows that children and teenagers are more prone to get brain cancer if they use cell phones. People using cell phones under the age of 20 are five times more likely to get glioma. Lennart Hardell, one of the advocates of the study, believes that children under 12 should not use phones unless it is an emergency and teenagers should limit their use of phones. The risk diminishes as they grow older since the brain becomes fully developed after the age of 20.

WHAT DO EXPERTS SAY?

- According to the National Cancer Institute (NCI), "Studies thus far have not shown a consistent link between cell phone use and cancers of the brain, nerves, or other tissues of the head or neck. More research is needed because cell phone technology and how people use cell phones have been changing rapidly."
- According to World Health Organization (WHO), "What microwave radiation does in most simplistic terms is similar to what happens to food in microwaves, essentially cooking the brain. So in addition to leading to a development of cancer and tumors, there could be a whole host of other effects like cognitive memory function, since the memory temporal lobes are where we hold our cell phones."
- According to Centers for Disease Control and Prevention (CDC), "Studies have shown that when some cellular phones are placed very close to implanted cardiac pacemakers they can interfere with the pacemaker's normal delivery of pulses. For most digital phones and pacemakers now in use, this does not have an effect if the phone is more than about six inches from the implanted pacemaker. Thus using the phone in the normal talking position would not disturb the operation of these pacemakers."
- According to the Federal Communications Commission (FCC), "Even though no scientific evidence currently establishes a definite link between wireless device use and cancer or other illnesses, and even though all cell phones must meet established federal standards for exposure to RF energy, some consumers are skeptical of the science and/or the analysis that underlies the FCC's RF exposure guidelines. Accordingly, some parties recommend taking measures to further reduce exposure to RF energy. The FCC does not endorse the need for these practices, but provides information on some simple steps that you can

take to reduce your exposure to RF energy from cell phones. For example, wireless devices only emit RF energy when you are using them and, the closer the device is to you, the more energy you will absorb."

- According to the Food and Drug Administration (FDA), "The low levels of RF cell phones emit while in use are in the microwave frequency range. They also emit RF at substantially reduced time intervals when in the stand-by mode. Whereas high levels of RF can produce health effects (by heating tissue), exposure to low level RF that does not produce heating effects causes no known adverse health effects."

RESULTS

Finally, here are some ideas that can potentially reduce your risk:

1. **LIMIT YOUR TIME ON THE PHONE:** Reduce cell phone use to only the most necessary calls, and when you do use it, keep your calls short and to the point. Research has shown that a short, two-minute call can alter the natural electrical activity of the brain up to one hour.
2. **TEXT WHEN YOU CAN:** Obviously you don't want to do this when you're driving or while performing any other activity that demands your full attention, but when a text will suffice, send one instead of dialing.
3. **CONSIDER REPLACING YOUR CURRENT PHONE WITH A LOW-RADIATION PHONE:** Whenever you make or receive a call, your phone signal travels via electromagnetic waves, and scientists don't yet know - fully - how much they will affect your health over a period of time. So for now, researchers are suggesting you replace your current model with a lower-emission phone.
4. **USE A HEADSET OR SPEAKER:** Right now, there isn't enough research to determine whether using a speaker or headset, rather than your phone itself, offers better protection. But one thing is known: the electromagnetic waves emitted by your phone are absorbed most often received by the temporal lobe of your brain, during normal usage (phone to your ear), and that part of your brain handles hearing, auditory processing, formation of long-term memory, speech, and vision.
5. **DON'T PUT THE PHONE BY YOUR BODY OR ON YOUR WAIST DURING USE:** Again, it's a device that emits and transmits electromagnetic waves that are absorbed by the soft tissues in your body. One study suggested that men who wear their cell phones near their waste could see their sperm count reduced by as much as one-third.
6. **DELAYED USE:** If you're using your phone without a headset, wait for your call to connect before putting it next to your ear.
7. **AVOID USE IN METAL BOXES:** That may sound funny but using your phone in, say, an elevator or your car, cuts signal strength and forces the phone to use more power to connect.
8. **ABOUT THAT POWER THING:** If your cell signal is down to a few bars, consider waiting to use your phone. Again, it's a power thing: less signal means more power is required for use.
9. **A WORD ABOUT EMFs PROTECT YOURSELF FROM EMFs - ELECTROMAGNETIC FIELDS:** You can do that by purchasing a scientifically validated EMF protection device. Doing so will strengthen your bioenergy field and immune system against the harmful effects of EMFs.
10. **AS ALWAYS, SUPPORT YOUR BODY WITH PROPER NUTRITION:** Think about supplementing your nutritional diet with anti-oxidants such as catalase, glutathione, and Coq10. You can also supplement with melatonin, Zinc and Gingo Biloba.

CONCLUSION

The study concludes that there are potential health issues that come from frequent use of a cellular phone. Exposure to electromagnetic radiation is almost inevitable, now that mobile phones are everywhere. Even young children use phones. Some of us even sleep with our phones under our pillows. Despite the fact that there are negative effects on the nervous and reproductive systems, cell phones are still used daily. Yes, it is good that every day, mobile technology is changing. Then again, the exposure also changes, and we do not know whether it is good or bad. Various studies indicate that the emissions from a cell phone can be extremely harmful, causing genetic damage, tumors, memory loss, increased blood pressure and weakening of the immune system. The fact that this radiation is invisible, intangible, and enters our bodies without our knowledge makes it even more intimidating. Global System for Mobile Communications (GSM) and Code Division Multiple Access (CDMA) are the two most prevalent second generation (2G) mobile communication technologies. This paper discusses on the analysis conducted to study the effect of electromagnetic radiation of two mobile phone technologies with different frequencies and power level via experimental works. The experiment was conducted in a laboratory using 10 human volunteers. The period of operation is 10 minutes as the talking time on the phone. Electroencephalogram is used to monitor and capture the brain signals during the experimental analysis for 10 minutes' interval. The result shows that mobile phone serving GSM has the larger effect on brain compared to mobile phone serving CDMA. The effect of mobile phone radiation on human health is the subject of recent interest and study, as a result of the enormous increase in mobile phone usage throughout the world (as of June 2009, there were more than 4.3 billion users worldwide). Mobile phones use electromagnetic in the microwave range. Other digital wireless systems, such as data communication networks, The WHO have classified mobile phone radiation on the IARC scale into Group 2B - possibly carcinogenic. That means that there "could be some risk" of carcinogenicity, so additional research into the long-term, heavy use of mobile phones needs to be conducted. Some national radiation advisory authorities have recommended measures to minimize exposure to their citizens as a precautionary approach. The rapidly evolving mobile phone technology raised public concern about the possibility of associated adverse health effects. The current body of evidence is summarized addressing epidemiological studies, studies investigating adverse biological effects, other biological effects, basic mechanisms and indirect effects. Currently, the balance of evidence from epidemiological studies suggests that there is no association between mobile phone radiation and cancer. This finding is consistent with experimental results. There is some evidence for biological effects, which, however, are not necessarily hazardous for humans. No basic mechanisms of biological effects have been consistently identified yet.

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