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MOBILE PHONES AND OUR HEALTH?

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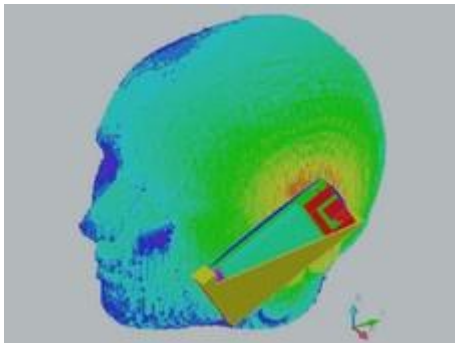
What is the effect of high-frequency electromagnetic (EM) radiation on our health, emitted by mobiles and smartphones that enter our daily lives and where many people communicate even on the roads? A new study in 30 countries shows that users in Turkey check their mobile phone an average of 72 times a day, or that is, every 15 minutes, except for 7-8 hours of sleep time, looking at the screen, we are the first in the world.

In this article, in previous years, we present important sections of our detailed articles on the effects of mobile phones on our health to readers by updating them in light of the developing technology. Mobile phones can negatively affect over time by heating the tissues in the ear area, especially when used frequently and for a long time by gluing them to the ear. We hope they are used much less and without being glued to the ear.

Many years of scientific research on the effects of electromagnetic radiation on the human body. Since cancer occurs over a very long period of 20-30 years, long-term scientific research is needed to compare the effects on the bodies of those who use mobile phones and those who do not. Although there are studies suggesting that high-frequency EM radiation emitted from mobile phones causes headaches, depression and insomnia, these are not conclusive. What is conclusive is the 'thermal effect' related to temperature increase, especially in tissues in the ear area.



Pictured is the temperature rise in the ear area shown in red after talking on a mobile phone for about 15 minutes

It is now a proven scientific fact that high frequency (Radio Frequency /RF/) EM radiation increases their temperature by transferring energy to the tissues it enters. Excessive temperature increase can impair the function of tissues.

Since RF radiation is not in the energy to disconnect molecules from cells and disrupt molecules such as DNA in the cell nucleus, it is not usually expected to show the effect that can cause cancer. However, in special cases, non-thermal negative effects can be expected in large molecules, cell membranes or cell organelles that disrupt their normal function, without creating a significant temperature increase in the tissues. Regarding non-heat effects, the only finding whose scientific reliability has been tested is that EM radiation can disrupt "pacemakers" and similar instruments placed in the body. In addition, some sensitive devices in hospitals and planes can be adversely affected by mobile phones. There are warnings from the[1]WHO's IARC board that if mobile phones/smartphones are glued to the ear and used for a long time, they can lead to[2] cancer. In fact, as a protective measure, IARC has classified mobile phones as substances that are 'likely to cause cancer'. Children in particular are advised to use them much less.

In addition to cell towers, mobiles and smartphones also communicate with Wi Fi (WLAN/Router) devices inside the building. Older mobile phones use GSM standards, while smartphones install much faster communication at much lower energy than[3][4] UMTS (19002200 MHz) [5][6] and LTE [7] (700 – 2600 MHz) standards. Thus, the effect of the EM radiation emitted by these on the body is less as a result of remaining at lower energy than older mobile phones; But it's not that there isn't. In the GSM standard, telephone communication starts to be established at the highest electrical power, and then the phone adjusts itself to lower power. In umts and LTE standards, the opposite is true. Communication begins at the lowest power, then normal power is switched.

Boundary Values and Specific Absption Rate (SAR)

SAR is a measure that shows the amount of energy absorbed in Watts per kg of the body. Sar: (Specific Absorption Rate) limit values are used for specific absorption rate values in the body to protect against EM radiation emitted by Mobile and Smartphones. A scan by the competent authority in Germany found that mobile phones on the market showed values between 0.10 and 1.94 Watts/kg for the head area and between 0.003 and 1.87 Watts/kg for whole body irradiation.

The body of a 70-kilogram person consumes energy equivalent to approximately 80 Watts per second in "sedentary state" (as much energy as an 80 Watt electric light bulb consumes when burning). From here, the body has roughly 80/70=1.2 Watts in power density per kilogram. When we walk, exercise or cycle, our body's energy exchange increases and the power density reaches 3 to 5 Watts per kilogram of our body. If a power density of this level is formed in the body through external Radio Frequency (RF) radiation, it is thought that this can be eliminated through the normal functions of organs and tissues in the body and there will be no damage to the body, and the first limit value is determined as such. Over the past 40 years, experiments and various scientific studies, especially on animals, have shown that some disorders occur in the body as a result of temperature increases exceeding 1 °C in the whole body and tissues for any reason. On the other hand, the power density caused by RF radiation, which leads to a temperature increase of 1 degree for 30 minutes in the body,

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[1] World Health Organization

[2] International Cancer Research Agency

[3] **GSM:** Global system for mobile communication (*Global System for Mobile Communications*) GSM frequency range in the European Union:

[4] -1800 MHz)

[5] **UMTS:** Universal Mobile Communication System (*Universal Mobile Telecommunications System*) Germany frequency range:

[6] -2200 MHz

[7] **LTE:** Long-Term Evolution (*Lbee Term EEvolution*) It is 4G (4. Generation) network, the usual phone socket connections will gradually disappear and 1GBit/second (downstream) speeds can be achieved today, well behind the 16 MBit/second reached by the DSL. German frequency range: 700 - 2600 MHz

is about 4 Watts per kilogram. This value is considered a "base SAR limit value". Taking into account the share of protection (or security), 0.4 Watts/kg, which is one-tenth of this value, is envisaged as the limit value for those working in the relevant professions. One-fifth of this, 0.08 Watts/kg, is recommended by the ICNIRP scientific board as the limit value for the whole body irradiation of any member of the public. This means a temperature increase of one-50th of 1 degree (0.020 °C) in the body. The limit value for the head area of the body is 1.6 Watts/kg (in some countries 2 Watts/ kg, which is a temperature increase of 0.50 °C). Limit values are derived in Volt/m and Watt/m 2 units equivalent to a limit value of 0.08 Watts/kg. These are 41V/m for 900 MHz, 4.5 Watts/m² and 58 V/m and 9.2 Watts/ m 2 for 1800 MHzrespectively.

Derivative limit values for high frequencies between 2 GHz and 300 GHz are 61.4 V/m for electrical field intensity and 10 Watts/m² for power flux (recommendation of the international superintendent, which sets criteria for protection from non-ionizing rays of ICNIRP). According to the relevant regulation published in 2001, the limit values in Turkey are a quarter of the ICNIRP "router limit values" and the electrical field intensity for the 900 MHz frequency is 10 Volts/m. For the frequency of 1800 MHz, the limit value is 14 Volts/m (according to the limit values, the application in Turkey is more protective). All these values, which determine the upper limits of the energy density that RF radiation transfers to the body, are based on experiments on animals in the 1970s and 1980s (especially in mice and monkeys, observing behavioral disorders as a result of tissue warming). In addition, experiments are used in which the energy transferred to this liquid by a mobile phone placed near an artificial head filled with a viscous liquid mixture is measured by electronic sensors at various points in the head (with phantom or modeling).

The model, which is filled with liquid equivalent to human head tissue, shows the experimental mechanism in which temperature increase is examined due to the effect of EM radiation.

Low SAR-Value must be selected when purchasing a mobile or smartphone

The person receiving a low SAR-value phone has already reduced the dose of radiation they will receive somewhat. In Germany, the relevant Radiation Protection Agency (BfS) publishes the SAR values of phones on the market in lists (see www.bfs.de/sar-werte-handy)

Those with SAR values below 0.6 Watts/kg are considered low radiation phones. It was found that 46% of smartphones in the German market were low radiation. The BfS institution rewards mobile phones with a sar value of less than 0.6 Watts/kg, whose structure can cause little **damage** to the

environment when worn out or recycled, with the label **'Blue Angel'.** BfS sets a SAR limit of 2 Watts/kg at a temperature of 2.5 cm to the body and recommends staying below it.

Scientific studies on headphones

The use of mobile phones directly into the ear, using wireless Bluetooth or wired headphones has been compared separately with scientific studies and detailed measurements on "per man models (phantoms)".

The results obtained when using headphones, compared to the adhesion of the mobile directly to the ear:

1. The total effect on the body varies depending on the type of headset, where the phone is carried in the body or away from the body, and the electrical power of the phone. If the mobile phone is far from the body, the effect on the body decreases significantly (5-10 times),
2. The dose (SAR) that wired headphones can generate in the ear area is even less than a fifth of the limit value of 2 Watts/kg for the head area. But in the worst case, the dose in the inner ear can increase,
3. Since the electrical currents generated by em fields around the headphone cable (such as an antenna) can transmit to the ear, the effect on the body decreases when a 'ferit armor bracelet' is passed to the end of the cable, which is quite close to the ear, and parasites are prevented (since the individual substance EM, an alloy with ironoxide ceramic, absorbs radiation and prevents it from transmitting to the ear).
4. The model, which is 1 milliwatt low power from wireless Bluetooth headphones, is capable of broadcasting up to 10 meters away, so it is sufficient for the speaker to communicate with the mobile phone, and the effect on the body is much less than the others. Sar values were well below the limit values in measurements made with Bluetooth headphones,
5. In wired headphones, the part of the cable that connects to the mobile phone should not be wrapped in the mobile phone (so that the electrical current of the antenna inside the mobile phone will consist of the EM area, so that the cable does not transmit to the ear) or on phones with external antennas, the cable should be kept as far away from the antenna as possible. Not gluing the cable to the ear and face will also reduce the effect on the body,
6. When using wired or wireless headphones, instead of carrying the mobile phone by hand or in the front pocket of the pants, the front of the pantophone is facing the body, and in closed places, a nearby table is quite far from the body on the seat
   the presence of it will reduce the effect on the body (since the back of the phone will look at the body, the antenna will affect the wearer more by increasing the power of the phone, since it is close to the back of the phone).
7. If long conversations with the mobile phone (with headphones, without headphones) are frequently required in closed places, the effect on the body will decrease by connecting the phone to an antenna outside the building. Thus, the signal from the base station will reach the phone without weakening as it passes through the thick walls, increasing its power and preventing it from affecting the body more so that the mobile phone can receive the low level of signal.
8. Especially where communication with the base station is problematic, long conversations should not be made in this case, since the mobile phone will automatically increase its power and the effect on the body will also increase.
9. It is better not to use armoring agents for mobile phones (since the effect on the body will increase, as the mobile phone will have to increase its electrical power in order to receive the signal, which will decrease as a result of armoring).

Results for headphones

When using headphones, the effect can only decrease if the phone is quite far from the body (for example, if it is about half a meter away or in our back pocket). When this is not achieved, the effect on the body may increase somewhat, albeit slightly, with EM radiation from two sources.

Although the headphones significantly reduce the effect on the body, it should be considered that the thermal and non-thermal effects may increase in the body as a result of the detection of other EM radiations in the vicinity of both the headset and phone, according to the location. For example, if the phones are used without connecting to the outer antenna of the car, the effect on the body will increase. Therefore, in general, in cars, (also on trains) phones with headphones and hopping phones are used without external antennas, the phone will have to increase its electrical power in order to receive EM radiation that can enter very little as a result of the 'Faraday Cage' armoring of the bodywork, and as a result, the increased power of the phone in the vehicle will affect both the speaker and those in the vehicle as a result of reflections from direct and metal surfaces.

Since the effects of very low levels of EM radiation on the body have not yet been demonstrated despite tens of thousands of scientific studies, they should be spoken as shortly as possible with phones as a protective measure (with wired or wireless headphones) unless it is very necessary, and long conversations should be made from wired landline phones in homes or offices.

Recommended Protective Measures for Mobiles and Smartphones

Although effects such as cancer formation and DNA degradation cannot be scientifically demonstrated today, preventive measures should be taken into account as follows:

1. Mobile phones should be used more for communication (as little and as short talk, long business conversations and interviews should be done by wired phones),

2. Inside the building, he should stand close to the window and talk by taking the phone between us with the window (the effect on us will decrease as the phone's broadcasting or working power will decrease, and electromagnetic radiation will pass through the phone before our head),

3. The places where the signal seen on the phone is highest should be selected (the effect on the person will be small, as the phone will run with less power near the base station). P.S. Most of us don't want a cell tower near where we live. However, if the base station is far from us, our phone will have to work with greater power and will affect us more. The radiation emitted by a cell tower near us has far less impact on us than the phone's, as measured.

4. When connecting to the phone, the phone should be kept a little farther away from the beginning, not glued to the ear when talking, the effect should be reduced by putting our finger in between

5. Keep the phone away from the eyes, chest, (abdomen in pregnant women) and breeding grounds, carrying it in the back pocket or handbag, not in the belt and pants pocket,

6. Especially young children should not buy mobile phones, only brief conversations for communication when necessary, and be taught the harmful effects that may occur,

7. Mobile phones should not be spoken on cars and trains unless it is mandatory (The dose of radiation in the ear area increases when talking, as the phone captures electrical areas formed in the interior of the metal bodywork. Also, if there is no external antenna, the outer surface of the chasm will block EM radiation as a Faraday cage, which will affect us more when communicating by increasing the power of the phone),

8. Those with lower specific absorsion intensity (SAR values) should be selected when purchasing a new mobile phone (see the corresponding website in 'Resources' below)

9. Mobile phones should be used at least 25 cm away from insulin pumps, heart and ear tools, they are already prohibited from being used in hospitals, aircraft (especially on take-offs and landings of aircraft)

10. Mobile phone conversations should not be made very close to babies and young children who may be more affected by EM radiation because their bodies are developing. Pregnant women and children should use them very little

Note: 'In physics, 'Power unit' is 1 Watt, indicating the amount of energy produced or consumed in 1 second (Joule/second).

Hertz : EM is the unit that indicates the frequency of radiation and 1 Hertz is 1 vibration per second. While the frequency of the alternating current we use in homes is 50, the frequency of EM radiation in which mobile phones interact with cell towers, or the number of vibrations per second can be 900, 1800 Mega Hertz (..billion Hertz).

Resources:

1. Publications of the German Radiation Protection Agency (www. bfs.de)

2.Radiation and Our Health? book, Y.Atakan, Nobel Publications 2014
https://www.nobelkitap.com/kitap_113005_radyasyonve-sagligimiz.html

3.Official Newspaper Date: 24.07.2010 Official Newspaper Issue: 27651 Regulation on measures to protect the environment and public health from the negative effects of non-ionizing radiation

4.Information Technology and Communication Institution
http://www.btk.gov.tr/ 5th TUBITAK Science Technical Journal
from March 2010 issue, Atakan,Y.

6. Atakan, Y., "Does mobile phone use form tumors in the brain?" (interphone Research) Cumhuriyet Bilim Teknoloji, 22 January 2010

7.Exposure to high frequency electromagnetic fi elds, biological effects and health consequences (100kHz-300 GHz), ICNIRP 16/2009

8. Sevgi, L., Electromagnetic Pollution, Mobile Phones and Cell Towers, TUBITAK MAM, 2000 - Mobile phones

9.For SAR values according to the brands and types of mobile phones, see: www.bfs.de/sar-werte-handy)and

http://gnrk.gazi.edu.tr/posts/view/title/sar-nedir 3F-10102 Note: The shorter form of this article is in the

12th issue of HBT magazine.

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