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The effect of mobile phone radiation on students

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Abstract

The aim of the study to investigatethe effects of mobile phones radiation on human health. Thestudy has used a questionnairewithin contacton 158students, in college of science, Thi-QarUniversity,Iraqon symptoms which students are exposed during use of mobilephones. There is increased incidence of focusingdifficulties is about (21%), headache (20%), dizziness (13.1%)and sleep disturbances (16.1%). Used significance at $(\alpha = 0.5)$ levels,that thereis no distinguished difference between users whether female ormale for mobile phone is observed atillness frequencies.

Keywords: PhoneRadiation, Radio Frequency(RF), Electromagnetic waves(EMW).

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تأثير أشعة الهاتف النقال على الطلبة

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الخلاصة

الهدف من الدراسة الحالية هو التحقق من التأثيرات الصحية للهاتف النقال على الإنسان ، من خلال عمل استبيان لعينة من مستخدم الهاتف النقال في كلية العلوم حيث تم الاتصال ب(158) من الطلبة في كلية العلوم- جامعة ذي قار . حيث تبين هناك زيادة ملحوظة في بعض العلامات المرضية لدى مستخدمي الهاتف النقال من الإناث والذكور مثل صعوبة التركيز حيث وصلة النسبة المئوية إلى (21%) ،الصداع (20%) ، الدوار (13.1%) و اضطراب النوم .(16.1%) تم اعتماد مستوى الدلالة $(\alpha = 0.5)$ ، في هذه الدراسة توصلنا بعدم وجد فروق كبيرة في طبيعة ونسب الأعراض الصحية بين الذكر و الأنثى من خلال استخدام الهاتف النقال.

الكلمات المفتاحيه : أشعة الهاتف النقال ، الترددات الراديوية ، موجات كهرومغناطيسية

1. Introduction

Electromagnetic radiations, in the system of waves of electric and magnetic energy, have been circulating together through space. The electromagnetic spectrum includes radio waves, microwaves, infrared rays, light rays, ultraviolet rays, X-rays, and gamma rays .The electromagnetic radiations are of two types, one being ionizing radiations such as X-rays and gamma rays, and the other being non-ionizing radiations such as electric and magnetic fields, radio waves, the radio - frequency band which includes microwaves, infrared, ultraviolet, and visible radiation is shown in figure. 1[1].With reference to the handsets, the effect of radiowaves (RF) emitted by the cell phone communication, especially with specific reference to human health, can be categorized as, thermal, non-thermal andgenotoxical. Thermal effect is one whereby theelectromagnetic field of radio waves induces polarmolecules that generates dielectric heat letting thelive tissues die. For instance some part of head, while receiving the message through radio waves ifit happens to experience increased temperature canhave damaged nerve fibers. Next to the thermaleffect is non-thermal effect, in which keeping thetemperature generated by radio waves constant (only the electric current) passes through the cell membrane, while transiting messagesand finally the genotoxical effect, which includes damage to chromosomes, alterations in the activity of certain genes and a boosted rate of cell division [2]

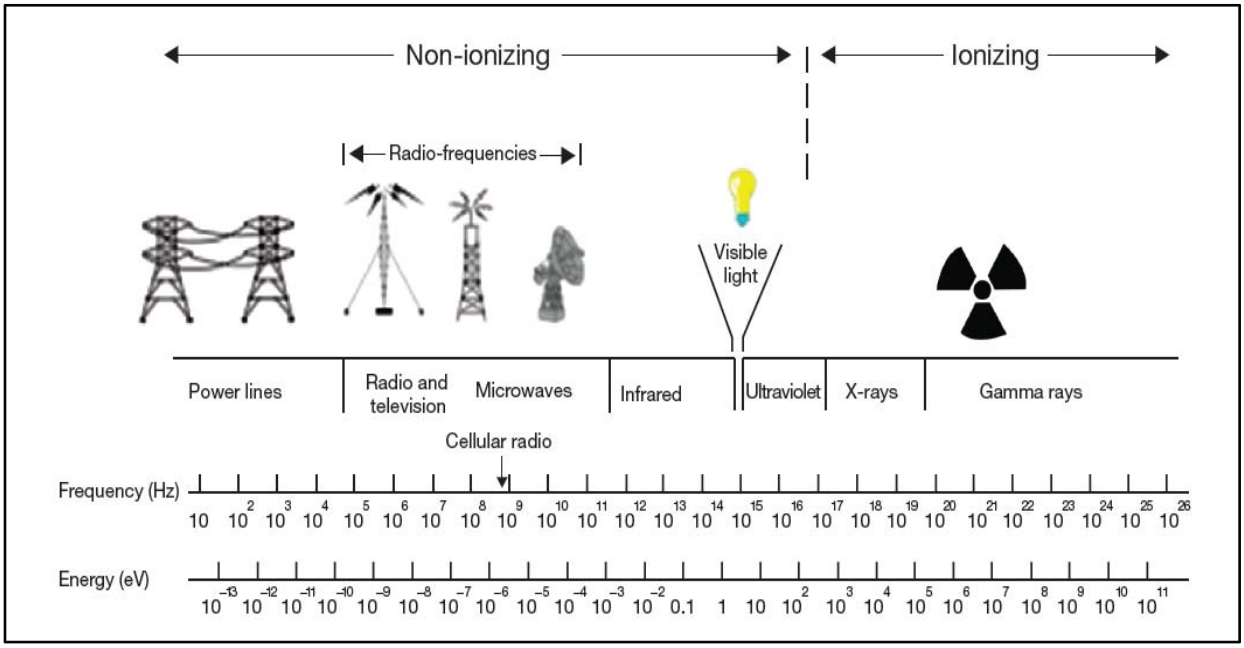

Figure 1. Electromagnetic spectrum [1]

The energyis carried by the electromagnetic waves which consist of both fields. Consider a plane electromagnetic wave passing through a small volume element of area Aand thickness dx, as shown in Figure.2.[3]

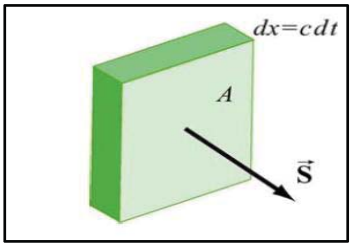

Figure 2. Electromagnetic wave passing through a volume element

The total energy in the volume element is given by[3]:-

$$d\,7 = Q\#@T = :Q + Q_{\$}\ ;\#@T = \frac{1}{2}\ F_{K}^{2} + \frac{\$}{K}\ G\#@T \qquad (1)$$

where

$$Q = \frac{1}{2}\ _{K}^{2}, \qquad Q_{\$} = \frac{\$}{2\ K} \qquad (2)$$

Q, $Q_{\$}$are the energy densities associated with the electric and magnetic fieldsrespectively.Since the electromagnetic wave propagates with the speed of light *c,* the amount of time it takes for the wave to move through the volume element is $dt = dx / c$. Thus, one may obtain the rate of change of energy per unit area, as.[4]

$$5 = \frac{@7}{\#@P} = \frac{?}{2}\ F_{K}^{2} + \frac{\$}{K}\ G \qquad (3)$$

where$S$ is measured by W/m^2,where $' = ?\$$and $? = 1/\ \sqrt{\ _{K}\ _{K}}$ the above expression, can be rewritten as

$$5 = \frac{?}{2}\ F_{K}^{2} + \frac{\$}{K}\ G = \frac{?\$}{K} = \ ?_{K}^{2} = \frac{'\$}{K} \qquad (4)$$

In general, the rate of the energy flow per unit area may be described by the Poynting vector **S**, which is defined as[4]

$$S = \frac{1}{\ J}\ \& \qquad (5)$$

where$\vec{\mathbf{S}}$Poyntingis in the direction of propagation. Since the fields$\vec{\mathbf{E}}$ and $\vec{\mathbf{B}}$are

Perpendicular, we may readily verify that the magnitude of $\vec{\mathbf{S}}$is

$$\left|\vec{\mathbf{S}}\right| = \frac{\left|\vec{\mathbf{E}} \times \vec{\mathbf{B}}\right|}{\mu_o} = \frac{EB}{\mu_o} = S \quad (6)$$

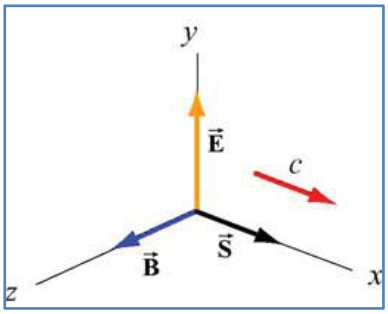

Figure3. Poynting vector for a plane wave [4]

As expected, $\vec{\mathbf{S}}$Points are in the direction of wave propagation, one can seefigure. 3. The intensity of the wave, ***I***, is defined as the time average of *S*, that :

$$I = \langle S \rangle = \frac{E_o B_o}{\mu_o} \langle \cos^2(kx - \omega t) \rangle = \frac{E_o B_o}{2\mu_o} = \frac{E_o^2}{2c\mu_o} = \frac{2B_o^2}{\mu_o} \quad (7)$$

where ,it has been used,

$$\langle \cos^2(kx - \omega t) \rangle = \frac{1}{2} \quad (8)$$

To relate intensity to the energy density, we first note the equality between the electric and the magnetic energy densities:

$$u_B = \frac{B^2}{2\mu_o} = \frac{\left(E/c\right)^2}{2\mu_o} = \frac{E^2}{2c^2\mu_0} = \frac{\varepsilon_o E^o}{2} = \quad (9)$$

The average total energy density then becomes:-

$$\langle u \rangle = \langle u_E + u_B \rangle = \varepsilon_o \langle E^2 \rangle = \frac{\mu_o}{2} E_o^2 \quad (10)$$

$$= \frac{1}{\mu_o} \langle B^2 \rangle = \frac{B^2}{2\mu_o}$$

Thus, the intensity is related to the average energy density by.[5]

$$I = \langle S \rangle = c\langle u \rangle (11)$$

It is so well confirmed that electromagnetic radiation can only be absorbed in quanta of energy hf. Now the energy is needed to take one electron away from (ionized) anatom or molecule is a few electron volts (eV).So if the quantum of energy is less than about (1 eV), it is essentially impossible for ionization to occur. The quantum of energy of RF radiation is in fact many thousand times less than 1 eV so RF radiation cannot ionize atoms or molecules and is described as non-ionizing radiation (NIR). The focus here is on radio frequency (RF) waves, the energy of which is far below the 10 eV threshold radiations(3.5×10^{-6}eV). Radio waves pass through most matter, including living tissue, with very little being absorbed. Therefore, is with the very small fraction of incident radio wavesabsorbed in living tissue. The RF energy absorbed in tissue is converted into heat, that is, it may raise thetemperature of that tissue. Themicrowave oven is a good example of the use of intense RF energy to increase the temperature and cook aroast[6].

2.Materials and Methods

In this study, a questionnaire is given to the users of mobile phone,which aimsat determining the influence of mobile phone use on nonspecific health symptoms, including headache, dizziness, focusing difficulties, and heat around the ear. I present a study involving 158 students, fromcollege of science Thi-QarUniversity, these students are divided into
(66 males and 92 females).The questionnaire openlyis stated the confidence of the respondents withoutmention of names or conducting information. The subjectsbelonging to college ofscience are contactedpersonally and besides explained the rules of the study.

3.Statistical analysis

Data have been collected, tabulated and statistically analyzedusing chi-square (χ^2) at $(\alpha = 0.05)$ level of significance.Use the chi-squaretest for independence to determine whether there is a significant relationship between two categorical variables.The term ‘chi square’ (pronouncedwith a hard ‘ch’) is used because the Greek letter χ is used todefine this distribution.[7]

4.Results and Discussion

The table.1 shows the mobile users are affected by mobile radiation and they aresuffered from variousillnesses(focusing difficulties, headache, loss of memory, sleep disturbances, earache,fatigue,discomfort, dizziness). An increased incidence offocusing difficulties, headache, sleep disturbances anddizzinessare given rise to the effectsofthe electromagnetic absorption.These symptoms are occurred as a result of exposure to mobile phone radio radiation where it has used for long durationof time near the head where studies have shown that these non-thermal rays ,it is worth to note that our results are in agreement with those obtained by.Bhargavi et al(2013).

Table1. Percentages of complaints frequency for studying symptoms.

Symptomsand diseases	**Age bracket 18-23 (158)**		**Overall**
	Male (66) 42%	**Female (92) 58%**	**Subscriber 158 100%**
No effect	16 15.3%	15 8.8%	31 11.3%
Focusing difficulties	17 16.3%	41 24.2%	58 21.2%
Headache	21 20%	35 20%	56 20.5%
Loss of memory	11 10.5%	22 13%	33 12%
Sleep disturbances	18 17.3%	26 15.3%	44 16.1%
Earache	3 2.8%	4 1.1%	7 2.5%
Fatigue	2 1.9%	2 1.1%	4 1.4%
Discomfort	1 0.96%	3 1.7%	4 1.4%
Dizziness	15 14.4%	21 12.4%	36 13.1%
Reject total	104	169	273

Figure (4)Shows the subscriber (Female) versus diseases diagram of different level of users in percentage, as a figure(5) shows the subscriber (Male) versus diseases, theseoutcomesare agreed with described by Al-Garawi et al (2012) who found that the frequency of headache, loss of memory,dizziness, concentration difficulties and sleep disturbance were significantly higher among exposed.

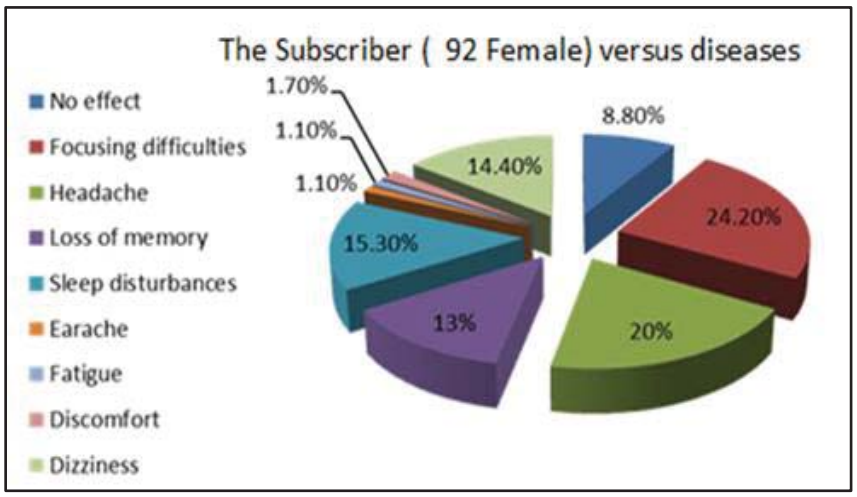

Figure4. Subscriber (92 Female) versus diseases

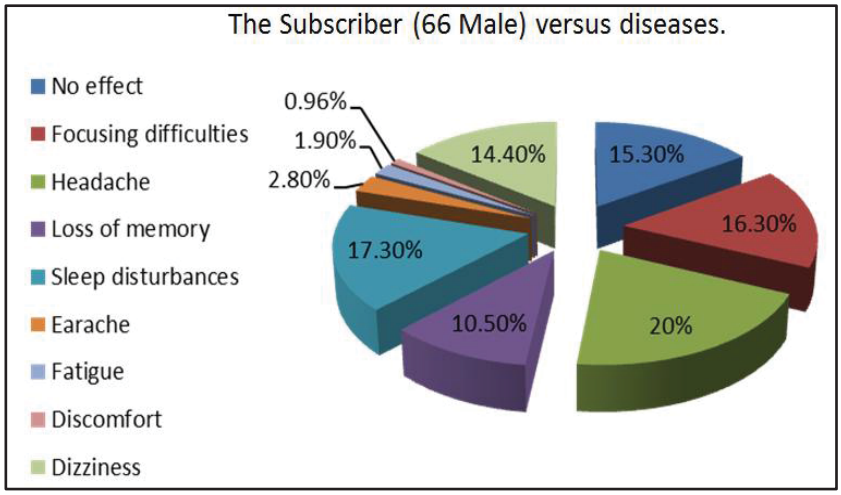

Figure 5. Subscriber (66 Male) versus diseases.

Figure. 6 shows increased percentage for Symptoms and diseases (headache,
Sleep disturbances, loss of memory) the overall health effect of subscriber and outcomes have been agreeing with those obtained byUddin and Ferdous(2010).

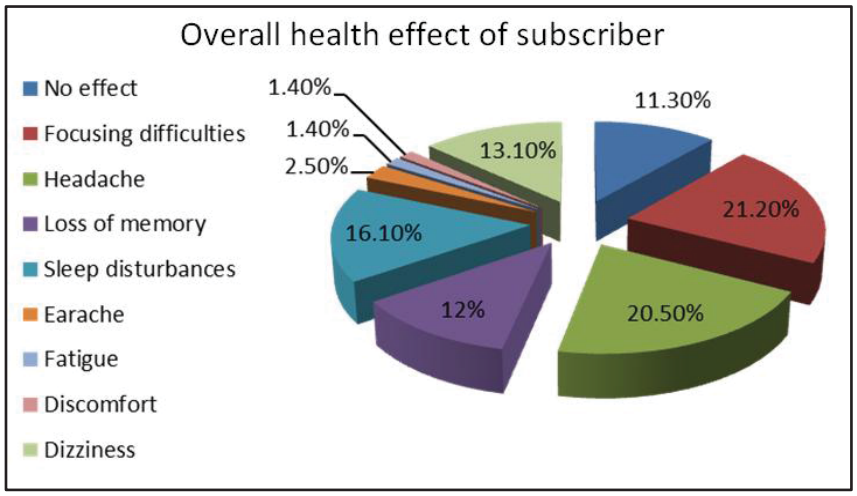

Figure6.Overall health effect of subscribe

The table 2.is indicated no significant difference between users (Female) and (Male) of mobile phone was observed at complaint frequencies even when we observed, as in the studySantini et al(2002). Figure. 7 represents that the influence of the mobilephone radiation on sex of student. My findings show that there is not effected on the sex via using Chi-square tests. In the table. 3 we observed a significant increase effect of mobile phone radiation in users when use duration per day was > 60 minthis result is in agreement with those obtained bySantini et al(2002), the figure. 8 will be seen to confirm this result.

Table2. Chi-square tests for sex differences. [7-11]

Sex	**No effect**	**Effect**	**Chi-square(χ^2)**
Male	16	50	0.94
Female	15	77	

Significant at 0.05 levels.

Table 3. Chi-square tests for using duration. [7-11]

Frequency symptoms and diseases	**Using duration < 30 min**	**Using duration <60min**	**Using duration <120 min**	**Chi-square(χ^2)**
Effect	**14**	**74**	**30**	**8.99**
No effect	**14**	**15**	**2**	

Significant at 0.05 levels.

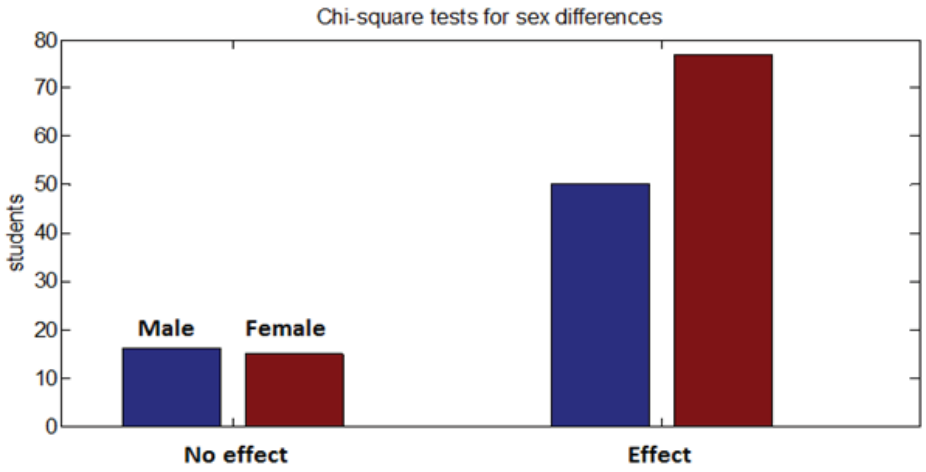

Figure7. Showsthe correlation between student sex and the effect of mobile phone radiation via Chi-square tests.

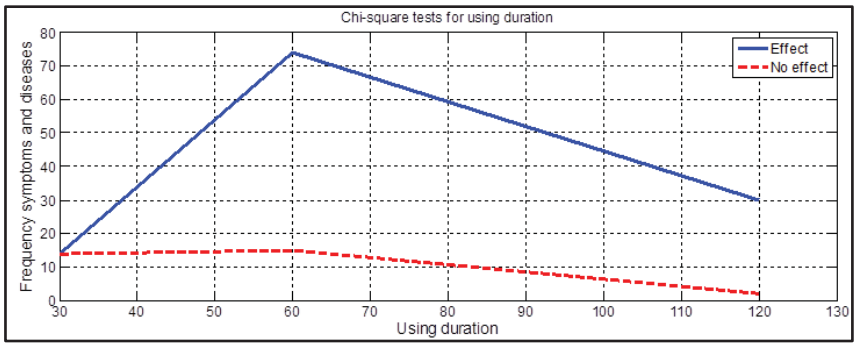

Figure8.Using duration Vs frequency symptoms diseases via Chi-square tests

To find the Symptoms and diseases of common to students ,wehavecompared to the present study with thestudy of (uddin and ferdes) (2010),figure.9illustratedthat. Where we observed some symptoms which share of high percentages like(Headache, Loss of memory ,Sleep disturbances and Earache) although the difference of numbers students in both studies.This confirms the effect of a mobile phone radio waves of students.

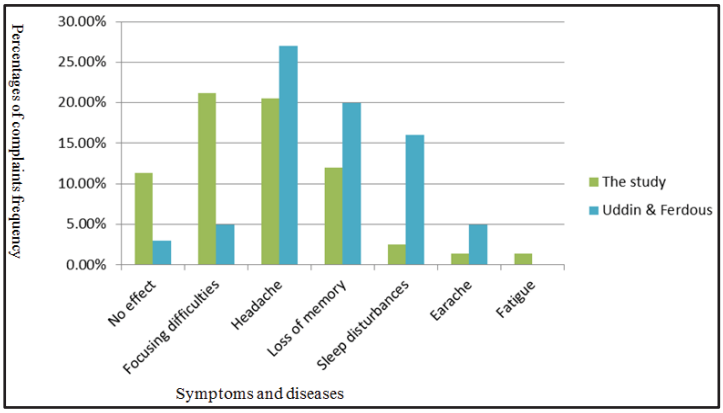

Figure .9 Showscomparethe present study with Uddin&Ferdous study.

5. Conclusions

The present study is shown that there are symptoms and diseases due to the bad using of mobile phone, where it is close to the head so radio fraquncy (mobile phone radiation) effect on the human brain during communication, the highest value is (21.2%) at focusing difficulties. This result agrees with earlier studieswhich it is studied samples of students in different environments. So the researchers are concerned about increasing from Radio frequencies of space because it creates health symptoms. We have to work hard to cut the risk of mobile phone radiation. Therefore the colleges and the university must take their role in guiding the studentsand for this the Government should take necessary steps for establish laws that limit radio frequency propagation at random

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