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To cite this article: Karar H. Hussein *et al* 2021 *J. Phys.: Conf. Ser.* **1804** 012001

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Evaluation of Health Hazards Due to The Wi-Fi Router On Humans

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Abstract. The purpose of this study is to investigate the negative effects of Wi-Fi routers in houses on human health. As these devices have become an essential part of daily life, they are widely used for communications and the Internet. No house can do without it. The radiation emitted from these routers causes many symptoms, such as heart diseases, sleep disorders, brain tumors, ear hearing problems, male infertility, etc. This study looked at 15 different symptoms that may be caused by the emitted radiation by the routers. A questionnaire was distributed for a large number of medical doctors working in five major hospitals in the city of Najaf, and another for individuals who have routers in their house and who do not. The results showed that Wi-Fi routers have an effect on human health that does not exceed 30%. Individuals with routers have more symptoms than people without Wi-Fi routers. While females are more affected by routers than others.

Keyword: Wi-Fi router, health risk, human health, Najaf, Iraq...

1. Introduction

Wireless technology was invented in 1880 by Alexander Graham Bell and Sumner Tainted at the same time as the invention of the photo phone [1]. Nowadays, your life has become easier with Wi-Fi. Although you are not tethered to a large computer that is physically connected to the Internet, Wi-Fi enables you to connect to the Internet from a coffee shop or your living room comfortably, but this luxury comes at a price.

People use many types of wireless devices to communicate. The wireless network and mobile phone are an essential part of daily life all over the world. Wi-Fi device exchanges data by sending and receiving it wirelessly using radio waves. There are many devices that use Wi-Fi technology, including tablet pc, cell phone, audio player, PC and digital camera, wireless router, Bluetooth device, laptop connected with the wireless router. The wireless devices are based IEEE standard 802.11[2].

Radiation is the energy that is emitted by unstable (excited) atoms or the motion of molecules, and radiation is the wave characteristic of a particle. The transmission or spread of radiation in space is in the form of particles, waves, or rays. The radiations can be mainly classified into non-ionizing radiation



and ionizing radiation. Non-ionizing radiations transmits directly (send or receive) electromagnetic energy, sound energy, or thermal energy without breaking the chemical bond [3]. While ionizing radiations are high-energy electromagnetic waves that can easily remove or eject electrons from molecules and atoms, and cause damage to living cells due to the formation of free radicals, in addition to this, these radiations increase the risk of many diseases [4]. According to medical laboratory experiments, exposure to small doses of ionizing radiations does not have great harm, but high and large doses of ionizing radiations can cause radiological diseases, cancers, etc. The cell's genetic material (DNA) is very sensitive to ionizing radiations and can change when exposed to these radiations [5].

Although the mobile phone is an increasingly common source of exposure to radio frequencies (RF-EMF). However, there are many other sources that emit this type of radiation that the general public has been exposed to for many years. There are common sources that cause people to be exposed to radio frequencies, including (wireless Internet routers (Wi-Fi), Microwave ovens, smart meters, cordless phones, and AM radio, television antennas, and FM radio). A number of other electronic devices also emit electromagnetic waves at different frequencies and power levels, such as (remote control toys and baby monitors) [6]. in general, the maximum radiated power (ERP) of Routers used for wireless networks is below 100 mW, but their effective radiated power up to 4W [7]. In practice, there are many factors effect on the radiated power level and reduced it, such as level of network use and the type of router [8].

Wireless routers “as well as Bluetooth and similar wireless systems” emits the electromagnetic radiation in the low-gigahertz frequency. This level of frequencies can be most likely dangerous to humans. There are a number of factors that exacerbate this risk exactly the same as the wireless signal, including a (The ability of electromagnetic waves to pass through walls, the largest number of routers operate at night and are not turned off, so people are exposed 24/7, Your exposure to electromagnetic waves is not caused solely by your own router). Certainly, you previously searched for a Wi-Fi signal and not only found your network, but also found many other networks, such as your neighbor's network, your business partner, etc. All of these networks emit EMFs. Researchers and scientists are increasingly arriving at health risks from exposure to electromagnetic fields, as these risks depend on the level and length of exposure. These risks can vary from headache and insomnia to tumors [9].

2. General effects of Wi-Fi

Many organizations “such as the Council of Europe, the European Environment Agency, UK Trades Union Congress, the International Commission for Electromagnetic Safety, and the Russian Commission for Electromagnetic Safety” have provided severe warnings about all technologies and devices that emit radiation identical to those of Wi-Fi networks, Because of the use of Wi-Fi networks, dangerous radiation when transmitting their signals through the walls [10-12]. The World Health Organization and the National Toxicology Program have both concluded that Wi-Fi radiation greatly increases the risk of glioma [10, 13]. They classified the radio frequency as a possible carcinogen discovered that the radiation can significantly increase the chance of glioma, a lethal brain tumor. They have labeled radio frequency as a possible carcinogen [13]. According to the recommendations of the above organizations, their reports and other sources [14], the general effects of Wi-Fi can be summarized as follows:

Cardiac: The vital functions of the cardiac system are to maintain homeostasis in all living parts in the body, and that the failure of any organ in this system leads to severe consequences and may even lead to death. The complications from continuous exposure to Wi-Fi are palpitations, cardiac arrhythmias and shortness of breath and hypertension [15].

Neurological: The nervous system includes cells and nerves that come together to form a complex network that transmits messages and signals between the brain and various parts of the body through the spinal cord, this system includes the peripheral nervous system “somatic and the autonomic nervous systems” and central nervous system “brain and spinal cord”. Exposure to Wi-Fi signals for long periods of time can lead to depression, dizziness, fatigue, headaches, insomnia, memory concentration difficulties, muscle and joint pains, nausea, etc. [16].

In addition to the aforementioned, the passive effects of Wi-Fi can appear on other parts of the human body, causing many anomalies such as (asthma, cataracts, deteriorating vision, genetic effects including reproductive health issues, hearing impairment, pain and discomfort, ringing in the ear, skin problems and various cancer) [17].

3. Survey and Methodology

This study depends on theoretical approach, questionnaires and survey to collect results. A questionnaire was designed for medical doctors in five major hospitals in the Najaf city, which are each of Al-Hakeem, Al-Zahraa, al-Saggad, Al-Sadder and Al-Manathera hospitals. The questionnaire included twenty questions that give direct and sufficient information about the Wi-Fi routers and its potential impact on human health and cause various diseases. The questionnaire was distributed to 296 medical doctors with different specialties. Each medical doctor gave his own ideas and opinions on the effects of Wi-Fi routers on human health based on their observations on the patients who were treated. Another questionnaire was designed for individuals living in the city of Najaf who were divided into two groups.

Group I: included city residents who live in the city center and who have Wi-Fi routers in their houses. 100 houses were selected with a total of 516 populations (220 males, 185 females, 111 children). The house was not chosen randomly, but the following conditions were observed: The house contains at least one Wi-Fi router, the absence of a microwave oven in the house, in order to exclude the effect of this oven on the dwellers due to the similarity of the microwave oven frequency range with the frequencies of Wi-Fi routers (see Table 1), similar, which cannot be distinguished from these two sources of exposure [6]. Finally, houses should be located at a distance from the cell-phone towers, in order to exclude the major impact of these towers on the health of the dwellers [18].

Table 1. Environmental and local exposure due to certain sources with different frequencies and powers [6].

Source	Frequency MHz	Power	Type of Exposure Measurements	Exposure
Cell-Phone [19]	824-849 1710-1755 1850-1915 2500-2690	0.1-2 W	Maximum SAR at the ear	0.5-1.5 W/kg
Microwave Ovens [20]	2450	500-1500 W	Maximum	< 50 W/m ²
Wireless Internet Routers [21]	2400-2500 5150-5850	100 mW	Ambient Average	18x10 ⁻⁶ W/m ²

Group II: included residents of the countryside and agricultural areas, who lived in the outskirts of the city and did not have any Wi-Fi routers or microwave ovens, and barely received cell-phone tower signals. 88 homes were selected and occupied by 485 individuals, with 186 males, 206 females and 93 children.

4. Results and Discussions

The results of the analysis of the questionnaires that included 296 doctors showed that 98% (291 person) of medical doctors have agreed that wireless devices have a direct and clear impact on human health, through the many cases that were treated by them in hospitals. While 2% (5 person) of them did not agree that wireless devices have an effect on human health (as shown in Figure 1). This is compatible with what some studies have indicated [22].

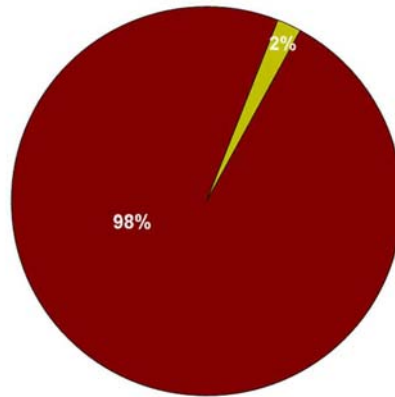


Figure 1. Percentage of medical doctor who agree and disagree with the effect of wireless devices on human health.

The results of the questionnaire also showed a difference in the opinions of medical doctors when answering a question, how much percentage of the Wi-Fi router affects human health in addition to other wireless devices. Table 2 shows the distribution of medical doctors' numbers according to the chosen percentages.

Table 2. Number of medical doctors according to the chosen percentages.

Percentage	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
Other Wi-Fi devices*	0	1	6	33	25	43	142	23	11	7
Routers	20	63	102	52	23	12	10	5	3	1

*It includes different wireless devices (tablet pc, Cell phone tower, Mobile phone, Bluetooth device, audio player, ...etc.)

More than 57% of the medical doctors agreed that the percentage of the impact of Wi-Fi routers on human health ranges from 20% to 30%, while 63% of them agreed that other wireless devices affected human health by 60% to 70% (as shown in Figure 2).

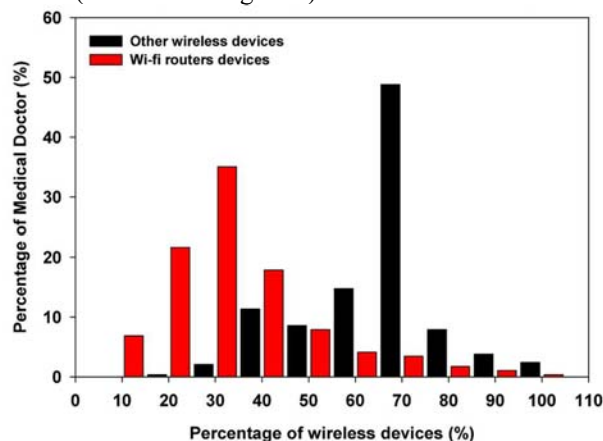


Figure 2. The percentages of medical doctors correspond to the percentages of health effect of routers and other wireless devices.

For the purpose of identifying the health risks of Wi-Fi routers on human health, the questionnaires for people were divided into two groups, the first for city residents who own Wi-Fi routers in their homes, and the second group for rural residents and city parties who do not have any Wi-Fi devices. The percentages of people suffering from possible symptoms as a result of radiation emission from Wi-Fi routers have been calculated, as Table 3 represents a comparison between the percentages of people divided by gender and by region of residence.

Fifteen of the common symptoms that could be caused by using Wi-Fi routers have been chosen, as the results listed in Table 3 show in general that people who have Wi-Fi routers in their homes or live in a house that has a router have different symptoms with higher percentages than those who do not. They have routers. Figures 3, 4 and 5 show a comparison of the percentages of those with symptoms for the rural and city population, and for both males, females and children, respectively.

Table 3. The percentages of people with possible symptoms.

	Male		Female		Kids	
	City	Rural	City	Rural	City	Rural
Brain tumors	6	0	5	0	3	1
Difficulty in concentration	4	0	5	0	2	0
Dizziness	3	1	4	1	1	0
Ear hearing problems	6	0	7	0	2	0
Effect on fetus	2	0	3	0	0	0
Fatigue	4	0	5	0	0	0
Feeling of discomfort	3	1	4	1	4	1
Headaches	3	0	4	1	3	0
Heart diseases	5	0	4	2	4	1
Male infertility	7	1	0	0	0	0
Memory loss	4	0	3	0	1	0
Muscle pain	4	0	4	0	2	1
Parkinson's disease	2	1	1	0	0	0
Sleep disorders	5	0	6	1	3	0
Vision problems	4	0	5	0	1	0

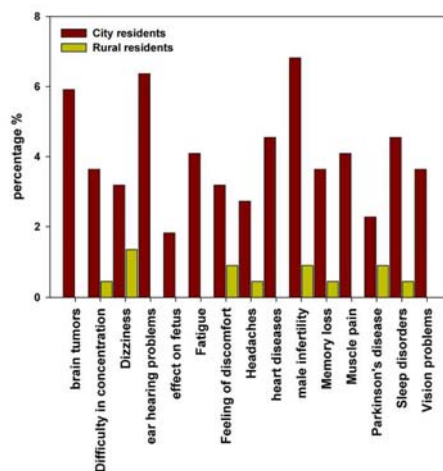


Figure 3. Comparison between the percentages of male resident in the city and rural areas

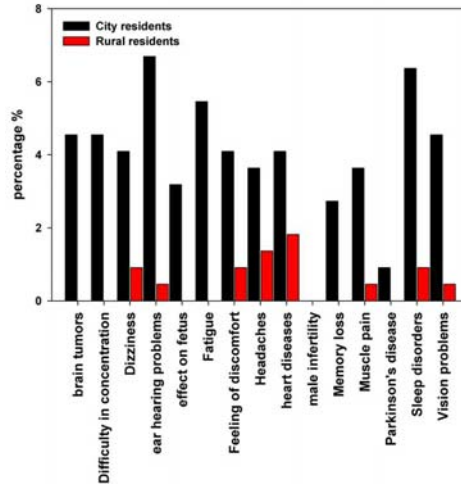


Figure 4. Comparison between the percentages of female resident in the city and rural areas

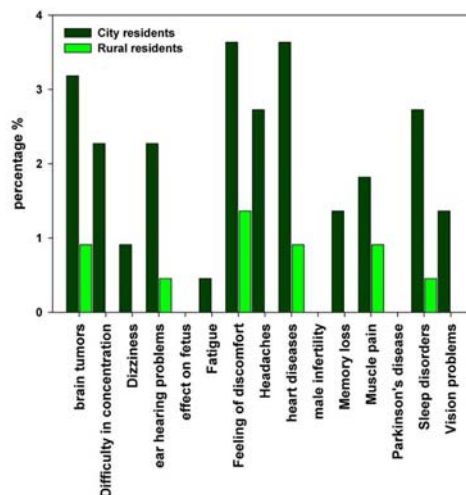


Figure 5. Comparison between the percentages of Kids resident in the city and rural areas

For people who have Wi-Fi routers, the results showed that (2% - 4%) of males suffer from (Effect on fetus, Parkinson's disease, Dizziness, Feeling of discomfort, Headaches, Difficulty in concentration, Fatigue, Memory loss, Muscle pain, Vision problems) while (5% - 7%) of them suffer from (Heart diseases, Sleep disorders, Brain tumors, Ear hearing problems, Male infertility), while for the females, (1% - 4%) of them suffer from (Parkinson's disease, Effect on fetus, Memory loss, Dizziness, Feeling of discomfort, Headaches, Heart diseases, Muscle pain) while (5% - 7%) suffer from (Brain tumors, Difficulty in concentration, Fatigue, Vision problems, Sleep disorders, Ear hearing problems) and children suffer from (Dizziness, Memory loss, Vision problems, Difficulty in concentration, Ear hearing problems, Muscle pain, Brain tumors, Headaches, Sleep disorders, Feeling of discomfort, Heart diseases) with a percentage ranging from 1% to 4%. It has been clearly observed that most of these symptoms disappear in the rural population, and this is mainly due to the absence of Wi-Fi devices in their houses.

It can also be seen that females have higher percentages in nine of the symptoms (Difficulty in concentration, Dizziness, Ear hearing problems, Effect on fetus, Fatigue, feeling of discomfort, Headaches, Sleep disorders, Vision problems) compared to males and Kids, as shown in Figure 6. This increase in percentages in females may be due to the long time that females spend in houses, which makes them exposed to the largest amount of exposure dose compared to others.

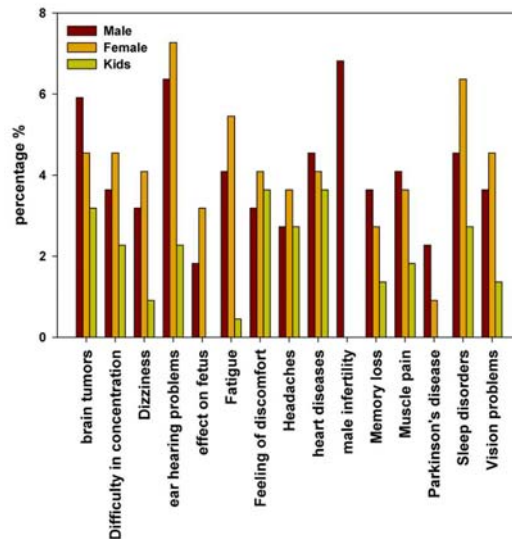


Figure 6. Comparison between the percentages of Male, Female and Kids who have Wi-Fi routers in their houses.

5. Conclusion

The study concludes from the questionnaires that Wi-Fi routers have a negative health effect on humans. And the impact of these routers does not exceed 30%. Also, most of the symptoms that appeared in people who have Wi-Fi routers, have disappeared in people without routers. The females were more affected by radiation emitted by Wi-Fi routers than others, and they recorded higher percentages in many symptoms. Also, children were greatly affected by the presence of routers in the houses.

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