

## **SOME NEUROLOGICAL SYMPTOMS EXPERIENCED BY USERS OF MOBILE PHONES: A SURVEY STUDY**

**Nermin KÜÇER<sup>1\*</sup>**

<sup>1</sup>Department of Physics, Faculty of Sciences and Arts, Celal Bayar University 45140 Muradiye-  
Manisa, Turkey

**Abstract:** In the last twenty years, it has been discussed frequently whether there are any harmful effects of the radiofrequency electromagnetic fields on human health. Among radiofrequency emitting devices, there is a great importance of mobile (cellular) phones. The aim of this study is to determine the possible neurological symptoms experienced by users of mobile phones. This survey study was conducted, using a questionnaire, in randomly selected 229 students at the Vocational School of Kocaeli Health Services. Chi-square test with Yates correction was used for comparisons of complaint frequencies in relation with sex and time of mobile phone possessions. As a result of the survey, the study has shown that users of mobile phones more often complained of extreme irritation, headache and dizziness symptoms according to sex and time of mobile phone possessions.

**Keywords:** *Mobile phone; radiofrequency wave; neurological symptoms; questionnaire*

## **CEP TELEFONLARINI KULLANANLAR TARAFINDAN YAŞANAN BAZI NÖROLOJİK BELİRTİLER: ANKET ÇALIŞMASI**

**Özet:** Son yirmi yılda, radyo frekans elektromanyetik alanların insan sağlığı üzerine zararlı etkisinin olup olmadığı sık tartışılmaktadır. Radyo frekans yayan aletler arasında cep telefonlarının önemli bir yeri vardır. Bu çalışmanın amacı, cep telefonu kullananlar tarafından yaşanan olası nörolojik belirtileri belirlemektir. Bu çalışma, Kocaeli Sağlık Hizmetleri Meslek Yüksekokulundan rasgele seçilen 229 öğrenciye bir anket uygulanarak düzenlendi. Yates düzeltmeli Ki-Kare testi, cep telefonuna sahip olma zamanı ve/veya cinsiyet ile ilişkili şikayet frekanslarının karşılaştırılması için kullanıldı. Anket çalışmasının bir sonucu olarak, cep telefonu kullanıcılarının, cinsiyet ve cep telefonuna sahip olma zamanına göre aşırı sinirlilik, baş ağrısı ve baş dönmesi belirtilerinde artış görüldü ( $P < 0.05$ ).

**Anahtar Kelimeler:** *Cep telefonu; radyo frekans dalgalar; nörolojik belirtiler; anket*

---

**\*Sorumlu yazar**

nerminkcr@gmail.com

## **1. INTRODUCTION**

In the last twenty years, it has been discussed frequently whether there are any harmful effects of the radiofrequency electromagnetic fields on human health. Among radiofrequency emitting devices, mobile (cellular) phones hold an important place. Because of the rapid increase in the use mobile phones, radiofrequency waves emitted from mobile phones and their base stations interest large numbers of people. It is considered that radiofrequency wave emitted from mobile phone cause harmful effects through oxidative stress [1] and on the central nervous system [2]. Mobile phones operate on wireless technology, with communication typically occurring via a 900-1800 MHz signal that is pulsed at 217 Hz. This

signal carries essentially no power when the user is not talking or receiving, but when the user communicates the power of this pulsed electromagnetic field reaches a maximum of 250 mW [3].

A survey study, using questionnaire, was conducted among 161 students and workers in a French Engineering School on symptoms experienced during use of digital cellular phones [4]. According to the results, digital cellular phone users significantly ( $P < 0.05$ ) more often complained of discomfort, warmth, and picking on their ear during phone conversation in relation with calling duration per day and number of calls per day and women significantly ( $P < 0.05$ ) more often than men complained of sleep disturbance.

One another survey study was conducted among 17 000 people in Norway and Sweden symptoms experienced during use of mobile phones [5]. The sensation of warmth on the ear and behind/around the ear, burning sensations in the facial skin and headaches were most commonly reported.

Another survey study, using questionnaire, was conducted among 437 people who have and had been using mobile phone in Riyadh, Kingdom of Saudi Arabia during the year 2002 to 2003 [6]. The symptoms of headache, sleep disturbance, tension, fatigue, and dizziness were reported.

This survey study, using questionnaire, was conducted among 229 university students living in a city in Turkey, where these phones are extensively used. The aim of this study is to detect the possible

neural symptoms experienced by the users of mobile phones in order to light the way of further studies.

## **2. MATERIALS AND METHODS**

### **2.1. Questionnaire**

A questionnaire was distributed to 229 students at the Vocational School of Kocaeli Health Services. The questionnaire was filled out by subjects and was returned to a person responsible for the study.

The questionnaire designed specifically for this study was composed of two sections. In the first section, general questions were asked to individuals to learn about their general health and use of mobile phone. In the second section questions were asked to directly detect the effects of long term use of mobile phone on each individual's health.

In the survey, questions were asked to investigate the following symptoms; headaches, dizziness, extreme irritation, forgetfulness, neuropsychological discomfort, decrease of the reflex, sleep disturbance and increase in carelessness.

## 2.2. Study Population

79% of the study group consisted of women and 21% consisted of men and all of them have owned a mobile phone. In this survey, attendants were grouped according to time of mobile phone possessions. Times of possessions were divided into four sub-groups. These are one, two, three, four and above years

respectively. Table 1 shows these intervals. Table 1 showed that almost 64.6% of women and men have owned their mobile phone for four year and above.

**Table 1:** Percentages of the Intervals of Mobile Phone Possessions

Possessions	Women	Men	Total
One year	6.1	8.3	6.6
Two years	12.2	16.7	13.1
Three years	17.1	10.4	15.7
Four years and above	64.6	64.6	64.6

## 2.3. Data Analysis

For this survey, chi-square test with Yates correction were used for comparisons of complaints frequencies in relation with sex and mobile phone time possession at  $P < 0.05$ .

### 3. RESULTS

#### 3.1. Influence of mobile phone time possession and sex

##### 3.1.1. Mobile phone time possession

A significant increase in extreme irritation ( $P < 0.05$ ) was reported by the users of mobile phone possession  $> 2$  years compared to users of mobile phone possession  $< 2$  years (Table 2). On the contrary, for other neurological symptoms experienced during communication, no significant difference was observed between users with mobile phone possession  $> 2$  years as compared to users with mobile phone possession  $< 2$  years.

**Table 2:** Influence of Mobile Phone Time Possession on the Percentages of Complaints

Symptoms	< 2 years (45)	> 2 years (184)
Neuropsychological discomfort	33.3	25.0
Extreme Irritation	44.4	63.6*
Increase in the carelessness	53.3	54.3
Decrease of the reflex	17.7	16.3
Headache	77.7	78.3
Dizziness	68.8	61.4
Forgetfulness	42.2	40.2
Sleep disturbance	66.6	57.0

In parenthesis: number of subjects. Results of chi-square test: \* =  $P < 0.05$

##### 3.1.2. Sex

It can be reported significantly that women have more headache and dizziness symptoms ( $P < 0.05$ ) than men have (Table 3). On the contrary, complaint frequencies for other neurological symptoms between men and women were not significantly different.

**Table 3:** Influence of Sex on the Percentages of Complaints

Symptoms	Women (181)	Men (48)
Neuropsychological discomfort	29.8	14.6
Extreme Irritation	61.3	54.2
Increase in the carelessness	56.4	45.8
Decrease of the reflex	14.4	25.0
Headache	82.3*	62.5
Dizziness	69.6*	37.5
Forgetfulness	43.6	29.2
Sleep disturbance	58.6	60.4

In parenthesis: number of subjects. Results of chi-square test: \* =  $P < 0.05$

#### 4. DISCUSSION

As result of the survey, there was no evidence that the use of mobile phone may cause headache, dizziness, forgetfulness, or neuropsychological discomfort, decrease of the reflex, sleep disturbance or an increase in carelessness. These results support [7,8] for neuropsychological discomfort [7,9] for dizziness and [9] for headache and forgetfulness, but contradicts to [5, 6, 10, 11] for headache, [7] for forgetfulness, increase in carelessness

and decrease of the reflex, [6] for sleep disturbance and [12] for increase in carelessness. The lack of some general symptoms between users with mobile phone possession >2 years and users with mobile phone possession < 2 years has also to be considered with the fact that, in our study, use of mobile phones by subjects was nearly same calling duration per day.

The use of mobile phone may cause extreme irritation as a result of our data. This result supports [13] the case for extreme irritation. This result may be related to effect of radiofrequency wave emitted from mobile phone on the central nervous system [2]. Furthermore, it has been observed that a significant difference between women and men mobile phone users in complaints about headache and dizziness.

These results support [13] for headache, but contradict to [14] for headache and dizziness. These results may be related to women's heightened sensibility to electromagnetic fields [4]. There are only a few publications dealing with influence of sex and mobile phone time possession on the complaints of mobile phone users. Therefore these symptoms should be further investigated in further experimental studies.

## **References**

- [1] Hayland, G.J., "Physics and biology of mobile telephony" *Lancet*, 356(9244):1833-1836 (2000).
- [2] Hossmann, K.A., Hermann, D.M., "Effects of electromagnetic radiation of mobile phones on the central nervous system" *Bioelectromagnetics*, 24: 49-62 (2003).
- [3] Croft, R.J., Chandler, J.S., Burgess, A.P., Barry, R.J., Williams, J.D., Clark, A.R., "Acute

mobile phone operation affects neural functions in humans" *Clinical Neurophysiology*, 113: 1623-1632 (2002).

- [4] Santini, R., Seigne, M., Bonhomme-Faivre, L., Bouffet, S., Defrasne, E., Sage, M., "Symptoms experienced by users of digital cellular phones: A study of a French engineering school" *Electromagnetic Biology and Medicine*, 21 (1): 81-88 (2002).

- [5] Oftedal, G., Wilen, J., Sandstrom, M., Mild, K.H., "Symptoms experienced in connection with mobile phone use" *Occup. Med.*, 50(4): 237-245 (2000).

- [6] Al-Khlaiwi, T., Meo, S.A., "Association of mobile phone radiation with fatigue, headache, dizziness, tension and sleep disturbance in Saudi population" *Saudi Med J.*, 25(6):732-736(2004)

- [7] Balikci, K., Özcan, I.C., Turgut-Balik, D., Balik, H.H., “A survey study on some neurological symptoms and sensations experienced by long term users of mobile phones” *Pathol. Biol.*, 53: 30-34 (2005).
- [8] Cook, C.M., Thomas, A.W., Prato, F.S., “Human electrophysiological and cognitive effects of exposure to ELF magnetic and ELF modulated RF and microwave fields: A review of recent studies” *Bioelectromagnetics*, 23: 144-157 (2002).
- [9] Koivista, M., Haarala, C., Kraus, C.M., Revonsuo, A., Laine, M, Hamalainen, H., “GSM phone signal does not produce subjective symptoms” *Bioelectromagnetics*, 22: 212-215 (2001).
- [10] Szyjkowska, A., Bortkiewicz, A., Szymczak, W., Makowiec-Dabrowska, T., “Subjective symptoms related to mobile phone use” *Pol. Merkuriusz Lek.*, 19(112):529-532 (2005).
- [11] Frey, A.H., “Headaches from cellular telephones: are they real and what are the implications?” *Environ Health Perspect*, 106(3): 101-103 (1998).
- [12] Santini, R., Seigne, M., Bonhomme-Faivre, L., Bouffet, S., Defrasne, E., Sage, M., “Symptoms experienced by users of digital cellular phones” *Pathol. Biol.*, 49(3):222-6 (2001).
- [13] Santini, R., Santini, P., Le Ruz, P., Danze, J.M., Seigne, M., “Survey study of living in the vicinity of cellular phone base station” *Electromagnetic Biology and Medicine*, 22(1): 41-49 (2003).
- [14] Hietanen, M., Hamalainen, A., Husman, T., “Hypersensitivity symptoms associated with exposure to Cellular Telephones” *Bioelectromagnetics*, 23: 264-270 (2002).

*Geliş Tarihi:26/07/2010*

*Kabul Tarihi:15/10/2010*