

Original Article

Evaluation of Students' Knowledge on the Effect of Electromagnetic Field (Emf) Exposure on Reproductive Health

Utkualp Nevin, PhD

Assistant Professor, Department of Obstetrics and Gynecology Nursing, Faculty of Health Science, Bursa Uludag University, Bursa, Turkey

Ozdemir Aysel, PhD

Associate Professor, Department of Public Health Nursing, Faculty of Health Science, Bursa Uludag University, Bursa, Turkey

Yildiz Hicran, PhD

Professor, Department of Internal Diseases Nursing, Faculty of Health Science, Bursa Uludag University, Bursa, Turkey

Eda Unal, RN, BSN, (c)

Uludag University Institute of Health Sciences, Bursa, Turkey

Correspondence: Hicran Yıldız, PhD, Professor, Bursa Uludag University, Faculty of Health Sciences, Bursa, Turkey, e-mail: hicran_yildiz@yahoo.com

Abstract

Background: Electromagnetic waves are one of the factors that negatively affect reproductive health. Increasing knowledge and awareness on this issue is important for the protection and maintenance of health.

Objective or Aims: The study was conducted to evaluate the knowledge of students about the effect of electromagnetic field (EMF) exposure on reproductive health.

Methods: The descriptive study was conducted on 143 students who had taken the women's health and diseases course. The "Survey Form" prepared by the researchers in line with the literature was used to collect the data.

Results: Students' age, gender, structure, father's education and occupation, and family income affect the level of knowledge about the effects of electromagnetic fields on reproductive health ($p < 0.05$).

Conclusion: Students' knowledge and awareness of EMF exposure is not at a sufficient level.

Keywords: Electromagnetic field, exposure, reproductive health, students, knowledge

Introduction

Today, with the development of technological tools, the daily life of individuals has become easier. However, the use and propagation of EMF waves have also increased as a result of advances in technology. These tools, which are frequently used in daily life, create magnetic fields as a result of electric current flow and cause electromagnetic field exposure (Ozdemir *et al.*, 2019; Yildirim, 2012; Seyhan, 2010; ARPNSA, 2010; İlhan, 2008; Cleveland and Ulcek, 1999). EMF exposure occurs through the use of electrical energy or

due to presence around electrically conductive devices (WHO, 2007; ICNIRP Statement 2012). EMF exposure in living environments varies according to the type and size of the residence, and the existing power lines and household appliances (Turkkan *et al.* 2009; Sarigoz, 2012).

Electromagnetic field exposure is not taken seriously and given the necessary importance because electromagnetic field pollution is not visible to the naked eye, the effects of electromagnetic waves are delayed in time, and the effects on the human body take years to emerge (Çerzci and Yener, 2016; Bold,

2003; Ellenbecker, 2008). In the literature, it is stated that electromagnetic field (EMF) exposure can create very serious health risks for public health (Turkkan *et al.*, 2009; Yakıcı, 2016; Koklukaya *et al.*, 2013). WHO emphasizes that EMF exposure has an impact on human physiology and behavior, and reports that it causes an increase in the incidence of depression and suicide, as well as increasing health problems such as cancer, behavioral changes, memory impairment, Parkinson's, and Alzheimer's (WHO, 2007). EMF exposure can also cause changes in blood pressure, ECG, heart rate, blood biochemistry, and body temperature in individuals (WHO, 2007).

Safe limits of EMF values regarding EMF exposure have been determined by international health institutions (İlhan, 2008; Cerezci and Yener, 2016; Turkkan *et al.*, 2012). EMF interaction in houses varies depending on the number of devices working at home and on their use. In studies conducted in the USA, the level of EMF to be allowed in houses was determined as 2-2.5 mg, and those living in houses with an EMF level above this were considered individuals affected by EMF (İlhan, 2008; Toros and Sen, 2003; CNIRP Guidelines, 1998; IEEE-SA Standards Board, 1999). In the case of indoor electromagnetic field exposure, women, children, the elderly, and patients are especially at risk compared to adult and healthy individuals (Yener, 2016; Guide, 2011; TSE, 1996). EMF can cause different health problems in individuals in risk groups (Turkkan *et al.*, 2012). It is known that EMF exposure affects reproductive health as well as general well-being (Asghari1 *et al.* 2016.; Esmailzadeh and *et al.*, 2019; İlhan, 2008). Exposure to electromagnetic fields seriously affects reproductive health, threatens maternal and fetal health, and causes serious problems if necessary precautions are not taken (Mahmoudabad, 2013; Koren, 2003; Canbaz *et al.*, 2005; Li *et al.*, 2002). In a study conducted on healthcare professionals in France, it was found that as a result of the use of medical technological devices in the hospital environment, the level of EMF in the environment was high, and in conjunction, the reproductive health of women is adversely affected (Synyach *et al.*, 2018).

In the study by Cojhen *et al.*, it was remarked that the best way of protection from EMF exposure is that individuals not being around EMF sources in their living environments or spend less time in places with EMF sources (Cohen *et al.*, 2004). In order to maintain electromagnetic pollution at the lowest level, it is important that individuals in society have knowledge and awareness about electromagnetic field exposure (Turkkan *et al.*, 2009). In a study conducted in France, it was remarked that healthcare professionals do not have knowledge and awareness on EMF exposure (Synyach *et al.*, 2018). In particular, it is

extremely important that students studying in the field of health are informed about the effects of EMF exposure on general health and reproductive health (Çelikkalp and Yorulmaz, 2018). In this regard, it is suggested that the effects of EMF exposure on general health and reproductive health should be included in the lectures of these students in order to contribute to the emergence of a vigilant and healthy society, and environment (Karoutsoul *et al.*, 2016; Blassa, 2002).

It is observed that there are various studies on the effects of EMF exposure on human health in Turkey, yet these lack focus on knowledge and awareness in this regard of students studying in the field of health. The study was conducted with the aim of evaluating the knowledge of students about the effect of electromagnetic field (EMF) exposure on reproductive health.

Research questions

1. What is the knowledge level of nursing students about the effects of EMF exposure on reproductive health?
2. What are the factors affecting the information levels of nursing students about the effects of EMF exposure on reproductive health?

Methods

The aim of this descriptive study was to assess the knowledge of nursing students about the effect of EMF on reproductive health. In our study, we aimed to evaluate the level of knowledge of students to be health professionals of the future, on the effect of EMF on reproductive health, and to contribute the results to the planning of nursing education.

The universe of the research consisted of all third and fourth-grade students (N=252) studying in the Nursing Department of Bursa Uludağ University Faculty of Health Sciences in the 2017-2018 academic year, and the sample consisted of 143 students who volunteered to participate in the research. First and second-grade students were excluded due to the fact that they are not educated on women's health and diseases, and occupational health and safety.

The "Survey Form" prepared by the researchers in line with the literature was used in collecting the data. The questionnaires were filled in on a voluntary basis by face-to-face interview method. The duration to complete the questionnaire is approximately 15 minutes. SPSS 22.0 bundle software was used in the analysis of the data, and the data were scrutinized by means of averages and percentages.

Ethical Approach: The written approval from the institution where the study was to be conducted and from Bursa Uludağ University Health Sciences Research and Publication Ethics Committee (Decision no: 675-34) were obtained for the study to be conducted. The students were informed that the aim of the study and participants were based on volunteering.

Results

The average age of the students was 21.56 ± 1.36 years, 78.6% were women and 47.9% live in dormitories. The descriptive characteristics of the students are given in Table 1. The distribution of the risks and thoughts, regarding the pregnant and fetus, of the students about exposure to EMF during pregnancy is shown in Table 2. There is a statistically significant difference between the hypotheses suggesting that EMF exposure to the fetus may cause low birth weight risk ($p=0.047$), risk of intrauterine growth restriction ($p=0.023$), risk of decreased movement ($p=0.006$), and risk of slowed heart rate ($p=0.006$). It was determined that younger students acknowledged these risks ($p<0.05$).

There was a statistically significant difference between the ages of the students and the idea that it is okay to have an electrical clock, radio, and alarm at their bedside during pregnancy ($p=0.001$). That difference is due to the younger group who disagree. There was a statistically significant difference between the students' grades and their statement on electrical appliances that they do not need to be turned off or unplugged ($p=0.004$). This difference is due to students who think that electrical appliances need to be turned off or unplugged. There was a statistically significant difference between the gender of the students and their statement on electrical

appliances that they do not need to be turned off or unplugged ($p=0.001$). This difference stems from the students who disagree (Table 3).

It was determined that, compared to males, female students agreed more with the idea that there is EMF in electrical appliances used in the living environment, that exposure to EMF was a risk to mother and baby, and this risk was associated with the risk of intrauterine development and decrease in baby movements ($p<0.05$). Compared to male students, female students do not agree with the idea that there is no need for electrical appliances to be turned off or unplugged ($p<0.05$).

Students with nuclear family structure favored more than those with extended family that exposure to EMF could cause a risk of low birth weight baby, intrauterine growth restriction, and prematurity ($p<0.05$). It was determined that, compared to the students with an extended family structure, students with a nuclear family agreed more with the idea that electrical appliances need

to be turned off or unplugged, and that being around a washing machine/dishwasher affects pregnant and fetal health ($p<0.05$). It was found that the students whose father's education level was secondary school and above thought that EMF might pose a risk of low birth weight for the baby ($p=0.042$).

The rate of those whose family income is equal to expenses and who do not agree that it is okay to have an electrical clock/radio/alarm at the bedside is higher than that of the students with other income ranges ($p=0.013$). There was a statistically significant difference between the father's occupation and the students who think that economic lamps contain more radiation ($p=0.004$). This difference is due to the students whose fathers are retired and who declare no idea. It was determined that the students whose hometown is the Marmara region thought that exposure to EMF might cause intrauterine growth restriction, decrease in baby movements, and premature birth ($p<0.05$) (Table 4).

Table 1. Distribution of Descriptive Characteristics of Students

Variables	n	%
Age		21.56±1.36
Class		
3	76	54.3
4	64	45.7
Gender		
Female	110	78.6
Male	30	21.4
Place of Residence		
Dormitory	67	47.9
Home + with friend	24	17.1
Home + with family	49	35.0
Family income status		
More income than expenses	3	2.1
Income equal to expenses	127	90.7
Less income than expenses	10	7.1
Family type		
Nuclear	117	83.6
Extended	23	16.4
Mother's Education		
Primary School	96	68.6
Middle school and above	44	31.4
Father's Education		
Primary School	58	41.4
Middle school and above	82	58.6
Mother's occupation		
Housewife	111	79.3
Employee	29	20.7
Father's occupation		
Worker	85	60.7
Civil Servant	16	11.4
Retired	39	27.9
Hometown		

Marmara Region	78	55.7
Aegean Region	11	7.9
Mediterranean Region	10	7.1
Black Sea	14	10.0
Eastern Anatolia	9	6.4
Central Anatolia	8	5.7
Southeast	10	7.1
Toplam	140	100

Table 2. Distribution of students' thoughts regarding the risk of exposure to Electromagnetic Field (EMF) in pregnancy from the point of pregnancy and fetus

Features related to the Electromagnetic Field (EMF)	n	%
Status of information retrieval on EMF		
Yes	41	29.3
No	99	70.7
Info source		
Internet	14	10.0
University obstetrics course	23	16.4
University public health course	5	3.6
Presence of EMF in electrical appliances used in living environment		
Existent	117	83.6
Nonexistent	23	16.4
Risk factor of EMF in terms of maternal and fetal health during pregnancy		
Existent	127	90.7
Nonexistent	13	9.3
Risk of Low Birth Weight		
Yes	84	60
None	56	40
Risk of Iron Deficiency Anemia		
Existent	28	20
Nonexistent	112	80
Risk of Birth with a Low Apgar Score		
Existent	40	28.6
Nonexistent	100	71.4
Low Weight Baby Risk		
Existent	58	41.4
Nonexistent	82	58.6
Perinatal Death Risk		
Existent	56	40.0
Nonexistent	84	60.0
Risk of Intrauterine Growth Restriction		
Existent	105	75
Nonexistent	35	25
Risk of Decreased Baby Movements		

Existent	79	56.4
Nonexistent	61	43.6
Risk of Slowed Heartbeat		
Existent	63	45
Nonexistent	77	55
Prematurity Risk		
Existent	87	62.1
Nonexistent	53	37.9
There is no harm in keeping an electronic clock/radio/alarm at the bedside		
Agreed	38	27.1
Disagreed	82	58.6
No idea	20	14.3
No inconvenience in the use of household appliances		
Agreed	73	52.1
Disagreed	29	20.7
No idea	38	27.1
No inconvenience on a low-radiation computer screen		
Agreed	100	71.4
Disagreed	17	12.1
No idea	23	16.4
Economic lamps contain more radiation		
Agreed	55	39.3
Disagreed	29	20.7
No idea	56	40
There is no harm in having a TV and radio in the bedroom		
Agreed	14	10
Disagreed	111	79.3
No idea	15	10.7
Being next to a washing machine/dishwasher does not affect pregnant and fetal health		
Agreed	31	22.1
Disagreed	61	43.6
No idea	48	34.3
Radiation at a dose of 100 mGy causes mental retardation in the fetus		
Agreed		
Disagreed	52	37.1
No idea	5	3.6
	83	59.3
An exposure to 1000 mGy radiation in the first trimester of pregnancy causes fetus miscarriage		
Agreed	71	50.7
Disagreed	4	2.9
No idea	65	46.4
No need to turn off or unplug electronic appliances		
Agreed	13	9.3
Disagreed	122	87.1
No idea	5	3.6

Table 3. Distribution of the statistics of the risks of EMF exposure, regarding pregnancy and fetus during pregnancy, according to the age variable

Variables / Age	n	U	p
Risk of Low Birth Weight			
Existent	84	1906.500	0.047*
Nonexistent	56		
Risk of Intrauterine Growth Restriction			
Existent	105	1386.500	0.023*
Nonexistent	35		
Risk of Decreased Baby Movements			
Existent	79	1792.000	0.006*
Nonexistent	61		
The Risk of Slowed Heartbeat of the Baby			
Existent	63	1918.500	0.026*
Nonexistent	77		
There is no harm in keeping an electronic clock/radio/alarm at the bedside			
Agreed	38		
Disagreed	82	13.253	0.001**
No idea	20		

*Mann-Whitney Test,** Kruskal Wallis Test

Table 4. Distribution of the statistics of the risks of EMF exposure, regarding pregnancy and fetus during pregnancy, according to the age variable

Variables	Grade		x ²	p
	3	4		
	n	n		
No need to turn off or unplug electronic appliances				
Agreed	4	9	9.680	0.004
Disagreed	72	50		
No idea	0	5		
	Gender			
	Female	Male		
	n	n		
No need to turn off or unplug electronic appliances				
Agreed	6	7	12.634	0.001
Disagreed	102	20		
No idea	2	3		
Risk of Intrauterine Growth Restriction				
Existent	88	17	6.844	0.009
Nonexistent	22	13		
Risk of Decreased Baby Movements				
Existent	67	12	4.191	0.041
Nonexistent	43	18		
EMF in electrical appliances you use in your living environment				
Existent	96	21	5.122	0.048
Nonexistent	14	9		
Risk of EMF to mother and baby during pregnancy				
Existent	103	24	5.203	0.034
Nonexistent	7	6		
No need to turn off or unplug electronic appliances				
Agreed	6	7	12.634	0.001
Disagreed	102	20		
No idea	2	3		
An exposure to 1000 mGy radiation in the first trimester of pregnancy causes fetus miscarriage				
Agreed	61	10	5.895	0.044
Disagreed	2	2		
No idea	47	18		
	Family type			
	Nuclear	Extended		
	n	n		
Risk of Low Birth Weight				
Existent	76	8	7.292	0.007
Nonexistent	41	15		

DAB					
Existent	53	5	4.397	0.036	
Nonexistent	64	18			
Risk of Intrauterine Growth Restriction					
Existent	94	11	10.839	0.001	
Nonexistent	23	12			
Prematurity Risk					
Existent	80	7	11.762	0.001	
Nonexistent	37	16			
No need to turn off or unplug electronic appliances					
Agreed	9	4			
Disagreed	106	16	8.457	0.008	
No idea	2	3			
Being next to a washing machine/dishwasher does not affect pregnant and fetal health					
Agreed	23	8			
Disagreed	58	3	10.441	0.005	
No idea	36	12			
	Father's education				
	Primary school	Secondary school and above			
	n	n			
Risk of Low Birth Weight					
Existent	29	55	4.126	0.042	
Nonexistent	29	27			
	Family Income				
	income more than expenses	equal income and expenses	less income than		
	n	n	n		
There is no harm in keeping an electronic clock/radio/alarm at the bedside					
Agreed	1	37	0		
Disagreed	2	75	5	10.373	0.013
No idea	3	15	5		
	Father's occupatio				
	Worker	Civil servant	Retired		
	n	n	n		
Economic lamps contain more radiation					
Agreed	27	6	22		
Disagreed	19	0	10	15.531	0.004
No idea*	39	10	7		
	Hometown				

	Marmara	Mediterranean	Aegean	Central A.	Southeast A	Black Sea	Eastern A.		
	n	n	n	n	n	n	n		
Risk of Intrauterine Growth Restriction									
Existent	63	8	7	12	8	3	4	14.052	0.017
Nonexistent	15	3	3	2	1	5	6		
Risk of Decreased Baby Movements									
Existent	50	56	4	11	5	4	0	20.399	0.001
Nonexistent	28	0	6	3	4	4	10		
Prematurity Risk									
Existent	53	7	8	12	2	2	3	19.913	0.002
Nonexistent	25	4	2	2	7	6	7		
* The group that makes the difference									

Discussion

During the education and training process, students should be informed about the risks and protective practices in the working environment and in the field of health in order to prepare them for the business life after graduation, to predict the risks they may encounter in the working environment, and to identify the hazards in the living environments of the students (Ozdemir *et al.*, 2019).

In our study, 90.7% of the students stated that EMF exposure poses risk to maternal and fetal health during pregnancy, followed by 60.1% suggesting a risk of prematurity and 60% suggesting low birth weight. In the study by Frank and Silesin, it was stated that EMF exposure mostly affects the female reproductive system, causing miscarriage and birth of babies with congenital anomalies (Frank and Silesin, 1998). In the Veselinova study, 28.26% of health personnel pointed out that they are exposed to EMF in hospitals due to their jobs, and as a result, there are abortions with a rate of 7.9%. (Veselinova, 2013). In the Windham and Osorio study, it was emphasized that EMF exposure increased involuntary abortions 1.7 times in a study in which the threshold value for EMF exposure was calculated under 24-hour measurement. (Windham and Osorio, 2014). Our study results support the literature.

In our study, 58.6% of the students stated that having an electrical clock/radio/alarm at their bedside is inconvenient in terms of health, and 52.1% that there is no harm in using household appliances. There are references regarding household electrical appliances having negative effects on reproductive health in Saunders' study (Saunders, 2003). Our study results support the literature.

There is a statistically significant difference between the hypotheses suggesting that EMF (electromagnetic field) exposure to the fetus may cause low birth weight risk ($p=0.047$), risk of intrauterine growth restriction ($p=0.023$), risk of decreased movement ($p=0.006$), and risk of slowed heart rate ($p=0.006$). It was determined that younger students acknowledged these risks ($p<0.05$). Students participated in our study stated that they learned about reproductive health in the 3rd grade in the course of Obstetrics and Gynecology Nursing, and about environmental health in the Public Health Nursing Course in the 4th grade. It is thought that the students in the third-grade are younger than the fourth-grade students, that the risks related to maternal and fetal health are discussed in more detail in the obstetrics and women's health course than in the Public Health Course, and that the fact that the knowledge of the younger students on this

matter is relatively new, is effective in this difference.

Identically, there was a statistically significant difference between the ages of the students and the idea that it is okay to have an electrical clock, radio, and alarm at their bedside during pregnancy ($p=0.001$). That difference is due to the younger group who disagree. It is thought that this situation is due to the fact that the students did not fathom the education they received in previous years regarding EMF exposure.

There was a statistically significant difference between the gender of the students and their statement on electrical appliances that they do not need to be turned off or unplugged ($p=0.001$). This difference stems from the students who disagree. It is thought that the number of female students in the 3rd-grade is higher and they could not practice the training they received on EMF exposure.

It was determined that, compared to males, female students agreed more with the idea that there is EMF in electrical appliances used in the living environment, that exposure to EMF was a risk to mother and baby, and this risk was associated with the risk of intrauterine development and decrease in baby movements ($p<0.05$). Compared to male students, female students do not agree with the idea that there is no need for electrical appliances to be turned off or unplugged, with a higher ratio ($p<0.05$). This may be due to the concern that women will need to use electrical household appliances at any time as a result of the fact that women undertake the housework more than men and use electrical appliances more due to the cultural effect.

Conclusion: Students' knowledge and awareness on EMF exposure is not at a sufficient level. The nursing program covers the topics related to the effects of EMF exposure on environmental health and reproductive health, but electromagnetic pollution is not scrutinized as an important reproductive health problem. In order to protect and maintain reproductive health, it is recommended to allocate more space for the effects of EMF exposure in the courses given.

References

- ARPNSA. (1999). Powerline Electromagnetic Fields and Human Health, www.ortho.isume.edu/Faculty/Marino/PowerlineTOC.html access date 13.09.2021.
- Asghari, A., Afshin, A.K., Rajabzadeh, A., Khaki, A. (2016). A review on Electromagnetic Fields (EMFs) and the Reproductive System Electron Physician, 8(7): 2655–2662.
- Blaaas, K.G., Tynes, T., Irgens, A., Lie, R.T. (2002). Risk of birth defects by parental occupational exposure to 50 Hz electromagnetic fields: a population based study. *Occup Environ Med*, 59:92–97.
- Bold, A., Toros, H., Sen, O. (2003). Effects of Magnetic Field on Human Health. Istanbul Technic University, 3. Atmosphere Sciences Symposium, Istanbul.
- Canbaz, S., Sunter, A.T., Suren, C., PekSen, Y. (2005). Fertility Characteristics of Female Health Employees and Working Conditions Following Pregnancy and Birth .*The Medical Journal of Kocatepe*, 6: 39-44 .
- Cleveland, R.F., Ulcek, J.L. (1999). Questions and Answers about Biological Effects and Potential Hazards of Radiofrequency Electromagnetic Fields, FCC Office of Engineering & Technology, OET Bulletin, 56(4): 1-36.
- CNIRP Guidelines. (1998). Guidelines for Limiting Exposure to Time-Varying Electric, Magnetic, and Electromagnetic Fields (up to 300 GHz), April.
- Cohen, C. (2004). Injuries Caused by Physical Hazards, Current Occupational and Environmental Medicine 3rd ed. J. La Dou Ed., Lange Medical Books/McGraw-Hill, USA, 122-152.
- Celikkalp, U., Yorulmaz, F. (2018). Pregnant Health Care Workers Occupational Risk and Protective Approaches. *HSP*, 5 (2):244-252.
- Cerezci, O., Yener, S.C. (2016). Electromagnetic Pollution in Our Environment and Its Effects on Our Health ISEM2016, 3rd International Symposium on Environment and Morality, 4-6 November, Alanya, Turkey.
- Ellenbecker, H.C., Samia, L., Cushman, M.J., Alster, K. (2008). Patient Safety and Quality in Home Health Care Background. *Patient Safety and Quality: An Evidence-Based Handbook for Nurses*, 13(1):301-340.
- Esmailzadeh, S., Delavar, M.A., Aleyassin, A., Gholamian, S.A., Ahmadi, A. (2019). Exposure to Electromagnetic Fields of High Voltage Overhead Power Lines and Female Infertility, 10(1):11-16.
- Frank, A.L., Slesin, N. (1998). Nonionising Radiation, Maxcy-Rosenau-Last,

- PublicHealth and Preventive Medicine. ed, Wallace, RB. Stanford, 526-535,
- Guide. (2011). Regulation on Determination, Control and Supervision of Exposure Limit Values of Electromagnetic Field Intensity Originating from Electronic Communication Devices According to International Standards, Official Newspaper, 27912(21).
- ICNIRP Statement. (2012). Health Issues Associated with Milimeter Wave whole Body Imaging Technology, ICNIRP Health Physics, January, 102(1).
- IEEE-SA Standards Board. (1999). Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300GHz. New York. USA, 1-81.
- Ilhan, M. (2008). Electromagnetic Field Mapping and Health Status of Workers Exposed to Electromagnetic Fields in a University Hospital. Public Health Department. Doctoral thesis. Ankara University. Health Sciences Institute.
- Karoutsou, E., Karoutsos, P., Karoutsos, D. (2016). Adverse Effects on Female Human Reproductive Health from Exposure to Endocrine Disruptors: Focus on Endometrial Lesions Journal of Clinical Epigenetics 2 (4):1-11.
- Koren, G. (2003). Exposure to Electromagnetic Fields During Pregnancy. Canadian Family Physician, 49:151-153.
- Koklukaya, A.N., Yildirim, E.G., Selvi, M. (2015). Determination of Science Teacher Candidates' Views on Electromagnetic Pollution. Journal of Faculty of the Education, 28 (2): 155-171.
- Li, D.K., Odouli, R., Wi, S., Janevic, T., Golditch, I., Bracken, T.D., Senior, R., Rankin, Iriye, R., (2002). A Population-Based Prospective Cohort Study of Personal Exposure to Magnetic Fields During Pregnancy and the Risk of Miscarriage. Epidemiology, 13:9-20.
- Mahmoudabad, F.S., Zaidi, S., Firoozabadi, M., Kazemnejad, A. (2013). Exposure to Extremely Low Frequency Electromagnetic Fields during Pregnancy and the Risk of Spontaneous Abortion: A Case-Control Study. JRHS, 13(2): 131-134.
- Ozdemir, A., Ciftci, H., Dagilgan, S., Unal, E. (2019). Determination of Smart Phone Use Status and Dependence Levels of Nursing Students of Bursa Uludağ University Faculty of Health Sciences. Journal of Uludağ University Medical Faculty, 45 (3):281-290.
- Sarigoz, O., Karakus, A., Irak, K. (2012). An Evaluation of the Views of the Vocational School Students about Electromagnetic Pollution. Electronic Journal of Vocational Colleges., 2(1):1-8.
- Sauders, T. (2003). Health hazards and electromagnetic fields. Complementary Therapies in Nursing & Midwifery, (9)4:191-197.
- Seyhan, N. (2010). Electromagnetic Pollution and Our Health Archives of Neuropsychiatry 2010; 47: 158-61. 47.
- Sunyach, C., Antonelli, B., Tardieu, S., Marcot, M., Perrin, J., Bertalle, F. (2018). Environmental Health in Perinatal and Early Childhood: Awareness, Representation, Knowledge and Practice of Southern France Perinatal Health Professionals. Int. J. Environ. Res. Public Health, 15:1-18.
- Toros, A., Sen, H. (2003). Effect of Magnetic Field Of Human Health Istanbul Technic University 3. Atmosphere Sciences Symposium, Istanbul.
- TSE. (1996). Exposure of People to Electromagnetic Fields-High Frequencies (10 KHz-300 GHz), Turkish Standards Institute, TSE NV 50166-2.
- Turkkan, A., Cerezci, O., Pala, K. (2012). Electromagnetic Field and Health Effects. Ozsan Publisher. Bursa.
- Veselinova, L. (2013). Biosomatic Effects of The Electromagnetic Fields on View of The Physiotherapy Personnel Health. Electromagn Biol Med., 32(2):192-199.
- WHO. (2007). Electromagnetic Fields and Public Health, Exposure to Extremely Low Frequency Electromagnetic Fields, Fact Sheet ,No:322, WHO, Geneva, Switzerland.
- Windham, G.C., Osorio, A.M. (2004). Female Reproductive Toxicology, Current Occupational and Environmental Medicine .3rd ed., Ed. J. LaDou, Lange Medical Books/McGraw-Hill, USA, 397-413.
- Yakinci, Z.D. (2016). Effects of electromagnetic field On Human Health. Journal of Inonu University Vocational School of Health Services, 4(2):44-54.
- Yildirim, M. (2012). Elektromagnetic Waves. Bilim ve Teknik .Tubitak Publishers: 33-36

