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Investigation of the Effects of Electromagnetic Radiation on Health and Psychological Complaints

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ABSTRACT

In the period referred to as the digital era, technological products dominate almost all facets of human life. While technology facilitates human life on one hand, it threatens health with electromagnetic radiation on the other. This study investigate the effects of electromagnetic radiation on health complaints and psychological anxiety and, accordingly, shopping malls were selected as areas of application because the electromagnetic radiation is high at such venues. In this study, the health and psychological complaints of employees working at shopping malls where the electromagnetic radiation is considered to be relatively high and of employees working in similar sectors outside of shopping malls were measured and comparatively analysed. The study sample is composed of 347 employees in total, 174 of whom are employed at shopping malls in Adana province, and 173 employed in stores located outside of shopping malls. It is seen that there is no statistically significant difference between the employees working inside and outside of the shopping malls in terms of health complaints ($p = .945 > .050$) and psychological complaints ($p = .122 > .050$). But the scale points related to the health complaints of those working at shopping malls is slightly higher. The models set up in relation to the effect of the number of years worked by employees working at shopping malls on "psychological complaints" and "health complaints" were found statistically significant ($F = 8.234$; $F = 4.174$; $p < .05$). It is important to make measurements in shopping malls and to increase the practices to prevent personnel from having health and psychological problems.

Keywords: *Electromagnetic Radiation, Health Complaints, Psychological Complaints*

Elektromanyetik Radyasyonun Sağlık Ve Psikolojik Yakınmalar Üzerindeki Etkilerinin İncelenmesi

ÖZET

Dijital çağ olarak adlandırılan bu dönemde, teknolojik ürünler insanoğlunun hayatının neredeyse her alanına hâkim olmuş durumdadır. Teknoloji bir yönüyle insanların hayatlarını kolaylaştırırken bir taraftan da yaydığı elektromanyetik dalgalarla sağlıklarını ciddi şekilde tehdit etmektedir. Bu çalışmada ise elektromanyetik radyasyonun kişilerin sağlık yakınmalarını ve psikolojik kaygılarını ne yönde etkilediği araştırılmak istenmiş ve bu doğrultuda elektromanyetik radyasyonun yüksek olduğu düşünülen alışveriş merkezleri uygulama alanı olarak seçilmiştir. Bu araştırmada alışveriş merkezlerinde çalışan personeller ile alışveriş merkezleri dışında benzer sektörlerde çalışan personellerin sağlık ve psikolojik yakınmaları ölçülerek, karşılaştırılmalı olarak analiz edilmesi amaçlanmıştır. Çalışmanın örneklemini Adana ilinde bulunan alışveriş merkezlerinde çalışan 174 personel ve alışveriş merkezi dışındaki mağazalarda çalışan 173 personel olmak üzere toplam 347 personel

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oluşturmaktadır. Alışveriş merkezleri içinde ve dışında çalışanlar arasında sağlık yakınmaları (*p = .945> .050*) ve psikolojik yakınmalar (*p = .122> .050*) açısından istatistiksel olarak anlamlı bir fark olmadığı ama alışveriş merkezlerinde çalışanların sağlık yakınmaları ölçek puanının biraz daha fazla olduğu görülmüştür. Alışveriş merkezinde çalışan personellerin çalışma yılının "psikolojik yakınmalar" ve "sağlık yakınmaları" üzerindeki etkisine ilişkin kurulan modeller, istatistiksel olarak anlamlı bulunmuştur (sırasıyla; *F=8,234; F=4,174; p<.05*). Elektromanyetik radyasyonun nispeten yüksek olduğu alışveriş merkezlerinde ölçümlerin yapılması ve personellerin sağlık ve psikolojik sorunlar yaşamasını önlemeye yönelik uygulamaların arttırılması oldukça önemlidir.

Anahtar Kelimeler: *Elektromanyetik Radyasyon, Sağlık Yakınmaları, Psikolojik Yakınmalar*

I. INTRODUCTION

The opportunities provided by rapidly developing technology have attained a rather important place in human life. It is seen that the opportunities provided by technology are used intensively in various common living spaces such as hospitals, schools, government offices, airports and shopping malls as well as many factors like communication instruments, computers, electrical household appliances, medical devices and base stations. The electromagnetic fields in the environments where these devices and the technology are intensively used by humans are far more than the electromagnetic fields inside of a human body and natural electromagnetic fields. Natural spaces are destroyed by technological developments for humans evolving in such an environment. It is impossible to fully avoid the effects of electromagnetic fields in the flow of life. The radiation emitted by base stations, Wi-Fi connections and technological devices affect the majority of the world population.

An approach that prioritizes the health and well being of humans is imperative to protect humans from the adverse effects of electromagnetic fields. This requires to consider the limit values of environmental electromagnetic fields when manufacturing and installing energy transmission lines and technological products [1]. These limit values are determined by the International Commission on Non-Ionizing Radiation Protection (ICNIRP) recognized by the World Health Organization (WHO) on the basis of exposure to time varying electric fields 24 hours a day [2,3].

Table 1. *Limit levels for general public exposure to time-varying electric fields determined by ICNIRP*

Frequency, f	Electric field strength (V/ m)
up to 1 Hz	-
1–8 Hz	10,000
8–25 Hz	10,000
0.025–0.8 kHz	250/f
0.8–3 kHz	250/f
3–150 kHz	87
0.15–1 MHz	87
1–10 MHz	$87/f^{1/2}$
10–400 MHz	28
400–2,000 MHz	$1.375f^{1/2}$
2–300 GHz	61

Table 2. *Limit values protecting health of general public due to adverse effect of non-ionizing em-radiation, organized by the turkish ministry of environment and urbanization in 2010*

Frequency, f	Electric field strength (V/ m)
up to 1 Hz	-
1–8 Hz	10,000
8–25 Hz	10,000
0.025–0.8 kHz	750/f
0.8–3 kHz	250/f
3–150 kHz	87
0.15–1 MHz	87
1–10 MHz	$87/f^{1/2}$
10–400 MHz	28
400–2,000 MHz	$1.375f^{1/2}$
2–300 GHz	61

The limit levels of time-varying electric fields determined by ICNIRP for the general public are given in Table 1. Although these values are accepted by most countries, some countries have set new and unique limit values that are different from those determined by the ICNIRP. A regulation on the protection of public health from the adverse effect of non-ionizing EM-Radiation was made by the Ministry of Environment and Urbanization in Turkey, in 2010 as shown in Table 2 [4, 5].

Table 3. *Safety limits for magnetic and electric fields accepted by some countries*

Electromagnetic Radiation Source	Magnetic Field	Electric Field
Turkey	100μT	5 kV/m
Switzerland	1 μT	5 kV/m
Italy	3 μT	5 kV/m
Slovenia	10 μT	500 V/m
Greece	80 μT	4 kV/m
France, Germany, Australia	100 μT	5 kV/m

In case of exposure to electromagnetic fields for more than 4 hours a day, the safety limit value is determined as 10 μT in Italy, and this value is accepted as 3 μT for new transmission lines and new buildings. In some regions in Italy, such as Veneto, Emilia-Romagna and Tuscany, the magnetic field value of 0.2 μT is accepted as the safety limit for places where people spend more than 4 hours a day like hospitals, nursing homes, schools and housing [6].

Some studies reveal that the interaction of electromagnetic fields with biological systems causes oxidative stress under certain conditions [7]. In studies conducted on work stress, it is concluded that serious adverse outcomes like death, illnesses, mental health problems, social problems and decreased work performance lead to a high level of stress [8]. In some studies found in the literature, on the other hand, electromagnetic radiation is measured in common living spaces, such as hospitals, schools and shopping malls, where electromagnetic fields are intense, and the findings are examined from different perspectives. Differently from other studies, the health and psychological complaints of staff working at shopping malls, where electromagnetic radiation is effective, and of employees working in similar sectors outside of shopping malls, were measured separately and comparatively analyzed in this study. Following the introduction section of the study, the effects of electromagnetic radiation on mental and physical health were discussed, followed by a mention of studies in literature, conducted in places similar to those in this study. In the rest of the study, the materials and method to be used were introduced, and the results of the analysis were discussed in the findings section. And finally, the findings were interpreted, with our suggestions presented, and the study was concluded.

II. EFFECTS OF ELECTROMAGNETIC RADIATION ON MENTAL AND PHYSICAL HEALTH

Both natural and human-induced electromagnetic fields are constantly penetrating many environments in daily life, and people are constantly being exposed to electromagnetic fields. Therefore, whether these fields are harmful to health or not is always a serious matter of debate. For example, whether electromagnetic radiation is one of the reasons for brain disorders such as Alzheimer, Parkinson, MS and brain neoplasms, which are seen in a widespread manner in recent years, has become one of the most important research subjects of the second millennium. Furthermore, studies revealing that those who live near high-voltage transmission lines statistically have considerably higher rates of headache, depression and hallucination [9].

In order to determine the relationship between exposure to electromagnetic fields and an array of diseases including depression, childhood leukemia and central nervous system diseases, numerous tests were conducted on animals, laboratory studies were conducted on cells, clinical studies were conducted, computer simulations were made and epidemiological studies were conducted [10]. Wertheimer and Leeper [11] revealed that childhood cancers, primarily leukemia, are related to living in close proximity to high-voltage transmission lines. In conjunction with the increased use of mobile communication, concerns related to potential interactions of electromagnetic radiation with human organism and particularly with brain gradually increase. Another unexplained but potentially significant health risk is the stress-induced biological reactions of people triggered those people who intensively use cellphones in public places. These indirect effects on human health probably outweigh the direct biological degradation [12].

The fact that the base station can serve a limited number of users in a limited geographical area forces the cellular system operators to build a greater number of Base stations to meet increasing user demands. [13]. The number of cellular base stations built near public places and particularly residential zones, schools and hospitals is gradually increasing as the number of customers using these technologies keeps increasing incrementally. The radiation emitted by these base stations leads to concern among the public that they may cause numerous health issues [14]. Due to the health risks posed by cellphone base stations, they should not be installed in common public areas such as school yards, nurseries, hospitals and parks where predominantly children, patients and elders are present at all times. Installation of base stations on top of buildings where people live together should not be left to the decision of flat owners. Workplace physicians should carry on periodic examinations at workplaces and make measurements in the environment to determine the potential problems that might be encountered particularly by employees that are exposed to electromagnetic radiation and electromagnetic fields.

In conjunction with technological developments, smart technological applications providing competitive advantage have become common at shopping malls. Cable networks that cover shopping malls with low ceilings spread on a large area lead to a serious amount of electrical current and a magnetic field formed around this electrical current. Furthermore, the electromagnetic fields and diffusion of light at shopping malls, where the visitors and employees are constantly exposed to ultraviolet rays, affect fatigue and pose serious health risks to humans [15].

III. LITERATURE

As a consequence of the intensive deployment of wireless devices and base stations, the measurement and assessment of exposure to the electromagnetic radiation they emit have become important in terms of human health, especially when it exceeds the limits specified in the standards. Base stations, Wi-Fi equipment and other electronic devices are intensively used in crowded places such as shopping malls in particular [16]. Based on the literature about stress in general, researchers have conducted studies

designed to reveal the relationships between the work environment and health outcomes [17]. Numerous studies have been conducted on electromagnetic radiation which remains on the agenda in recent years. Some studies in which the electromagnetic radiation was measured in various environments are provided below.

Kurnaz and Engiz [18] have measured the electric field strength at a shopping mall for 24 hours a day, for a whole week. Their findings show that the number of users directly affects the measured E, the value of E varies depending on the day of measurement, and the electric field strength is up to 55% higher when the shopping mall is open compared to when it is closed.

Urbinello et al. [19] have assessed the common trends of exposure to temporary electromagnetic fields in different micro-environments in three different cities in Europe by using a common measurement protocol. They have concluded as a result of the measurements they made in settlement areas, downtown, suburbs, trains, buses, trolleys, subways, airports, train stations and shopping malls that the highest level of exposure to temporary electromagnetic fields occurs in public transport vehicles. They have also concluded that constant observation is necessary to determine the high exposure areas and predict the critical growth of exposure to electromagnetic fields in public places. Bolte and Eikelboom [20] have found that the level of exposure to electromagnetic fields varies depending on time and space. They have concluded that the highest level of average exposure is related to spending time in crowded places by means of using public transport vehicles, attending social activities or visiting shopping malls.

As a result of his electromagnetic pollution measurements at Karamanoğlu Mehmet Bey University, Yunus Emre Campus, Polat [21] has concluded that the highest values were obtained in the dormitory zone on campus established by the Credit and Dormitories Institution. It was emphasized that these high values were due to wireless Internet network signals in the dormitory zone and intensive signals emitted from the cellphones of the students living in the zone.

Gürğan and Seyfi [5] measured the electromagnetic radiation for a short period of time at the 100 kHz-3 GHz frequency band to show the level of electromagnetic pollution at two shopping malls located in downtown Konya. When these two shopping malls are compared with each other, the result of the measurement at the second shopping mall was found to be higher. They have concluded that this result was due to the number of GSM signal amplifiers used at the second shopping mall being higher than those used at the first one. Joseph et al. [22] have measured and compared the levels of exposure to electromagnetic radiation in various micro environments such as houses, public transport vehicles and outdoors in five countries (Belgium, Switzerland, Slovenia, Hungary and the Netherlands). In all countries except the Netherlands, the highest exposure measured was the radiation in transport vehicles (train, car and bus) caused by cellphones (up to 97%). It was emphasized in the study that mobile telecommunication is the main cause of exposure to total radio and electromagnetic frequencies in all micro-environments.

IV. MATERIAL AND METHOD

The study was aimed at investigating the effects of electromagnetic radiation on the health and psychological complaints of people and, shopping malls, where electromagnetic radiation is relatively higher, were selected as the area of application. An additional aim is to measure and compare the health and psychological complaints of people working at shopping malls and in similar sectors outside of shopping malls. One of the questions for which an answer was sought in the study was whether the electromagnetic radiation leads to more adverseness in the health and psychology of people working in relatively worse electromagnetic fields at shopping malls than those who work outside of shopping malls.

The study was conducted in Adana province due to the difficulties faced regarding the procedures in the process of getting permission from the managements of shopping malls to conduct surveys and limited financial resources. A total of 347 employees, 174 of whom are employed at shopping malls in Adana province and 173 in shops located outside of shopping malls were selected using the convenience sampling method and included in the sample of this study. A questionnaire form, including questions that measure the psychological and health complaints in Vragenlijst Organisatie Stress-Doetinchem (VOS-D), as well as some demographic questions, was used with the participants of the study. Meral Türk translated and adapted the VOS-D into Turkish and carried out the necessary validity and reliability works [23].

In order to determine whether the independent variables of health complaints and psychological anxieties show a significant difference in terms of dependent variables of gender, marital status, age and educational background, the general screening model was used in the study in the form of relational screening model. It was determined that the distribution of all sub-dimensions of the scale was not normal and, accordingly, nonparametric statistical methods were preferred for hypothesis tests. Mann Whitney U-Test and Kruskal-Wallis H-Test were used for paired and multiple comparisons respectively. Moreover, the models set up to measure the effects of the independent variables of "number of years worked at the workplace" and "daily working hours" on the health and psychological complaints of employees were tested through regression analysis.

It was assumed that the participants completed the questionnaire sincerely and without error, and the scale used was sufficient to determine the health and psychological complaints of employees.

V. RESULTS AND DISCUSSION

The findings obtained as a result of the analyses of data collected from the surveys conducted on employees working at and outside of shopping malls consist of findings from analysis outcomes of the effect of dependent variables composed of demographic findings of employees, identifier findings regarding the scales of psychological and health complaints, and lastly, independent variables such as the number of years worked by and daily working hours etc. of participants, and the extent of health and psychological complaints.

Table 4. *Demographic qualities of participants*

Variables		**N**	**%**	**Variables**		**N**	**%**
Gender	Male	158	45,5	Marital Status	Married	207	59,7
	Female	189	54,5		Single	140	40,3
Educational Background	Primary Education	9	2,6	Age	18-27 years old	78	22,5
	High School	222	64,0		28-37 years old	158	45,5
	Üniversity	116	33,5		38-47 years old	104	30,0
					48 years and older	7	2,0
Is your workplace located inside the shopping mall?	Yes	174	50,1	Have you received occupational health and safety training?	Yes	244	70,3
	No	173	49,9		No	103	29,7
In which sector do you work at the shopping mall?	Technology	106	30,5	What is your monthly income level?	2,500 TRY and less	142	40,9
	Clothing-Shoe	30	8,6		2501 TRY- 3500 TRY	117	33,7
	Restaurant-Cafe	29	8,4		3501 TRY- 5000 TRY	64	18,4

Table 4 (continue). *Demographic qualities of participants*

	Cinema	4	1,2		5001 TRY- 7500 TRY	19	5,5
	Others	5	1,4		7500 TRY and more	5	1,4
How long have you been working at your current workplace?	1-4 years	97	27,7	Would you like to change your job?	Yes	187	53,9
	5-9 years	127	36,8		No	160	46,1
	10-14 years	69	19,9				
	15-19 years	43	12,4				
	20 years and more	11	3,2				

From the demographic properties of the participants, it was understood that the majority were females (54.5%), 64% of them were high school graduates and 45.5% of them were in the age range of 28-37. In addition, the number of those who work at shopping malls (*n=174*) and the number of those who work outside of shopping malls (*n=173*) are almost equal. Moreover, the majority of participants working at shopping malls (30.5%) work in technology stores.

The validity and reliability of health complaints and psychological anxiety dimensions included in the VOS-D scale used in the study were tested in terms of the obtained data, and reliability coefficients of Cronbach's Alpha were found to be *0.824* and *0.647* respectively. The obtained data show that the measurement instrument used was reliable. While the Kaiser-Meyer Olkin (KMO) value for the same scale was found to be 0.821, the value obtained by the Barlett Sphericity Test was $\chi^2 = 3502{,}358$, $(p < 0{,}01)$. These values show that the data collected via the scale are suitable for factor analysis.

Table 5. *Descriptive properties of psychological and health complaints dimensions used in the study*

	Participants working at the shopping mall			**Participants working outside of the shopping mall**		
Dimensions	***N***	***Mean***	***Std. Dev.***	***N***	***Mean***	***Std. Dev.***
Psychological Complaints	174	2.13	0.29	173	2.14	0.33
Health Complaints	174	1.63	0.37	173	1.58	0.36

In consideration of the scale means provided in Table 5, it is understood that there is not much difference between the psychological complaints of employees working at shopping malls ($\bar{x}$= 2.13) and those working outside of shopping malls ($\bar{x} = 2.14$). In terms of health complaints, on the other hand, it was found that although there is not much difference between those who work at shopping malls ($\bar{x} = 1.63$) and those who work outside of shopping malls ($\bar{x} = 1.58$), the health complaints of those who work at shopping malls are slightly higher. However, when it is considered that a 4-point Likert scale was used as an organizational stress scale in the study, it is observed that both dimensions of psychological and health complaints create medium level stress.

Table 6. *Distribution of concerns caused by electromagnetic radiation by the place of work of participants*

		Is your workplace located inside the shopping mall?							
		Yes		**No**		**Total**			
		N	**(%)**	**N**	**(%)**	**N**	**(%)**	**Chi-Square**	**Sig.**
Does electromagnetic radiation affect your work performance?	Yes	36	10,4	46	13,3	82	23,6	1,673	0,196
	No	138	39,8	127	36,6	265	76,4		
	Total	174	50,1	173	49,9	347	100		
Do you have a health concern due to electromagnetic radiation?	Yes	48	13,8	64	18,4	112	32,3	3,513	0,061
	No	126	36,3	109	31,4	235	67,7		
	Total	174	50,1	173	49,9	347	100		
Did you have any chronic disorders that emerged after you started to work?	Yes	62	17,9	56	16,1	118	34,0	0,411	0,521
	No	112	32,3	117	33,7	229	66,0		
	Total	174	50,1	173	49,9	347	100		
Would you like to change your job?	Yes	113	32,6	74	21,3	187	53,9	17,156	0,000
	No	61	17,6	99	28,5	160	46,1		
	Total	174	50,1	173	49,9	347	100		
Did you receive any occupational health and safety training?	Yes	116	33,4	128	36,9	244	70,3	2,228	0,136
	No	58	16,7	45	13,0	103	29,7		
	Total	174	50,1	173	49,9	347	100		

Table 6 shows that 79.3% of those working at shopping malls stated that electromagnetic radiation does not affect their work performance, while 72.4% stated that they do not have any health concern due to electromagnetic radiation, and 64.4% stated that they did not have any chronic disorder after they started to work at the shopping mall. In addition, 64.9% of those working at shopping malls and 42.8% of those working outside of shopping malls stated that they want to change their jobs. As many as 66.7% of the participants working at shopping malls and 74% of those who work outside of shopping malls stated that they received occupational health and safety training.

Table 7. *Comparison of employees working inside and outside of shopping malls in terms of using medication*

	Participants working at the shopping mall			**Participants working outside of the shopping mall**		
	N	***Mean***	***Std. Dev.***	***N***	***Mean***	***Std. Deviation***
Do you use sleeping pills?	174	1,32	0,525	173	1,34	0,511
Do you use tranquilizers?	174	1,28	0,531	173	1,28	0,498
Do you use any other medication?	174	1,44	0,667	173	1,43	0,640

When the responses of participants to the statements directed to them using the four point scale (*1=Never, 2=Sometimes, 3=At Regular Intervals, 4=Very Frequently*) shown in Table 7 are examined, no significant difference was found between the employees working at and outside of shopping malls in terms of using medication. In particular, the tranquilizer use rates of employees working at and outside of shopping malls ($\bar{x} = 1.28$) are the same and very low.

Table 8. *Assessment of degree of health and psychological complaints by location of workplaces of participants (inside or outside of shopping malls)*

Dimensions	**Participants working at the shopping mall**	**N**	**Mean Rank**	**Total Rank**	**Mann-Whitney U Test**	**Sig.**
Psychological Complaints	Yes	174	173,63	30212,00	14987,0	0,945
	No	173	174,37	30166,00		
Health Complaints	Yes	174	182,29	31718,50	13608,5	0,122
	No	173	165,66	28659,50		

One of the important questions, the answer of which was sought in the study, was whether the electromagnetic fields in which the employees working at shopping malls create greater negativeness in their health and psychological states compared to those working in similar sectors outside of shopping malls. An examination of Table 8 reveals, based on the answers given by participants in the study sample to the scale questions, that there is no statistically significant difference between the health complaints of those working at and outside shopping malls ($p = .945 > .050$) and their psychological complaints ($p = .122 > .050$).

Table 9. *Assessment of health and psychological complaint dimensions in terms of independent variables of participants*

		Participants working at the shopping mall				**Participants working outside of the shopping mall**			
Dimensions	**Gender**	**N**	**Mean Rank**	**Mann-Whitney U**	**Sig.**	**N**	**Mean Rank**	**Mann-Whitney U**	**Sig.**
Psychological Complaints	Male	79	90,09	3548,0	0,533	79	90,68	3422,5	0,372
	Female	95	85,35			94	83,91		
Health Complaints	Male	79	84,70	3531,5	0,503	79	87,79	3650,5	0,848
	Female	95	89,83			94	86,34		
Dimensions	**Marital Status**	**N**	**Mean Rank**	**Mann-Whitney U**	**Sig.**	**N**	**Mean Rank**	**Mann-Whitney U**	**Sig.**
Psychological Complaints	Married	100	85,72	3521,5	0,583	107	84,97	3314,0	0,494
	Single	74	89,91			66	90,29		
Health Complaints	Married	100	87,50	3700,0	1,000	107	83,88	3197,5	0,295
	Single	74	87,50			66	92,05		
Dimensions	**Age**	**N**	**Mean Rank**	**X^2**	**Sig.**	**N**	**Mean Rank**	**X^2**	**Sig.**
Psychological Complaints	18-27 years old	39	93,44	1,591	0,661	39	96,94	2,214	0,529
	28-37 years old	80	88,52			78	85,04		
	38-47 years old	53	81,10			51	83,58		
	48 years old and older	2	100,50			5	75,00		
Health Complaints	18-27 years old	39	87,12	4,023	0,259	39	92,71	3,007	0,391
	28-37 years old	80	84,16			78	83,64		
	38-47 years old	53	90,31			51	84,66		
	48 years old and older	2	154,00			5	118,8		
Dimensions	**Educational Background**	**N**	**Mean Rank**	**X^2**	**Sig.**	**N**	**Mean Rank**	**X^2**	**Sig. (p)**
Psychological Complaints	Primary Education	4	81,75	0,645	0,724	5	98,50	0,288	0,866
	High School	117	89,62			105	86,98		
	University	53	83,26			63	86,12		

Table 9 (continue). *Assessment of health and psychological complaint dimensions in terms of independent variables of participants*

Health Complaints	Primary Education	4	125,38	2,327	0,312	5	70,10	1,341	0,511
	High School	117	86,72			105	90,09		
	Üniversity	53	86,36			63	83,20		

The study also aimed to examine whether there is a significant difference between the approaches of participants to health and psychological complaint dimensions with respect to independent variables such as gender, marital status, age and educational background. In order to compare thehealth and psychological complaint dimensions with respect to gender and marital status variables, a nonparametric statistical test, in this case the Mann Whitney U test, was used. An examination of Table 9 shows no significant difference was found between the psychological complaint scores of the employees working at (*p=.533>,05*) and outside of shopping malls (*p=.372>.050*) in terms of their gender. Similarly, no significant difference was found between the health complaint scores of employees working at (*p=.503>,.050*) and outside of shopping malls *(p=.848>.050)* in terms of their gender. The same table reveals there is no statistically significant difference between the psychological complaint scores (respectively *p=.583>.050 and p=.494>.050*) and health complaint scores (respectively *p=1.0>.050* and *p=.295>.050*) of employees working at and outside of shopping malls in terms of their marital status. In order to compare the health and psychological complaint dimensions in terms of age and educational background variables, a nonparametric statistical test was used, namely the Kruskal-Wallis H test. As seen in Table 9, there is no significant difference between the scale scores of health and psychological complaints in terms of these variables (*p< .05*).

The model set up in relation to the effect of the number of years worked by employees working at shopping malls at the "psychological complaints" dimension was found statistically significant as a result of the analyses conducted (*F=8.234; p<.05*). Table 11, which shows the parameter coefficients related to the model, reveals that there is a negative directional relationship between the number of years worked and psychological complaints dimensions (*t=-2.870; p<.05*). This result can be interpreted reflect that the psychological concern of a person declines when their fear of losing their job in which they developed themselves and where they are accepted after long years of efforts in their job is replaced by self-confidence.

Table 10. *ANOVA analysis related to the significance of the regression model in relation to the effect of number of years worked on psychological complaints*

	Sum of squares	**df**	**Mean Square**	**F**	**Sig.**
Regression	,650	1	,650	8,234	,005
Residual	13,109	166	,079		
Total	13,759	167			

Table 11. *Parameter coefficient in relation to the variable of number of years worked in the model (psychological complaints)*

	Unstandardized Coefficients		**Standardized Coefficients**	***t***	**Sig.**
	B	Std. Error	Beta		
(Constant)	2,219	,040		55,922	,000
Working Hours	-,012	,004	-,217	-2,870	,005

The model set up in relation to the effect of the number of years worked on "health complaints" dimension was found statistically significant as a result of the analyses conducted (*F=4.174; p<.05*). Table 12, which shows the parameter coefficients related to the model, reveals that there is a positive

directional relationship between the number of years worked and health complaints dimension (*t=2.043; p<.05*). This result can be interpreted as the indicator of the emergence of certain health issues in individuals working at shopping malls for long years due to working conditions (exposure to electromagnetic radiation, standing for long hours, carrying heavy loads, progressing age etc.).

Table 12. *Parameter coefficient related to number of years worked in the model (health complaints)*

	Unstandardized Coefficients		**Standardized Coefficients**	**t**	**Sig.**
	B	Std. Error	Beta		
(Constant)	1,541	,052		29,394	,000
Working Hours	,011	,005	,150	2,043	,047

Table 13*. Determination of relationship between health and psychological complaint dimensions*

		Participants working at the shopping mall	**Participants working outside of the shopping mall**
		Health Complaints	Health Complaints
Psychological Complaints	Pearson Correlation	,255**	,301**
	Sig. (2-tailed)	,000	,000

**. Correlation is significant at the 0.01 level (2-tailed)

It was determined that there is a positive directional significant relationship between the health and psychological complaint dimensions for employees that work at shopping malls at the rate of $r = 0{,}255$ and for those who work outside of shopping malls at the rate of $r = 0{,}338$, even if weak (Table 13).

VI. CONCLUSIONS AND RECOMMENDATIONS

In this study, the health and psychological complaints of employees working at shopping malls where the electromagnetic radiation is considered to be relatively high and of employees working in similar sectors outside of shopping malls were separately measured and comparatively analysed. Based on the demographic qualities of the participants in the study, it was understood that the majority were females (54.5%), 64% of them were high school graduates and 45.5% of them were in the 28-37 age range. In addition, the number of those who work at shopping malls (*n=174*) and the number of those who work outside of shopping malls (*n=173*) are almost equal. Moreover, the majority of participants working at shopping malls (30.5%) work in technology stores. According to the answers of participants in the study sample to scale questions, it is seen that there is no statistically significant difference between the employees working inside and outside of the shopping malls in terms of health complaints (*p=.945>.050*) and in terms of psychological complaints (*p=.0122>.050*).

[5,16,18] have concluded at the end of their studies, in which they measured the electric field strength levels at various shopping malls in Turkey, the measured E levels are below ICNRP and ICTA limits. In this study, 79.3% of those working at shopping malls stated that electromagnetic radiation does not impact their work performance, 72.4% stated that they do not have any health concerns due to electromagnetic radiation, and 64.4% stated that they did not have any chronic disorder after they started to work at the shopping mall, and the findings obtained supported the conclusions of other studies.

These conclusions show that the majority of the employees working at shopping malls are not disturbed by or do not have any negative experiences due to the electromagnetic radiation at their workplaces, and this suggests that it is related to the findings of previous studies revealing that the E levels inside shopping malls in Turkey are below ICRNP and ICTA limits. Concurrently Engiz [24] stated that the measured E levels are considered high in some countries like Switzerland and Italy, where lower limits are applied even if they are below the limits specified by the ICNIRP and BTK, and suggested that the E levels exposed to should be measured at regular intervals, observed and kept at levels that will not pose a threat to public health.

No significant difference was found between the psychological complaint scores of employees working at shopping malls ($p=.533>.050$) and outside of shopping malls ($p=.372>.050$) , as well as that between the health complaints of the employees working at shopping malls ($p=.503>.050$) and outside of shopping malls ($p=.848>.050$) in terms of gender. No statistically significant difference was found between the psychological complaint scores(respectively $p=.583>.050$ *and* $p=.494>.050$) and health complaint scores (respectively $p=1.0>.050$ *and* $p=.295>.050$) of employees working inside and outside of the shopping malls in terms of their marital status. Health and psychological complaint dimensions were also compared in terms of age and educational background and no statistically significant difference was found between them ($p<.05$).

The models set up in relation to the effect of the number of years worked by employees working at shopping malls on "psychological complaints" and "health complaints" dimensions were found statistically significant as a result of the analyses conducted*($F=8.234$; $F=4.174$; $p<.05$ respectively*). When the parameter coefficients related to models are examined, it is seen that there is a negative directional relationship between the number of years worked and psychological complaints dimensions ($t=-2.870$; $p<.05$) and a positive directional relationship between the number of years worked and the health complaints dimension ($t=2.043$; $p< ,05$).

Armağan and Kubak [25] conducted a study at a shopping mall in Aydın province and stated that the employees are happy with their workplaces because the shopping mall was not an indoor space but designed in a way to create an outdoor space. The shopping malls at which this study was conducted consisted generally of indoor spaces, and their outdoor spaces, where employees rest during their break, were limited, and this fact supports the finding that individuals working inside shopping malls are more willing to change their jobs than those who work outside of shopping malls.

Consequently, although most of the employees working at shopping malls stated that the electromagnetic radiation does not affect their work performance, they have no health concerns and that they did not have any chronic disease after they started to work at the shopping mall, this does not mean that the electromagnetic radiation at shopping malls will be ignored. Studies should be carried out to further decrease the impact of electric fields in these environments, employee awareness should be raised in this respect, and shopping malls should have open spaces where both employees and visitors can breathe. It is considered that the contribution of the frequent measurement of electromagnetic radiation, which is relatively high at shopping malls and in various environments, and efforts aimed at preventing employees working in such environments from experiencing health and psychological problems, to society is quite important.

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