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Research

Relationship between Job Stress and Occupational Exposure to Electromagnetic Fields and Workplace Lighting in Power Distribution Staffs

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ABSTRACT

Job stress is one of the important factors for productivity in the workplace. Stress can be defined as physical and mental changes when responding to different environmental conditions. Exposure to the physical hazards of the work environment can cause a person's behavioral change also the psychological hazards of the workplace, such as job design, management, and organization can hurt workers. This descriptive cross-sectional study was conducted in August to February 2018 in Northwest Iranian Power Distribution Company. The combination of self-reporting and observation techniques was used to collect data. The result shows that the average job stress is 171.6 ± 17.5, which represents the "moderate-high "level. There was a significant difference between the mean electric field, role boundary (P=0.005), physical environment (P=0.045), and magnetic field, role insufficiency (p=0.001), the results show the relationship between variables and job stress in a way that there is a direct relationship between work hours and occupational stress and increases with the increase in the hours of work, but the job stress also increases and this is accepted by other studies. In this study, we found the relationship between job stress and occupational exposure to electromagnetic fields and workplace lighting.

Keywords: Job stress; Electromagnetic field; Lighting; Power distribution

INTRODUCTION

Job stress is one of the important factors for productivity in the workplace [1]. Enhancive job stress is effective for workers health [2]. Stress can be defined as physical and mental changes when responding to different environmental conditions [3]. Exposure to the physical hazards of the work environment can cause a person's behavioral change also the psychological hazards of the workplace, such as job design, management, and organization can harm workers [4]. Research indicates the relationship between the properties of the work environment, job satisfaction and occupational stress [1]. Based on the studies, occupational stress accounts for 50% -60%of work absenteeism [5]. Research shows that 4 percent of the work time is lost due to job stress [6]. Workers with lower health status are more vulnerable to higher-health occupational status. Also, high levels of chronic stress can cause acute stress and cardiac arrest [7]. According to studies on the biological effects of electromagnetic fields on the brain and the central nervous system(CNS) is one of the hottest discussions in this field [8]. The electromagnetic field above 35kw/m can cause significant changes in memory and learning ability in mice [9]. Occupational exposure to electromagnetic fields can increase the risk of workers with Alzheimer's [10-12]. Studies show that long-term exposure to electromagnetic waves in the working environment increases the beta-amyloid in the brain and surrounding that chronic contact with the electromagnetic field can be associated with increased stress and cognitive dysfunction in people [13]. Also studies show that the electromagnetic field affects sexual cells and also affect sexual desire [14-16].

Power Distribution Company is one of the most important companies in providing energy in Iran. Working in long shifts and different working conditions is one of the most important factors affecting occupational stress. The purpose of this study

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was to determine the relationship between occupational stress and exposure to electromagnetic fields and workplace lighting.

MATERIALS AND METHODS

This descriptive cross-sectional study was conducted in August to February 2018 in Northwest Iranian Power Distribution Company in three provinces of Kermanshah, Ilam, and Kurdistan. The staff of Northwest Power Distribution Company is about 600 people. Samples size according to the reference [17] for linear regression test and logistic regression test with α=0.5 and confidence intervals=95%, with a 20 percent drop, will be 272 people. The random cluster sampling method used to select samples.

Data gathering tools

The combination of self-reporting and observation techniques was used to collect data.

Self –reporting: The Osipow Persian Job Stress Questionnaire, which includes the following two sections, was used. (1)The demographic information section includes age, sex, experience, marital status, wage, type of employment, education level and daily working hours. (2) The Job Stress Questionnaire consists of six sub-scales, role overload, role insufficiency, role ambiguity, role boundary, responsibility, and physical environment. Each subset contains 10 questions that are categorized into 5 Likert scales (1 = never, 2= occasionally, 3 = sometimes, 4=usually, and 5=most of the time). The subscale score of the questionnaire is categorized into 4 levels, including low (10-19), low-moderate (20-29), moderate-high (30-39), and high (40-50)[18]. The total score of the Job Stress Questionnaire is classified into 4 levels: low (60-119), low-moderate (120-179), moderate-high (180-239), and high (240-300)[18].The validity and reliability of this questionnaire were assessed in a study by Sharifian et al[19]. The Cornbrash alpha coefficient was calculated to be 0.83.

Measurement data: Local lighting area measurements were made with the EC1 device manufactured by the Hagener Company in Switzerland. The device can measure from 0.1-200,000 lux at a precision of less than 3%. Measurements were made according to BS 667: 2005 standard. Electromagnetic field measurements were performed by the device for measuring the intensity of electromagnetic fields in the ELF range of the HI 3604 model made by ETS Lindgren, USA. Frequency precision of the device: 30Hz - 2000Hz, Electrical field sensitivity: 1V / m - 200kV / m Magnetic field sensitivity: 0.2mG - 20G The ability to store 112 measurement points In accordance with ANSI C95.1.

Data analysis

After collecting the data, the data was transferred to the computer for analysis. SPSS version 21(IBM, Armonk, NY, USA) software was used for analysis. Pearson correlation analysis was used to determine the relationship between quantitative variables such as occupational stress and electromagnetic fields and lighting. Linear regression analysis was used to find out the relationship between factors affecting occupational stress. Also, the significance level in all tests is considered to be 0.05.

RESULT

Table 1 shows the demographic characteristics of the participants in this study.

Age(y)	Mean ± SD	36.2 ± 5.29
	Min-Max	26-62
Work experience(y)	Mean ± SD	9.5 ± 5.36
	Min-Max	Jan-32
Working hours(h)	Mean ± SD	12 ± 2.3
	Min-Max	Aug-15
Sex	Male	252(100)
	Female	
Material status	Single	57(22.6)
	Married	195(77.4)
Education	Underdiploma/ Diploma	11(4.4)
	B.Sc.	215(85.3)
	M.Sc.	26(10.3)

Table 1: Demographic characteristics of the employees studied (N =252).

According to Table 2, the average job stress is 171.6±17.5, which represents the "moderate-high "level. One-way ANOVA test and Independent sample t-test were performed between different parameters and indicate that there is no significant difference between the mean of job stress and age variables, work experience, marital status, and education level. But there was a significant difference between the mean of occupational stress and the working hours variable (P=0.00).

Job stress (Mean±SD)			
171.6±17.5			p
Mean±SD			
Age*	26-36	170.7±18.9	0.373
	37-47	173.8±16.7	
	48-62	169.1±8.1	
Experience*	01-Oct	171.7±18.3	0.773
	Nov-20	172±17.35	
	21-35	167±8.83	

Working hours**	08-Nov	165.7±15.6	0
	Dec-15	180.4±15.5	
Marital status**	Single	172.5±18.5	0.64
	married	171.3±17.2	
Education*	Diploma	175.9±11.8	0.21
	Upper diploma		
	B.Sc	170.6±18.3	
	M.Sc	177.8±10.6	

** Independent sample t-test.

*One-way ANOVA test.

Table 2: Analysis of the relationship between occupational stress and demographic characteristics.

Table 3 shows that the mean electric fields, magnetic fields, and the lighting are respectively 75.3±32.8, 12.09±7.12and 322.9±148.23. One-way ANOVA test between job stress sub-scales shows that there is no significant difference between the mean of work environment lighting and sub-scales. According to the table, there was a significant difference between the mean electric field, role boundary (P=0.005), physical environment (P=0.045), and magnetic field, role insufficiency (p=0.001), but in other subscales, there was no significant difference between the variables.

	Electric field (Mean ± SD)	Magnetic field (Mean ± SD)	Workplace lighting (Mean ± SD)
	75.3 ± 32.8	12.09 ± 7.12	322.9 ± 148.23

		(Mean ± SD)	p	(Mean ± SD)	p	(Mean ± SD)	p
Role Overload*	Low	62.7 ± 50.4	0.45	8.3 ± 6.1	0.167	328.09 ± 147	0.512
	Low-moderate	74.8 ± 31.1		12.17 ± 6.7		325.9 ± 146.3	
	Moderate-high	78.54 ± 32.8		12.6 ± 7.9		320.9 ± 157	
	high	77 ± 29.4		13.4 ± 7.1		254.5 ± 94.4	
Role insufficiency*	Low	73.5 ± 45.2	0.27	5.3 ± 5.9	0.001	361.2 ± 54.4	0.668
	Low-moderate	73.8 ± 30.8		12.8 ± 6.8		319.6 ± 149	
	Moderate-high	76.1 ± 31.7		11.3 ± 7.08		320.5 ± 156.2	
	high	97 ± 32.8		15.7 ± 8.2		375.1 ± 142.5	
Role ambiguity*	Low	61.3 ± 32.9	0.122	12.2 ± 6.6	0.853	415.5 ± 273	0.194
	Low-moderate	72.8 ± 35.9		11.4 ± 7.7		319.8 ± 133.4	
	Moderate-high	74.8 ± 29.4		12.3 ± 6.7		321 ± 154.7	
	high	92 ± 45.6		11.8 ± 8.4		330.5 ± 108.6	
Role boundary*	Low	60 ± 26.8	0.005	10.6 ± 7.01	0.37	419.3 ± 250.5	0.284
	Low-moderate	70.8 ± 32.5		11.6 ± 7.13		320.3 ± 144.2	
	Moderate-high	84 ± 32		12.8 ± 7.1		319.7 ± 144.8	
	high	~		~		~	
Responsibility*	Low	76.2 ± 31	0.213	8.03 ± 7	0.125	310.18 ± 67.7	0.544
	Low-moderate	71.4 ± 31.4		12.4 ± 6.38		332.6 ± 161.4	
	Moderate-high	80.8 ± 33.24		12.4 ± 7.1		310.2 ± 141.9	
	high	79.4 ± 43.2		10 ± 12.8		313.8 ± 79.8	
Physical environment*	Low	69.9 ± 26.6	0.045	11.8 ± 6.4	0.983	282.9 ± 130.6	0.2

Low-moderate	71.4 ± 26.5	12.2 ± 6.7	332.8 ± 147.9
Moderate-high	83.8 ± 42.9	11.8 ± 8.6	319.1 ± 147.5
high	80.8 ± 30.4	12 ± 7.1	374.5 ± 193.3

*One-way ANOVA test

Table 3: Analysis of the relationship between occupational stress and electrical and magnetic field and workplace lighting.

DISCUSSION

Studies on the effects of electromagnetic fields and workplace lighting on stress not have been published. However, many studies have been published in symptoms such as headache, fatigue and other health effects [20-22]. The present study is the first study on the effects of electromagnetic and light environmental factors on occupational stress. Work environment lighting affects hormonal function, circulatory rhythm, efficiency, alertness [23-25]. According to the results obtained from the measurement of lighting workstations in the range of 250-450 lux and it is suitable for this job so there isn't a relationship between lighting and stress. The results show the relationship between variables and job stress in a way that there is a direct relationship between work hours and occupational stress and increases with the increase in the hours of work, but the job stress also increases and this is accepted by other studies [26]. The number of accidents and injuries is related to the number of work hours and increases with an increase in the working hours of accidents and injuries [27]. The results of this study indicate the relationship between the psychological factors of the work environment, such as Role boundary, Physical environment and the electrical fields of the workplace. These results are consistent with another study [28].

CONCLUSIONS

In this study, we found the relationship between job stress and occupational exposure to electromagnetic fields and workplace lighting. We found an association between occupational stress and environmental factors. Meanwhile, there was a significant relationship between magnetic and electrical fields and occupational stress. This study studied real exposure to human beings. Although the displacement of participants was subject to design constraints, it is suggested that future human exposure to different transmission lines be considered.

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