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Survey noise exposure and fasting and their effect on salivary cortisol on hospital staff

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Abstract*---Introduction:*** One of the most important risk factors in workplace is noise pollution and it affects the quality of human life. Especially these effects on the hospital environment are more impressive because these workplaces should be calm. This study aimed to investigate the combined effects of noise exposure and fasting on saliva cortisol levels at two hospitals staff. *Method:* This study included 75 participants of two hospital worker.A calibrated noise level meter (Cel- 231, UK) was used to measurement noise levels in two hospitals parts. Also, Saliva cortisol levels assessed in two different situations: fasting and feeding. Descriptive statistics, paired sample t-test and regression analysis were used as statistical tools of this study with P<0.05. *Results:* our result showed that sound pressure levels (mean ± SD) in Amiralmomenei hospital and Abozar hospital were 75.3±6 and 76.9±5, respectively. Salivary cortisol levels in samples with normal feeding and fasting showed significant difference (P<0.05).Also, comparison between salivary cortisol levels in without noise exposure and noise exposure in fasting time showed significant difference (P<0.05). Salivary cortisol levels in workers in two hospitals were different (P<0.05). *Conclusion:* Our study showed that sound pressure level in the workplaces is a effective factor on salivary cortisol levels. Also, fasting and noise exposure showed a synergism effects on salivary cortisol levels.

Keywords*---*Hospital, salivary cortisol, fasting.

Introduction

Environment plays an Important role in physical, mental and social human health. There are many environmental factors which could harm the human health such as physical, biochemical and biological factors ،(1) Noise is one of the physical factors which is very considered in recent years .(2) Noise is an undesirable sound that usually defined as a huge inappropriate and out improper sound. Sound transportation happen through air and because of its structure can pass through buildings, walls and rooms which could affect different aspects of human health that are divided into two groups: hearing and non-hearing groups. Jobs with lots loudly noise exposure cause unpleasant effects such as high blood pressure, decrease employee's performance, sleep problems, agitation, stress and at last decrease their hearing .(3-5) Noise in hospitals is a common hazardous situation. mechanical equipment, ventilation systems, patients and visitors who need medical services conversation with employees are the main source of noise production in hospitals. The inappropriate effects of noise are totally obvious on medical health service to patients, visitors and also employees' function in medical care units (including nurses doctors practical nurses and...) .(7 و 6) According to the world health organization (WHO) guidance the noise level in hospital environments determinate to be 35_40 decibel (DB) in days and 30-40 DB in nights .(8) Hospitals are one of the most important and vital public service canters that they're type of activity and representing services necessitate to have a quiet, calm and silent environment.

This desired situation is related to the patient and personal needs. These harmful effects of noise in hospital environment are listed here: disturbance in employees' conversation together and with patients, lost attention and decrease personnel accuracy, physiological and nervous disorders, increase blood pressure, higher heartbeat and breathing rate, patients' sleep disorders and longer hospitalization .(21-9)

Cortisol has different roles In human body such as decreasing inflammation, reducing immune reactions, affecting metabolism and higher levels of blood sugar. This hormone is secreted in response to stress and inflammation or decreased levels of blood glucocorticoid. The Secretion is regulated by corticotropin releasing hormone which is secreted from the hypothalamus and leads to more adrenocorticotropin secretion from hypophyse.

This secreted hormone cause higher levels of cortisol, indeed this condition happens during the body reaction to stress. Because this hormone is responsible for some stress related changes in the body, scientists called it a stress hormone.

Many studies have been done on humans and animals regarding fasting and its interaction with other factors in the body. Here we mention one of them with the title "correlation of fasting with cortisone level". Fasting leads to increased levels of cortisol secretion in the body. Besides that, according to the studies, articles classified fasting into two groups. In the first group of studies fasting is mentioned as a stressful factor that could increase reactive oxygen species (ROS) production in the body. In this regard some studies showed that higher ROS levels in the body lead to more cell death in tissues. According to this fact,

presence of ROS in auditory labyrinths may cause hair cell destruction, which resulted in hearing loss at last. In the second group of studies scientists revealed that severe fasting leads to the production of ROS in the body.
.(11)

Banser et al. in 2014 assessed the auditory and non-additive effects of noise on the health in Germany with analysing the questionnaire assessment and measuring the noise in different workplaces, they concluded that the noise could cause harmful effects on human health.(22)

In 2013 Makximovichugay et al. showed in the article "Reduction of automotive noise pollution" that 50-70 sound intensity is accompanied with high blood pressure and higher heart rate through disturbance in blood supply process which is one of the risk factors in cardiovascular disease. furthermore they showed that 40 DB noise could impress the nervous system negatively.
.(23)

Salami et al. In 2013 assessed the correlation between voice calls and increased level of blood pressure in a socks factory in Nigeria. Voice calls are an important factor in the employees working place which could lead to higher blood pressure and they showed that being exposed to noise is inevitable in these places and as a result they could see significant improvement in systolic blood pressure, so they recommended that the staff should avoid the higher than 89 DB noises.(24)

In a study in 2013, tiesler et al. examined the correlation between traffic noise in roads and the sleep disorders in German children. They demonstrated that being exposed to traffic noise may be correlated with increasing the psychiatric symptoms like instability and sleep disorders in children.
.(25)

In a study in 2012,Joyrdepo et al. analyzed the traffic noises in oyemekun oba-adesida road of Akure Ondo State town in Nigeria in order to analyze the noise amount in this road. The results showed that road traffic noise pollution is more than the country standard in most of the target places. Indeed this event could affect different actions inappropriately.
.(26)

Mehravaran et al. in a study in 2011, used noise pollution data to represent a method for recognizing the critical areas in Tehran. Data showed that using the noise maps of different places could be used as a useful tool in the controlling noise effects programs.
.(27)

Golmohammadi et al. in 2012 analyzed the quantity of noise pollution in Hamedan city hospitals. The results showed that 17% of employees feel mild air pollution, 22% moderate and 16% severe and 45% very severe air pollution. Besides that, noise pollution in women was 10% higher than men.
.(28)

Tomei et al. in 2010 in a study assessed the professional interactions between noises and cardiovascular system. They analyze the comparison correlation between the changes in cardiovascular system in staffs who exposed continuously with noise at professional workplace in Italy.
.(29)

In 2012 Karami et al. assessed the quantity of noise pollution in different departments of Golestan hospital in Ahwaz and in Fatemeh-Zahra hospital in bushehr. The noise pollution was assessed with different digital noise recorder equipments and in different hours a day from 8 a.m. to 10 p.m. in a normal day of week and on a holiday.
.(30)

In a observation study of Padmakumar et al. in 2013 in India "Evaluation of noise levels in intensive care unite in two large teaching hospital" the noise amount in 24-hours a day in care units (ICU) of the two mentioned hospitals was measured. Their results showed that the amount of noise in each of the 2 care units were higher than the standard value of WHO
.(31)

Erdoghangoltakin et al. in 2013 analyzed the noise pollution in hospital polyclinics in Istanbul. The results showed that the higher noise level mean was observed in number 3 polyclinic but it had no significant difference with other groups. By the way, all of the measuring data where higher than WHO recommendation.(32)

Al-Abuzeer et al. in 2012 assessed the noise pollution in the main educational hospitals in Mosul Iraq. They concluded that for avoiding harmful effects of noise pollution, the authorities must monitor the noise level and following that they could control it.(33)

In 2011, Foladi et al. In the study "measure stress of noise to change measurent salivary cortisol" demonstrated that being exposed to noise levels higher than 80 DB in industrial environments could impress salivary secretion .(34)

In a study of PerssonWaye in 2003, the scientists concluded that in exposure to low frequency sounds during night could cause lower levels of cortisol on awaking and this itself has significant relation with state and quality of sleep.
.(35)

In 2010 Kalantari et al. Examining the urine cortisol level changing in labors who worked at sepahan Laye Isfahan factory. They realize that using auditory protective equipment has impressive effect on decreasing the harmful effects of high cortisol levels due to noise pollution.
.(36)

Barcellus et al in 2010 examine the fasting effects on cortisol level, blood glucose, liver and muscle glycogen of Rhamdia fish. They observed that long fasting periods (7,14 and 21 days) significantly increased cortisol levels compared to control group. (37)

Dikensoy et al in 2009, is evaluated the effects fasting in Ramadan on mother's lipid serum, fetus growth and cortisol level. Results showed that no significant difference between fetus groups. Fasting mother's cortisol levels in day 20 were higher than its level that measured one week before Ramadan($P<0.005$)(38)

In a study Sharifi et al in 2006, measured the changes in cortisol, cytokine and immunoglobulin during fasting in Ramadan. They showed that the interphone gamma and cortisol levels are significantly increased and TNF-alpha level was significantly decreased.
.(39)

According to the library studies that we have done in this article, until now, no study has done about the correlation of fasting and noise pollution and their effect on salivary cortisol level. So, the aim of this study is to examine the effect of simultaneous exposure to the noise and fasting on saliva cortisol levels of hospital personnels.

Methods and Materials:

2.1. Introduction

This basic and quasi-experimental research was done in 2015 as a field and laboratory study. This study was done in two phases. in first phase we first visited different departments of educational and non educational hospitals then we measure the noise level, equivalent sound level exposure and sound effect index in the related places. In second phase we measured the blood pressure, heart beat rate and blood oxygen concentration percentage. In this case we collected the species from elected employees saliva when they were fasting and feeding and also at the beginning and end of their work shift (before and after the noise exposure). After that we evaluated other general health signs such as headache, stress. anxiety and sleep disorders through Goldberg and William 28 test questionnaire. A statistical sample size calculation method that is used in this cross-sectional study showed below:

$$n = \frac{(Z_{1-\alpha/2} + Z_{1-\beta})^2 \times 2 \times \sigma^2}{(\mu_1 - \mu_2)^2}$$

In this case confidence level was 95%(0.005) and power of a test was 80%(beta=0.2)

$$Z_{1-\alpha/2} = 1.96$$

$$Z_{1-\beta} = 0.84$$

$$\sigma^2 = 20^2 = 400$$

$$\frac{(1.96+0.84)^2 \times 2 \times 400}{10^2} \approx 64$$

According to the statistical calculation, 64 cases were needed in this study but at last 75 cases participated in this study (46 women and 29 men) that were approximately 30-45 years old.

Data statistical methods that were used in this study were descriptive statistics, paired independent sample t-tests and regression analyzes. (Alpha=0.05)

The inclusion and exclusion criteria were considered as follows:

Employees participate in this study who fasting in Ramadan with pleasure.

We omitted the cases that suffer from auditory disorder, headache, head surgery, shock reaction in the last 6-months, cardiovascular disease and diabetes. We are also emitted the employees with less than one year work experience.

Each case had authority to lay off from this project anytime.

Generally due to the importance of evaluating the air pollution effects on hospital staffs and few studies that has been done in this case, we choose two educational (Abozar hospital) and non educational (Amiralmomenin hospital) hospitals which one of them was belonged to the ministry of health, treatment and medical education and the second one was belonged to the social security organization in Ahwaz, Khuzestan.

Study phase:

This study had two phases which are mentioned here. Noise evaluation in environments and doing experiments and laboratory tests in elected cases.

A) Phase one: evaluate the noise in mentioned workplaces.

A.1) preliminary visit of different departments in chosen hospitals and determining the source.

A.2) measuring noise in different departments of the hospital with a station ING method. In this method the hospital departments were divided into equal Checkered segments so that in the centre of each segment one station was evaluated with noise detector CEL-231. There is a fact that, the more checkered parts, the better valid results (12).

A. 3) Evaluation the equivalent noise level exposure and sound effect index on the mentioned hospital employees.

In order to analyze the staff exposure noise as a hazardous factor in the workplace, we averaged the noise exposure times taken during shiftworks that each staff exposed to them. In this case we firstly measured the level of each

exposure along with the exposure time and then we use this data to evaluate the equivalent staff exposure level in a period of time. The time level equation is followed below: (12)

$$\overline{LP} = 10\ \mathrm{Log}\left[\frac{1}{n} \times \sum_{i=1}^{n} 10^{\frac{LP_i}{10}}\right]$$

In order to determine the harmful effects of noise to people, we have to consider the number of people exposed in this study. This index is calculated with the following formula and then by collating them with a standard table the exact amount defined.

NII= SLWP/P total

W: amount of noise harmfeeding according to sound level.

P: The number of exposed person

A) Phase two: doing tests and diagnostic experiments on elected cases.

B.1) measure blood pressure and heartbeat

B.2) measure blood oxygen concentration

B.3) Saliva sampling from studying population in order to measure cortisol in two states, feeding and fasting at the beginning and end of the workshift.

We collected cortisol from blood, urine and saliva. Blood and urine analyzing for Cushing syndrome and Addison's disease detection as two serious adrenal disorders. Some physicians measure salivary cortisol for Cushing syndrome detection and stress related disease evaluation. Urine and saliva samples used for evaluation of stress-related disorders. Urine and saliva test was used to measure the cortisol overproduction.

B.4) Evaluate the general health of employees with a standard 28 test questionnaire. General health questionnaire (GHQ), has 28 tests that each one has 0-3 level. Each case total Mark was between 0-80. The less Mark number means mental health and more number means less mental health. The questionnaire sun scales are listed below: (41)

Physical symptoms subscales: question 1-7

Agitation and Insomnia subscale: question 8-14

Social function disturbance subscale: question 15-21

Depression symptoms subscale: question 22-28

After calculating each case marks we divided in 4 groups:

No symptoms: 0-6 mark in subscale and 0-22 mark in total

Mild symptoms: 7-11 mark in subscale and 23-40 mark in total

Moderate symptoms: 12-16 mark in subscale and 41-60 mark in total

Severe symptoms: 17-21 mark in subscale and 61-84 mark in total (41)

2-3) Collecting information equipments:

2-3-1) Noise meter

Noise metre CEL-231 (CASELLA CEL company, England) was used in order to measure sound pressure level in different departments of hospitals.

2-3-2) Calibration

CEL-231 noise meter has a side piece for calibration (CEL 110/2) which does calibration in DB levels and 1 kHz frequency. The machinery should be calibrated before using.

2-3-3) Blood pressure measure equipment

ATM sphygmomanometer Echomax A HBP2000 (Echomax, South Korea) was used for measuring systole (maximum) and diastole (minimum) blood pressure.

2-3-4) Pulse oximeter (blood oxygen concentration). This machine is from Bruer factory in Germany that measure the concentrated oxygen in a hemoglobin of arteries and heartbeat in fingers through a non-invasive method.

2-3-5) Cold box

A Cold box is a plastic box with a handle and cap which is made by a CNT company in China. This box could carry 60 plastic vials and two ice bags. The box is used for quick and safe transferring of collected saliva samples to the laboratory.

2-3-6) Materials

For cortisol analyzing and extraction from saliva, we used Cobas kits (France).
2-4) Variables

The following factors were set as variable.

scale	Practical definition	Quality		quantity		dependent	independent	Variable characteristics
		ordinal	Nominal	discontinuous	continuous			

	Being male or female of the participants in study		*				*	gender
mmHg	Maximum measured blood pressure				*	*		Systolic blood pressure
mmHg	Minimum measured blood pressure				*	*		Diastolic blood pressure
percentage	Blood oxygen level				*	*		Blood oxygen level
w/m^2	The amount of sound energy generated at the time unit				*		*	Sound intensity
-	A machine or generator that produced and spread sound			*			*	Sound source
µg/dl	Amount of cortisol secretion in mouth				*	*		Salivary cortisol
time	While it was being prevented from taking a food ration				*		*	fasting

2-5) Data analysis

In order to analyse the data we used a central tendency index like mean. In this study ،minimum maximum and standard deviation used as dispersion index for a statistical description several factors were used such as analysing general health questionnaire for employees, cortisol level before exposure in a feeding and fasting situation, cortisol level in four condition (in beginning and end of work shift and in feeding and fasting), gender of cases effect on cortisol secretion and hospital type effect on cortisol secretion. Frequency distribution graphs and relative frequency were used in this case the Kolmogorov Smirnov test was used to evaluate the normality of variables for describing fasting and noise effects and cortisol secretion. Besides that, paired t-tests were used for comparing mean of cortisol secretion and for analyzing the correlation between gender and general health we used chi-square test. The p value in this study was 0-0.36 as significant and 0.36-0.67 as insignificant.

3. Results

The result of each measurement is constitutional in detecting the study route and achieving basic solutions. In this part we statistically analyzed the dependent variables normality with parametric and non-parametric tests.

3-1) Demographic specifications of cases.

Due to phase one of the study, 75 personnel from two educational and noneducational hospitals get into the study.

Table -4: demographic characteristics of participants based on gender

Cumulative percentage	Valid frequency	percentage	frequency	gender
7/70	7/70	70/7	53	female
100	3/29	29/3	22	male
	100	100.0	75	total

Table -5: demographic characteristics of participants based on hospital

Cumulative percentage	Valid frequency	percentage	frequency	hospital
3/61	3/61	61/3	46	Amiralmomenin
100	7/38	38/7	29	Abozar
	100	100	75	total

Table-6: descriptive statistics of blood pressure, heart rate, blood oxygen level

Descriptive statistics					
Standard deviation	mean	maximum	minimum	number	Variable type
750/7	49/124	145	110	75	Maximum blood pressure (mmHg)
110/5	57/79	90	70	75	minimum blood pressure (mmHg)
530/11	43/86	127	69	75	Heart rate (number)
920	33/97	99	95	75	Blood oxygen percentage
				75	Valid number

In the next part, the noise level in different hospitals departments, the equivalent sound level exposure and sound level index were measured, separately.

Table-7: descriptive statistics of sound pressure level , Interaction counterpart level, Sound effect index in different departments of non-educational Amiralmomenin Ahvaz hospital

Standard deviation	Mean	maximum	minimum	number	Variable type
6/0642	75/321	3/95	8/67	24	Sound pressure level
6/0682	74/746	92/7	67/2	24	Equivalent exposure level
5/4529	42/6	31/2	54	24	Sound effect index
				24	Validated number

Table-8: descriptive statistics of sound pressure level, Interaction counterpart level, Sound effect index in different departments of educational Abozar Ahvaz hospital

Standard deviation	Mean	maximum	minimum	number	Variable type
5/5849	76/907	86/8	9/66	14	Sound pressure level
5/5849	76/607	86/2	3/66	14	Equivalent exposure level
	1807/1	31/2	0.54	14	Sound effect index
				14	Validated number

Table-9: results of other effects of noises on participants like headache. sleep disorders, stress, emotions, agitation taken by validated 28 questionary public health

Cumulative percentage	Validated percentage	Percentage	frequency	
7/82	7/82	82/7	62	No symptoms
96	3/13	3/13		Mild symptoms
100	4	4	3	Moderate symptoms
	100	100	75	Total

Descriptive statistics of case genders on saliva cortisol secretion is mentioned in the following table.

Table-10: correlation between gender and its effect on public health of the participants

	Analysis of test results			
Total	No symptoms	Mild symptoms	Moderate symptoms	Gender
53	43	7	3	Female
%70/7	%57/3	%9/3	%4	Total percentage
22	19	3	0	Male
%29/3	%25/3	%4	%0	Total percentage
75	62	10	3	Final total
%100	%82/7	%13/3	%4	

Table-11: descriptive statics for the cortisol level in 4 condition of sampling salivary cortisol

maximum	minimum	Standard deviation	Mean	number	
512	163	0/99196	0/32895	75	End of the shift in feeding
661	102	0/111883	0/34137	75	beginning of the shift in feeding
480	222	0/116912	0/21341	75	End of the shift in fasting
490	69	0/99063	0/25827	75	beginning of the shift in fasting

In the following table, we showed that insignificance of gender on cortisol secretion level.

Table-12: descriptive statics on effects of gender of the participants in secretion of salivary cortisol

Number	Standard deviation	mean	gender	situation and shift
53	0/97972	0/32806	female	End of the shift in feeding
22	0/104400	0/33109	male	
75	0/99196	0/32895	total	
53	0/118438	0/32853	female	beginning of the shift in feeding
22	0/89196	0/37232	male	
75	0/111883	0/34137	total	
53	0/120112	0/20894	female	End of the shift in fasting
22	0/110766	0/22418	male	
75	0/116912	0/21341	total	
53	0/101786	0/26066	female	beginning of the shift in fasting
22	0/94220	0/25250	male	
75	0/99063	0/25827	total	

The following table shows the descriptive statistics of hospital type on Saliva cortisol separation of cases.

Table-13: non-significant effects of gender on secretion of salivary cortisol in participants

significance	frequency	Median	Degree of freedom	Type of both gender	source
000	736/965	23/474	1	23/474	acceptance
673	.180	0/006	1	0/006	gender
		0/32	78	2/484	error

In the following table, we showed the significance of the discordance effect of hospital type on cortisol secretion.

Table-14: descriptive statics on effects of hospital on salivary cortisol secretion of participants

number	Standard deviation	Mean	hospital	situation and shift
46	0/81992	0/37628	Amiralmomenin	End of the shift in feeding
29	0/75373	0/25386	Abozar	
75	0/99196	0/32895	total	
46	.0/85437	0/39409	Amiralmomenin	beginning of the shift in feeding
29	0/98950	0/25776	Abozar	
75	0/111883	0/34137	total	
46	0/123588	0/25411	Amiralmomenin	End of the shift in fasting
29	0/67378	0/14886	Abozar	
75	0/116912	0/21341	total	
46	0/100821	0/28630	Amiralmomenin	beginning of the shift in fasting
29	0/79116	0/21379	Abozar	
75	.0/99063	0/25827	total	

Table-15: significant difference between hospitals on cortisol secretion

significance	Degree of freedom	Standard deviation	number	Both hospitals	source
000	1/2593	23/987	1	23/987	source
000	52/682	1/004		1/004	Type of hospital
		19/0	78	1/486	error

Here, to compare the exclusion criteria in pairs (cortisol secretion mean), we used paired t-tests.

Table-16: significant connection between secretion of cortisol and fasting or feeding at the beginning of shift (before noise)

Standard error	Standard deviation	number	mean	Situation
0/12919	111883	75	0/34137	beginning of the shift in feeding
0/11439	0/99063	75	0/25827	beginning of the shift in fasting

Table-17: significant connection for secretion of cortisol at the beginning and ending of shift (before and after noise)

	Mean	number	Standard deviation	Standard error
Group 1	0/25825	75	0/9903	0/1145
Group 2	0/21341	75	0/1169	0/1356

	mean	Standard deviation	Standard error	Margin of safety 95 %		T-test	Degree of freedom	significance
				down	up			
Beginning of the shift.	/831070	124743	0/14404	/544060	111807	/7705	74	0.000

	mean	Standard deviation	Standard error	Margin of safety 95%		T-test	Degree of freedom	significance
				down	up			
End of the shift	0/44853	0/95154	0/10987	0/22960	0/66746	4/082	74	0.000

Table-18: significant connection for secretion of cortisol at the beginning of the shift

							shift
significance	Degree of freedom	T-test	Margin of safety 95%		Standard error	Standard deviation	Mean	Beginning of the shift
			down	up				
0/00	74	/7705	111807	544060/	/144040	124743	831070/	

Table-19: significant connection for secretion of cortisol at the end of the shift

								shift
significance	Degree of freedom	T-test	Margin of safety 95%		Standard error	Standard deviation	Mean	End of the shift
			Down	up				

0.000	74	/082 4	/66746 0	/22960 0	0/10987	0/95154	/44853 0	

Table-20 significant difference between fasting and feeding at the beginning and ending of shift

mean	Number	Standard deviation	Standard error
0/346	75	0/111	0/129
0/328	75	0/991	0/114

						T-test	Degree of freedom	significance
	mean	Standard deviation	Standard error	Margin of safety 95%				
				down	up			
Beginning of the shift	0/12427	116749	0/13481	-0/14435	0/39288	922	74	360

Table-21 : non- significant difference between feeding at the beginning of the shift

								shift
significance	Degree of freedom	T-test	Margin of safety 95%		Standard error	Standard derivation	Mean	Beginning and end of the shift
			low	high				
360	74	922	392880/	/14435 -0	/13481 0	116749	124270/	

Table-22: significant difference between fasting and cortisol secretion confronting to noise while working

Standard error	Standard derivation	number	mean	Situation
0/136	0/1162	75	.0/213	Fasting while working
.0/1146	0/996	75	0/3286	Feeding while working

Table-23: significant difference between fasting and cortisol secretion confronting to noise at the beginning of the shift

							shift
significance	Degree of freedom	T-test	Margin of safety 95%		Standard error	Standard derivation	Mean	Beginning of the shift
			dow	Up				

			n					
000	74	/640 7	/854 0	- . /1456 0	.0/1522	0/1309	/11533 0	

Table-24: summary results of 4 cortisol level test in starvation and feeding

P in t-test	Margin of safety 95%difference	Mean after confronting noise	Mean before confronting noise	
0/36	0/01 -0/04	0/33	0/34	Cortisol level in feeding
0.00	0.07-0.02	0.21	0.26	Cortisol level in fasting

Table-25: summary results of 4 cortisol level test before and after noise

P in t-test	Margin of safety 95%difference	Mean in fasting	Mean in feeding	
0.00	0.11-0.05	0.26	0/34	Cortisol level before confronting noise
0.00	0/15 -0/09	0.21	0/33	Cortisol level after confronting noise

4)discussion and conclusion

Discussion

- Analyzing the data of evaluation of noise in the hospital environment and equivalent exposure level and sound effect index.

In this study, the noise measuring used for determining noise exposure level, noise equivalent level and sound effect index in different departments of Amiralmomenin and Abozar hospitals in 24 and 14 departments, respectively. we concluded that departments with higher noise pollution like powerhouse installation, garbage obliteration system which has industrial instruments and equipments, departments such as emergency ward and paediatric ward that have lots of patients and also lots of visitors and staff conversation, restlessness, patients and injured people wailing because of pain, ventilation system and air conditioner sound, hospital amplifier sound and phonetic system and medical equipments, had higher noise pressure and sound effect index from other departments.

In Karimi et al. study, as "noise pollution in different wards of Golestan and Fatemeh Zahra hospitals" the maximum noise pressure level was related to emergency ward that was due to conversations, ventilation system, different medical equipment usage which the results are consistent with our data (30). In another study Sadeghi et al. analyze the noise pollution in two elected hospitals in mashhad, the results match with our data (42).

- Analyze the blood pressure test, heartbeat, blood oxygen concentration percent in cases.

In this part of study, we measured blood pressure (maximum and minimum), heartbeat rate, blood oxygen concentration percentage of the people elected for study (75 people) from the mentioned hospitals who were exposed to noise pollution and showed that the noise could have made changes in these factors. totally, noise has a direct influence on cardiovascular and respiratory systems.

In the investigation of Salami et al. in Nigeria (Noise exposure as a factor in the increase of blood pressure of workers in a sack manufacturing industry department of mechanical engineering), showed that noise exposure causes increased systolic and diastolic blood pressure (24). Besides that, Shahid Mohammad et al. in another study as "Nuisance caused by aircraft noise in the vicinity of Tehran international airport", proved that several noise exposures have direct effects on blood pressure (systolic and diastolic), heartbeat rate and oxygen concentration percentage in cases that was compared to our results and matched with them (5).

- Analyze the other effects of noise on the general health situation of cases.

We used 28 test Goldberg questionnaires for 75 elected persons. 62 cases had no signs, 10 cases mild signs and 3 cases had moderate signs. The data revealed that 2 cases with moderate signs were worked in facilities and emergency wards which have the most noise pollution compared to other hospital departments. Also, the data showed that gender had no effect on the case's general health. In another word, the difference between gender and noise effect is insignificant. ($p=0.39$)

Abbasi et al. in the study "Evaluation of the electrolyzer noise on general health of wind farms staff" revealed that equivalent sound level had significant relation with all general health dimensions except the depression (43) that this results, matches with our data of our 2 cases study with moderate signs who worked in emergency and facility developments which have the most noise effects. In another study by Zamanian et al. as "evaluation the effects of workplace noise exposure on staff's general health of the steel industry". It was demonstrated that noise exposure has a significant and direct effect on the general health situation of some staff in the mentioned industry (44) and this data matched with our results.

- Analyze the cortisol level of hospital staff in two fasting and feeding situations at the beginning and the end of the workshift.

At last, we sampled the saliva in order to extract cortisol in two fasting and feeding situations at the beginning and end of the workshift. The results revealed that the cortisol secretion in every situation except feeding, has significant differences with noise.

Person et al. showed that stress and noise exposure at work had an effect on salivary cortisol that matched results (35). Mickey et sl. showed that noise

exposure in the workplace causes significant increases in cortisol amount and concentration in saliva (45) that match our results.

Margeoz et al. examined the fasting effects in cortisol, blood glucose, liver and muscle glycogen of Rhamadia fish. The results showed that 7,14 and 21 fasting periods increased the cortisol level compared to the control group (37). That would prove our results, significantly.

In another study in Sweden by Wayne et al. It was revealed that low frequency sound exposure at night could affect the cortisol impression on awakening and also low saliva cortisol levels after awakening has a significant relation with sleep quality (46).

4-2) conclusion

In this study of noise and fasting simultaneous exposure on saliva cortisol level of Hospital Staff, we concluded that there is a significant difference between feeding and noise exposure in workplaces with cortisol secretion. In another word, the direct effect of sound pressure level on cortisol secretion and increased cortisol levels in fasting was seen contrary to feeding. Increasing the sound pressure level on the study hospitals different departments, noise direct effect on the staff general health and sound effect index on staff was proved. Besides that, the staff hospital type has a significant effect on cortisol secretion and increased stress in the same way. Indeed, by considering the cares and environment controlling, we could diminish the related effects.

According to the studies, we could conclude that noise exposure, especially in places with higher noise pollution, could approve this relationship. As it was showed, with managing and engineering control executions, the effect of noise and stress because of cortisol secretion on the staff is decreased.

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