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MESLEKİ GÜRÜLTÜYE MARUZ KALAN İŞÇİLERDE UYKU KALİTESİ YAŞAM KALİTESİNİ ETKİLER Mİ?

DOES SLEEP QUALITY AFFECT QUALITY OF LIVES OF THE WORKERS EXPOSED TO OCCUPATIONAL NOISE?

Nuray BAYAR MULUK*, Ömer OĞUZTÜRK, Osman Kürşat ARIKAN***, Oğuzhan DİKİCİ******

ARAŞTIRMA

ÖZET

Amaç: Mühimmat Fabrikası'ndaki işçilerde, mesleki gürültünün uyku kalitesi ve yaşam kalitesi (QOLs) üzerindeki etkilerini araştırdık.

Hastalar ve Yöntemler: Mesleki gürültüye maruz kalan 39 erkek işçi, çalışma grubunu oluşturmuştur. 39 sağlıklı erkek, kontrol grubuna dahil edilmiştir. Uyku kalitesi ve QOL, sırası ile Mini Uyku Anketi (MSQ) ve SF-36 anketi kullanılarak değerlendirilmiştir.

Bulgular: Tüm MSQ başlıkları, uyku ilacı (SM) kullanımı hariç, çalışma ve kontrol gruplarında yüksek olarak bulunmuştur. Kötü uyku kalitesi, SF-36 skorlarında azalmaya neden olarak, işçilerin yaşam kalitelerinde azalmaya yol açmıştır. Uykudan uyanma ve kronik yorgunluk, daha düşük mental ve emosyonel QOL skorlarına yol açarken; sabah yorgunluğu, QOL değerlerinde, daha düşük fiziksel sağlık değerleri ile sonuçlanmıştır.

Sonuç: Çalışma ve kontrol gruplarının her ikisinde de, uyku ve yaşam kalitesi farklı bulunmadığından, aynı gruplar üzerinde daha farklı parametrelerle, yeni bir çalışma yapılması gerektiği ortaya çıkmıştır. Gürültünün tek başına uyku ve yaşam kalitesini etkileyen majör bir faktör olmadığı söylenebilir.

Anahtar kelimeler: Mesleki gürültü, uyku kalitesi, Mini Uyku Anketi (MSQ), SF-36 Sağlık Taraması, yaşam kalitesi (QOL).

RESEARCH

ABSTRACT

Aim: We investigated the effects of occupational noise on sleep quality and quality of lives (QOLs) of the workers in an Ammunition Factory.

Patients and Methods: Thirty-nine male workers exposed to occupational noise constituted the study group. Thirty-nine healthy male subjects were included into the control group. Sleep quailty and QOL were evaluated using the Mini Sleep Questionnaire (MSQ) and SF-36 questionnaire respectively.

Results: All the items of MSQ, except sleep medication (SM) usage, were found higher in the study and control groups. Poor sleep quality caused a decrease in the scores for SF-36 items and reduced the QOL of the workers. Sleep awakenings and chronic fatigue leads to lower mental and emotional QOL scores, whereas morning fatigue results in lower physical health related QOL scores.

Conclusion: As no significant differences was present between sleep and quality of lives of the study and control groups, it was concluded that a new study should be done on the same groups with different parameters. It may be sait that noise alone is not a major factor, affecting sleep and quality of life.

Key words: Occupational noise, sleep quality, Mini Sleep Questionnaire (MSQ), SF-36 Health Survey, quality of life (QOL).

INTRODUCTION

Noise is one of the commonest physical stressors to which industrial workers are exposed (1). Many occupations involve workers being subjected to loud noise levels without adequate protective measures (2). Generation of noise should be minimized by technical methods, and exposure to noise, by personal protection. The most important aural effect of noise on health is the occupational hearing loss. The methods for occupational medical check-up are important to prevent and decrease the incidence of occupational hearing loss (3).

The effects of noise on health can be divided into aural effects and extra aural effects. Extra aural noise effects mainly originate from the environment (traffic

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İletişim:

Dr. Nuray Bayar Muluk
Birlik Mahallesi, Zirvekent 2. Etap Sitesi, C-3 blok, No: 62/43, 06610 Çankaya / ANKARA / TURKEY
Tel: +90 312 4964073 , +90 532 7182441 **Fax:** +90 318 2252819 **E-mail**: nbayarmuluk@yahoo.com, nurayb@hotmail.com

1) Professor, Kırıkkale University, Faculty of Medicine, ENT Department
2) Assistant professor, Kırıkkale University, Faculty of Medicine, Psychiatry Department
3) Associate professor, Kırıkkale University, Faculty of Medicine, ENT Department
4) Doctor, Kırıkkale University, Faculty of Medicine, ENT Department

noise, construction noise on building sites). The objectivation and quantification of extra aural effects of noise on health is very difficult because there exist a lot of disturbing factors (3).

Exposure to noise causes physiological and psychological effects in an individual. The non-auditory adverse effects of occupational noise exposure on cardiovascular functions (4), breathing, sleep, and physical and mental health (5) are a serious cause for concern (6).The disturbance of sleep is a major problem area in noise pollution. Extensive laboratory tests using multichannel electroencephalograms (EEG) have been carried out by many researchers to determine the general response of people when exposed to noise during sleep. In the home experiments, using a simplified one-channel EEG, the subjects appeared to be approximately 10 dB less sensitive to noises than laboratory subjects for similar noise exposure were. There also appeared to be some adaptation to the noise exposure (7).

Noise acts by means of the ear on the central and autonomous nervous systems. When this stimulus is over determined limits, it provokes deafness and has pathological effects, both instantaneous and varied, on both nervous systems. At much lower levels, noise produces discomfort, diminishes attention, or impedes communication, concentration, and sleep; noise reduces school or professional performance, increases the possibility for antisocial behavior, and can lead to a loss in the value of a building or cause accidents in the work place (8).

Occupational noise exposure may affect sleep qualities and QOLs of the workers. In the literature, there are few studies on this issue. Thus, the present study was undertaken to evaluate the sleep qualities and QOLs of the workers exposed to occupational noise in an Ammunition Factory by applying Mini Sleep Questionnaire (MSQ) (9) and SF-36 Health Survey (10) respectively. The study also investigated the relationship between sleep qualities and QOLs of the workers, aiming to evaluate the factors involved in maintaining and increasing work efficiency.

PATIENTS AND METHODS

This prospective study was carried out in the Ear Nose Throat (ENT) and Psychiatry Departments of Kırıkkale University, Faculty of Medicine.

Subjects

The study involved workers exposed to noise during work in an Ammunition Factory in Turkey. The workers who were not exposed to occupational noise in an Ammunition Factory, were not included into the study group. Thirty-nine male workers were included in the study and their written informed consent to participate in the study was obtained. Subjects worked at an Ammunition Factory for 19.48±7.32 years (Range: 6-30 years). The mean daily noise exposing time was 6.43±2.43 hours (Range: 2-9 hours) daily. The mean age of the workers was 43.76±6.81 years (Range: 28-53 years). The workers were evaluated by periodic health check-up in the factory. The noise level in the factory was measured, and the map of the noise level for all the departments in the factory was produced. Noise levels varied between 70 dB and 100 dB. There were no ototoxic chemical exposures in the factory medium. The workers were instructed to wear hearing protection devices (protective ear headings or earplugs).

The control group consisted of 39 healthy male subjects. They were not exposed to noise during their work-life; and they did not work in an Ammunition Factory. They were government employee, retired persons, workers who worked at different non-noisy places except Ammunition Factory. Their mean age was 42.10±8.38 years (Range: 26-66 years).

None of the patients in the study and control group had a history of head trauma or any symptoms and findings of the infectious ear diseases at the time of the study. None reported obstructive sleep apnea and known psychiatric diseases. Sosyoechonomic levels of the study and control groups were similar and there were no extreme cases in both groups. One to one matching were not done about sosyoechonomic status between two groups. Because the jobs are different in both groups. The major differency of involving criteria was exposing to the occupational noise (Study group) or not (Control group).

Instrumentation

1. Questionnaire: A history of occupational noise exposure and total noise exposure time (years); the complaints of the subjects (hearing loss, tinnitus, vertigo, earache, fullness of the ear, etc.); the usage of the hearing protection devices (protective ear headings or earplugs) (never, rare, often, always); smoking status (current, past or never) were evaluated.

2. Mini Sleep Questionnaire (MSQ): A 10-point Mini Sleep Questionnaire (MSQ) was completed focusing specifically on the sleep complaint. This consisted of questions about fatigue, daytime sleep, restless sleep, sleep medications, and other factors disturbing or affecting sleep. The items on sleep quality were indicated

on a frequency scale of 1-7 (1=never, 4=sometimes, 7=always). The mean scores in normal sleepers across different age groups were 2.1-2.5 with standard deviation of 1.3 or 1.4. The items of 10-point MSQ are:1-Sleep delay (SD), 2-Sleep awakenings (SA), 3-Sleep medications (SM), 4-Daytime sleep (DS), 5-Morning fatigue (MF), 6.Habitual snoring (HS), 7-Morning-awakening (MA), 8-Morning headache (MHMSQ), 9-Chronic fatigue (CF) and 10-Restless Sleep (RS) (9).

3. The SF-36 Health Survey: The SF-36 Health Survey (10) is a multi-item global assessment of patient function that assesses eight health concepts including:

1. Physical functioning (10 items) (PF),
2. Role limitations due to physical problems (four items) (RP),
3. Social functioning (two items) (SF),
4. Bodily pain (two items) (BP),
5. General mental health (five items) (MHSF-36),
6. Role limitations due to emotional problems (three items) (RE),
7. Vitality (four items) (VT)
8. General health perceptions (six items) (GH).

Each scale yields a score of 0-100, with lower scores reflecting greater limitations in function. If the patient consented to participate in the study, a questionnaire form was given to him/or her and the same physician informed the patient for filling the form. The questionnaire was filled out by hand.

Method

All the patients included in the study were evaluated through a questionnaire form and Mini Sleep Questionnaire (MSQ); QOL of the workers were determined using SF-36 Health Survey.

All the steps of the study were planned and continued according to the principles outlined in the Declaration of Helsinki (11).

Statistical analysis: Statistical package for SPSS (Version 8.0) was used for statistical evaluation. The difference between age, each of the MSQ results (SD ,SA,SM,DS,MF,HS,MA,MHMSQ,CF,RS), and each of the SF-36 Health Survey results (PF, RP, SF, BP, MHSF-36, RE, VT, GH) of the study (occupational noise exposed group) and control groups were analyzed by "Student-t Test".

For the study group, effects of each of the MSQ findings on each of the SF-36 Health Survey items were analyzed by "Linear Regression Analysis".

p value < 0.05 was considered statistically significant.

RESULTS

Age, MSQ and SF-36 Health Survey Results of the study and control groups are demonstrated in Table 1 and Figures 1 and 2.

The differences between age, each of the MSQ results (SD, SA, SM, DS, MF, HS, MA, MHMSQ, CF, RS), each of the SF-36 Health Survey results (PF, RP, SF, BP, MHSF-36, RE, VT, GH) of the study (occupational noise exposed group) and control groups were analyzed by "Student-t Test"; and except for RE (p=0.025), no significant differences were found (p>0.05).

For the study group, effects of each of the MSQ results on each of the SF-36 Health Survey items were analyzed by "Linear Regression Analysis" (See Table 2). The results of "Linear Regression Analysis" were listed below:

- As the SD increased, PF, RP, MHSF-36, VT and GH decreased.
- As the SA increased, RP and SF decreased.
- As the SM increased, PF, RP, SF, BP, VT and GH decreased.
- As the DS increased, RP, SF, MHSF-36, RE and GH decreased.
- As the MF increased, PF and GH decreased.
- As the HS increased, SF, MHSF-36, RE, VT and GH decreased.
- As the MA increased, PF, RP, SF, BP, MHSF-36, VT and GH decreased.
- As the MHMSQ increased, PF, BP, MHSF-36, RE and VT decreased.
- As the RS increased, PF, RP, MHSF-36, VT and GH decreased.
- The results of the Linear Regression Analysis may be evaluated as:
- General health perceptions (GH) were negatively affected by sleep parameters of SD, SM, DS, MF, HS, MA, and RS.
- Vitality (VT) was negatively affected by sleep parameters of SD, SM, HS, MA, MHMSQ, CF, and RS.
- Role limitations due to emotional problems (RE) were negatively affected by sleep parameters of DS, HS, MHMSQ and CF.
- General mental health (MH) was negatively affected by sleep parameters of SD, DS, HS, MA, MHMSQ and RS.
- Bodily pain (BP) was negatively affected by sleep parameters of SM, MA, and MHMSQ.

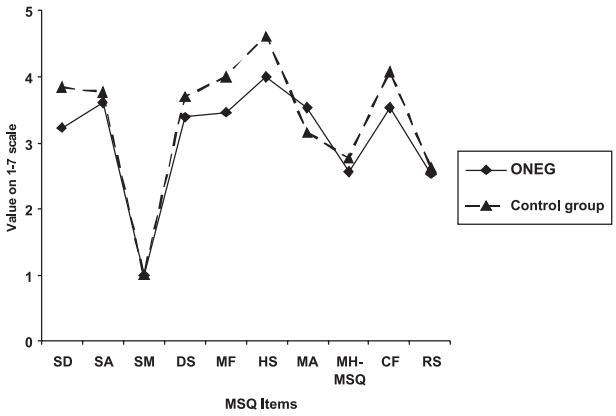

Figure 1- MSQ results of the occupational noise exposed group (ONEG) and control group*
*SD: Sleep delay, SA: Sleep awakenings, SM: Sleep medications, DS: Daytime sleep, MF: Morning fatigue, HS: Habitual snoring, MA: Morning-awakening, MHMSQ: Morning headache, CF: Chronic fatigue, RS: Restless Sleep.

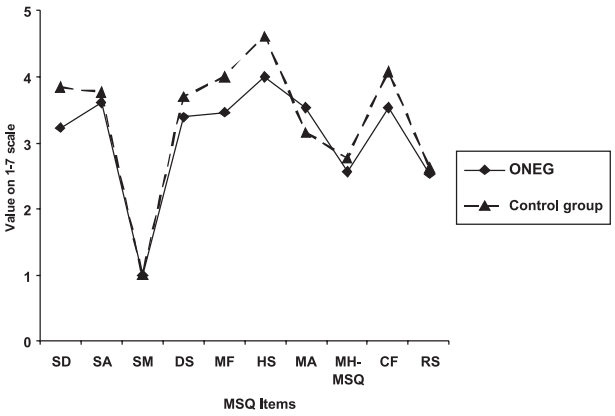

Figure 2- SF-36 Health Survey Results of the Occupational Noise Exposed Group and Control Group*
* For RE domain, statistically significant difference was found by "Student-t Test".
PF: Physical functioning, RP: Role limitations due to physical problems, SF: Social functioning, BP: Bodily pain, MH: General mental health, RE: Role limitations due to emotional problems, VT: Vitality, GH: General health perceptions.

Table 1- Age, MSQ and SF-36 Health Survey Results of the Occupational Noise Exposed Group (ONEG) and Control Group

	Groups							
	ONEG (n=39)				Control (n=39)			
	Mean	St.Dev -	Minimum	Maksimum	Mean	St.Dev -	Minimum	Maksimum
Age	43.76	6.81	28.00	53.00	42.10	8.38	26.00	66.00
MSQ Items*								
SD	3.23	1.64	1.00	7.00	3.84	1.81	1.00	7.00
SA	3.61	1.71	1.00	7.00	3.76	1.59	1.00	7.00
SM	1.00	0.00	1.00	1.00	1.00	0.00	1.00	1.00
DS	3.38	1.22	1.00	4.00	3.69	1.50	1.00	7.00
MF	3.46	1.35	1.00	7.00	4.00	1.53	1.00	7.00
HS	4.00	1.94	1.00	7.00	4.61	1.71	1,00	7,00
MA	3.53	1.75	1.00	7.00	3.15	2.05	1.00	7.00
MH	2.56	1.99	1.00	8.00	2.76	1.49	1,00	4,00
CF	3.53	1.75	1.00	7.00	4.07	1.61	1.00	7.00
RS	2.53	1.80	1.00	7.00	2.61	1.80	1.00	7.00
Results of the SF-36**								
PF	83.07	20.05	20.00	100.00	86.41	20.42	15.00	100.00
RP	82.69	30.43	.00	100.00	78.84	34.66	0.00	100.00
SF	83.97	17.66	37.50	100.00	77.82	27.22	0.00	100.00
BP	80.00	18.25	35.00	100.00	74.93	23.72	10.00	100.00
MH	74.87	13.20	32.00	100.00	69.43	23.27	12.00	100.00
RE	95.72	11.29	66.66	100.00	82.90	33.22	0.00	100.00
VT	69.61	18.07	25.00	100.00	66.02	24.66	5.00	100.00
GH	65.36	18.56	16.66	91.66	65.68	17.44	32.50	91.66

*SD: Sleep delay, SA: Sleep awakenings, SM: Sleep medications, DS: Daytime sleep, MF: Morning fatigue, HS: Habitual snoring, MA: Morning-awakening, MH^{MSQ}: Morning headache, CF: Chronic fatigue, RS: Restless Sleep.
** PF: Physical functioning, RP: Role limitations due to physical problems, SF: Social functioning, BP: Bodily pain, MH: General mental health, RE: Role limitations due to emotional problems, VT: Vitality, GH: General health perceptions.

Table 2- In the occupational noise exposed group, Linear Regression Analysis results about effects of each of the MSQ items on SF-36 Survey Results

MSQ	SF-36 Survey Results*															
Items*	PF		RP		SF		BP		MH^{SF-36}		RE		VT		GH	
	Beta	p	Beta	p	Beta	p	Beta	p	Beta	p	Beta	p	Beta	p	Beta	p
SD	-0.402	0.105	-0.143	0.571	0.109	0.660	0.007	0.978	-0.170	0.462	0.401	0.060	-0.300	0.199	-0.196	0.453
SA	0.121	0.503	-0.054	0.774	-0.095	0.606	0.013	0.943	0.196	0.254	0.410	0.012	0.174	0.312	0.050	0.794
SM	-0.231	0.227	-0.084	0.669	-0.147	0.450	-0.256	0.180	0.025	0.889	0.318	0.055	-0.050	0.781	-0.348	0.094
DS	0.041	0.858	-0.143	0.553	-0.076	0.748	0.106	0.646	-0.232	0.295	-0.014	0.945	0.122	0.580	-0.092	0.710
MF	-0.186	0.300	0.170	0.363	0.315	0.091	0.247	0.170	0.105	0.535	0.340	0.031	0.038	0.824	-0.117	0.540
HS	0.079	0.697	0.120	0.568	-0.167	0.420	0.168	0.404	-0.275	0.157	-0.223	0.200	-0.032	0.869	-0.052	0.812
MA	-0.496	0.018	-0.370	0.084	-0.297	0.155	-0.260	0.198	-0.278	0.150	0.233	0.179	-0.139	0.468	-0.102	0.636
MH^{MSQ}	-0.021	0.930	0.105	0.675	0.069	0.778	-0.241	0.316	-0.021	0.925	-0.462	0.030	-0.086	0.704	0.085	0.741
CF	0.291	0.192	0.339	0.146	0.007	0.976	0.110	0.615	0.073	0.725	-0.322	0.093	-0.384	0.074	0.126	0.594
RS	-0.402	0.105	-0.143	0.571	0.109	0.660	0.007	0.978	-0.170	0.462	0.401	0.060	-0.300	0.199	-0.196	0.453

* PF: Physical functioning, RP: Role limitations due to physical problems, SF: Social functioning, BP: Bodily pain, MH: General mental health, RE: Role limitations due to emotional problems, VT: Vitality, GH: General health perceptions.

**SD: Sleep delay, SA: Sleep awakenings, SM: Sleep medications, DS: Daytime sleep, MF: Morning fatigue, HS: Habitual snoring, MA: Morning-awakening, MH^{MSQ}: Morning headache, CF: Chronic fatigue, RS: Restless Sleep.

- Social functioning (SF) was negatively affected by sleep parameters of SM, DS, HS, and MA.
- Role limitations due to physical problems (RP) were negatively affected by sleep parameters of SD, SA, SM, DS, MA, MHMSQ and RS.
- Physical functioning (PF) was negatively affected by sleep parameters of SD, MF, MA, MHMSQ and RS.

DISCUSSION

Loud noise has been shown to evoke physical, psychosocial, and behavioral responses in animals and human beings (2, 12). Many workers complain of symptoms associated with a non-specific generalized stress response, including disturbed sleep. However, industrial workers may be exposed to more than one source of stress, and it is not possible to completely attribute the disturbed nocturnal sleep and changes in heart rate to the effects of loud noise alone (1).

In the literature, in subjects exposed to continuous occupational background noise, all night sleep polysomnography was done; and in the morning, subjects rated their quality of sleep on a Visual Analogue Scale. There is a strong association between occupational exposure to loud noise and poor sleep efficiency. The group exposed to noise for 1-2 years had a decrease in Total Rapid Eye Movement Time, Non Rapid Eye Movement Time, Slow Wave Sleep Time, Sleep Onset Latency, and Total Sleep Time. Workers exposed to loud background occupational noise are at an increased risk of having poor quality sleep but adaptation to this effect probably takes place after a few years (2).

Rojas-González et al (13) investigated the effects of environmental noise in the serum cortisol levels pre and post journal labor and the presence of non-auditory manifestations in workers of a brewer industry. The levels of noise were > 85 dB in all the workstations studied. There was not a significant relationship between the intensity of the noise in the workstations and the levels of serum cortisol.

Literature reveals some studies on sleep quality and noise exposure. However, no detailed studies investigating sleep problems due to occupational noise and its effects on the QOLs of workers have been conducted to date. In the present study, the relationship between sleep quality and QOLs of the workers exposed to occupational noise was investigated by using Mini Sleep Questionnaire (MSQ) (9) and SF-36 Health Survey (10).

The results of the study indicated that all the items of 10-point MSQ, except SM, were higher than the nor-

mal limits of the mean scores in normal sleepers across different age groups (2.1-2.5 with standard deviation of 1.3 or 1.4) (9) in the study and control groups. Sleep delay, sleep awakenings, daytime sleep, morning fatigue, habitual snoring, morning-awakening, morning headache (MHMSQ), chronic fatigue and restless sleep items were increased in the group exposed to occupational noise and in the control group. However, there were no statistically significant differences between the scores of the study and control groups for MSQ items. Thus, it can be said that sleep quality is not in normal limits in the group exposed to occupational noise and the control group. This may have been associated with age.

In the literature, sleep quality of elderly people has been shown to progressively change due to general aging processes. In this population, a high prevalence of excessive daytime sleepiness, insomnia, nighttime awakenings, snoring, restlessness and periodic leg movements during sleep were found (14). Similarly, the subjects in both of our groups were not of young population.

In our study, QOLs of the study and control group were analyzed. Except RE ($p=0.025$), no significant differences for SF-36 survey items were found ($p>0.05$). Value of the role limitations due to emotional problems in the study group was higher than in the control group.

In the present study, physical health related SF-36 items (General health perceptions, role limitations due to physical problems, physical functioning and bodily pain) were negatively affected by sleep delay, sleep awakenings, sleep medications, daytime sleep, morning fatigue, habitual snoring, morning-awakening, morning headache and restless sleep. SF-36 items related to mental and emotional status (Vitality, role limitations due to emotional problems, general mental health and social functioning) were negatively affected by sleep delay, sleep medications, daytime sleep, habitual snoring, morning-awakening, morning headache, chronic fatigue, and restless sleep.

It has been reported that poor sleepers are more likely to take sick leave, suffer from poor physical and psychological health, and have problems in occupational activities and personal relationships (15), as was in our study. Thus, the results of our study have demonstrated the relationship between sleep quality and QOLs of the workers in a more detailed manner.

The most strongly associated factor underlying poor sleep quality was perceived stress, followed by job dissatisfaction, being unmarried, poor bedroom environment, lower academic attainment, younger age, and hypertension. It is suggested that the cost related to poor sleep quality is extremely high. Comprehensive counter measures against poor sleep quality need to be considered at not only the individual but also the organizational and societal levels for both employees and employers to ensure health, safety, and productivity (15).

Rios and Da Silva (16) investigated the effect of chronic workplace exposure to excessive noise on sleep quality. All the subjects were interviewed and submitted to physical examination, pure tone and speech audiometry, immittance testing, and nocturnal polysomnography. Their results showed that active men working 40 hours a week in the presence of excessive noise without adequate protection for more than eight years presented with noise-induced hearing loss, but their quality or quantity of night sleep was unaffected. Sensory-neural deafness may represent an element of adaptation against noise during sleep.

Patients with cognitive dysfunctions showed less difficulty in falling asleep and fewer nighttime awakenings; they snored less frequently and were the only ones to present enuresis and to fall off the bed. Moreover, patients with cognitive impairment presented excessive daytime sleepiness with variable intensity and frequency. These results indicated significant differences in sleep disorders between healthy subjects and patients cognitively impaired (14).

In our study, it was observed that sleep quality of the workers, exposed to occupational noise, was not good. Poor sleep quality, demonstrated by higher scores for MSQ items, caused decreases in the scores for SF-36 items and reduced the QOLs of the workers. According to the results of the study, it can be said that sleep awakenings and chronic fatigue decrease only the mental and emotional QOL scores, whereas morning fatigue decreases especially physical health related QOL scores. The other MSQ items, except these ones, decrease QOL scores for both physical and mental and emotional ones.

Sleep quality is very important for all humans; workers exposed to occupational noise had poor sleep quality. There may be different causes of sleep problems, such as sleep hygiene and watched TV problems. General life qualities of the people may also affect sleep qualities.

As no significant differences was present between sleep and quality of lives of the study and control groups, it was concluded that a new study should be done on the same groups with different parameters. It may be sait that noise alone is not a major factor, affecting sleep and quality of life.

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