



Noise Pollution, Psychiatric Symptoms and Quality of Life: Noise Problem in the East Region of Turkey

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Aim: As to clinical examinations, predisposition to aggression and aggressive behavior among drivers are very high in Turkey. For this reason, direct correlation between the noise pollution and general psychological symptoms with quality of life in public transport drivers were investigated in this survey.

Material and Methods: Bus drivers of varying bus brands (F, O and P which has different noise levels) were subjected in this study. SCL-90-R and SF-36 questionnaire were used to assess the presence and severity of psychiatric symptoms and quality of life. Sound level meter (Smart Sensor AR844) was used for noise pollution measurements (dB(A)) within the buses and city main streets.

Results: According to the measurements; F, O and P brand buses average 65.16 dB(A), 70.86 dB(A) and 75.33 dB(A) noise produces respectively. Especially, P brand mini-bus drivers were found to have worked under continuously high noise (75.33 dB(A), average 11.22±3.86 hours daily). According to psychiatric SCL-90-R and SF-36 assessments, observed psychiatric symptoms were more pronounced between the high noise exposed group than other groups (P<0.001).

Discussion: In this survey, we observed that Psychologies and quality of life of bus drivers were affected by the noise pollution and noise pollution had cause to serious psychological symptoms on drivers such as anxiety, depression, hostility, etc., and noise had negative effects over the quality of life, particularly, when drivers were exposed for longer working periods and above certain values

Key Words: Noise Pollution; Work Place Safety; Psychological Symptoms; Quality of Life; Drivers.

Gürültü Kirliliği, Psikiyatrik Semptomlar ve Yaşam Kalitesi: Türkiye'nin Doğu Bölgesinde Gürültü Problemi

Amaç: Kliniksel bulgulara göre, agresyona yatkınlık ve agresif davranış Türkiye'de toplu taşıma sürücülerinde oldukça yaygındır. Bu sebeple, bu çalışmada, gürültü kirliliği ile psikolojik semptomlar ve yaşam kalitesi arasında doğrudan bir ilişki olup olmadığı toplu taşıma araç sürücülerinde araştırıldı.

Materyal ve Metod: Çeşitli marka ve model araçta (Farklı gürültü seviyelerine sahip P, O, F marka araçlar) çalışan araç sürücülerini bu çalışmaya alınmıştır. Sürücülerin psikiyatrik semptom ve yaşam kalitesi analizleri için SCL-90-R ve SF-36 analiz ölçekleri. Şehir içi ana caddelerde ve araçların içerisindeki gürültü seviyesinin belirlenmesinde gürültü seviye ölçüm cihazı (Smart Sensor AR844) kullanıldı.

Sonuçlar: Ölçümlere göre F, O ve P marka araçlar sırasıyla ortalama 65.16 dB(A), 70.86 dB(A) ve 75.33 dB(A) gürültü üretmektedirler. Özellikle P marka araç sürücülerini sürekli olarak yüksek gürültü altında çalıştırmaktadırlar (75.33 dB(A) ortalama 11.22±3.86 saat günlük). Psikiyatrik SCL-90-R ve SF-36 değerlendirmelerine göre gözlenen psikiyatrik semptomlar yüksek gürültüye maruz kalan çalışanlarda diğer iki gruba göre daha belirgindi (P<0.001).

Tartışma: Bu çalışma, toplu taşıma araç sürücülerinin psikolojilerinin ve yaşam kalitelerinin gürültü seviyesine bağlı olarak özellikle sürücüler yüksek düzeyde gürültüye maruz kalırlarsa etkilendiğini ve gürültü kirliliğinin anksiyete, depresyon, gibi ciddi psikolojik semptomlara yol açarak yaşam kalitesi üzerinde negatif etkiye sahip olduğunu ortaya koymuştur

Anahtar Kelimeler: Gürültü Kirliliği; İş Yeri Güvenliği; Psikolojik Semptomlar; Yaşam Kalitesi; Sürücüler.

Introduction

Noise is defined as unwanted sounds and is mainly produced by traffic, airplanes and factories. These

unwanted sounds can trigger cardiovascular, psychological, and psychoneuroendocrinological mechanisms depending on noise exposure duration and

noise intensity.^{1,2} Noise has been reported to lead to harmful effects by activating sympathetic nervous and endocrine systems, causing hypertension and elevation of blood lipid levels. A direct relationship has been reported between noise levels, increased noradrenaline levels and myocardial infarction.^{3,4}

In addition to causing cardiovascular diseases, excessive noise can cause psychological symptoms such as anxiety, restlessness, irritability, sleep disturbances and difficulty concentrating.^{5,6} In addition, noise can also reduce employee's morale, motivation and mental fatigue and can diminish job performance by causing impairment in decision-making. Furthermore, noise can lead to antisocial behavior such as nervousness and violence.⁵ Laboratory studies have demonstrated that high voice levels can reduce social interactions, verbal disinhibition and helping behavior, and can increase aggressive behavior.⁷⁻⁹

Genetically determined stress mechanisms can be changed by environment and experiences. A continuous sound impulse is filtered and interpreted by the cortical and subcortical brain circuits. The limbic system, hippocampus and amygdale structures play an important role in emotional processes in this circuit.¹⁰ Moreover, the auditory system has a close relationship with the autonomic nervous system and hypothalamus which regulates endocrine balances. The presence of noise has been shown to cause changes in blood flow, heart rate acceleration, and increased secretion of stress hormones such as cortisol, adrenaline and noradrenalin in laboratory studies.^{11,12} All of these data suggest a relationship between noise and psychiatric disorders. In addition, there are a few studies that reported a higher incidence of psychiatric illness in people living in areas exposed to loud noise.¹³⁻¹⁵

Transportation noise represents a large majority of external noise that affects people in large cities. Professional drivers are the highest risk group.¹⁶ Especially, workers health and occupational safety are often neglected in the Turkey. For this reason, in this study, we focused on levels of noise pollution in public transport vehicles and effects of noise over the quality of life and psychology of the drivers in Van City-Turkey.

Material and Methods

Subjects

This study was performed on 161 public transport vehicle drivers in Van City-Turkey. 74 F brand, 42 O brand and 45 P brand bus drivers were subjected in to the study.

Noise measurements

A sound level meter (Smart Sensor AR844) was used for noise pollution (dB(A)) measurements in buses and main city streets. Sound is a mechanical wave in which atoms and molecules transmit vibrational forces or pressure through matter (solid, liquid or gas). Like other waves, sound waves have velocity, frequency and amplitude. In humans, the lowest audible sound energy level is $I_0=10^{-12}$ dyne/cm² (0 dB) at 1000 Hz. The sound intensity level can be expressed as dB where $dB=10 \log (I/I_0)$. For this reason, there is a 10 fold difference between the 65-75 dB sounds, when evaluated in terms of the sound energy.

Group definition

Different noise levels were observed in the 3 different brands of midi-minibus (P, O and F brands). Driver groups were created according to the average level of noise. 45 driver from P, 42 drivers from O, and 74 drivers from F brand buses were subjected to the study (total of 161 public transport vehicle drivers, comprising 20% of all drivers in Van City-Turkey).

Symptom Checklist 90 Revised (SCL-90-R)

SCL-90-R and SF-36 scales were used to assess presence and severity of psychiatric symptoms and quality of life, respectively. The SCL-90-R by Derogatis has 90 multidimensional questions designed to screen for a broad range of psychological problems. Each of the 90 questions is rated from 0 (not at all) to 4 (extremely). The answers to these questions primarily identify nine symptoms- somatization, obsessive-compulsive, interpersonal sensitivity, depression, anxiety, anger- hostility, phobic anxiety, paranoid ideation and psychoticism.¹⁷

Short Form 36 (SF-36)

SF-36 (SF-36 Quality of Life Scale) is a scale that defines a person's quality of life. The defined nine parameters are physical functioning, social functioning, role limitations due to physical problems, role limitations due to emotional problems, mental health, vitality, bodily pain, general health and health changes in the past year. The scale was developed by the Rand Corporation in order to assess the quality of life.¹⁸

Statistical analysis

Descriptive statistics were presented as mean, standard deviation and minimum and maximum values. One-way ANOVA was used to compare F, O and P group means. Noise measurements within the buses were recorded more than three times and the Kruskal-Wallis

Test was performed on the measurements. The values were considered statistically significant at $P < 0.05$.

Results

In Van City-Turkey, we studied in three different mini-bus brands (F, O and P). Brand F bus had an average of 65.16 dB(A) noise, brand O had an average of 70.86 dB(A) noise and P brand bus had an average of 75.33 dB(A) noise ($P < 0.01$). Driver and passengers were exposed to these noise levels along travel. Brand P mini-bus drivers worked under the highest noise (75.33 dB(A); average 11.22 ± 3.86 hours daily) (Table 1b), (Figure 1). Max and Min value of noise and noise pattern in 3 different buses were quite different (Figures 2- 4).

While the difference between the maximum and minimum values of noise is low in F brand vehicles, these difference are very high in the O and P brand vehicles (Figures 2-4).

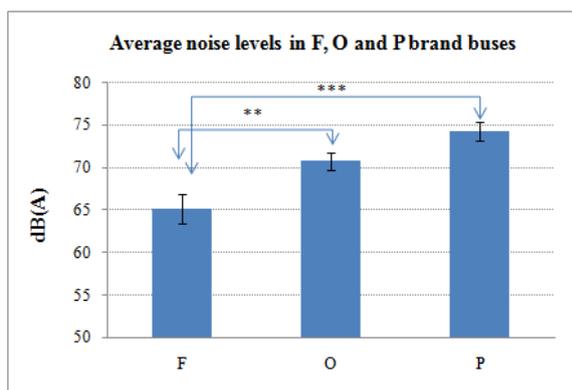


Figure 1. Noise levels were measured in the buses during the travel. ** $P < 0.01$, *** $P < 0.001$

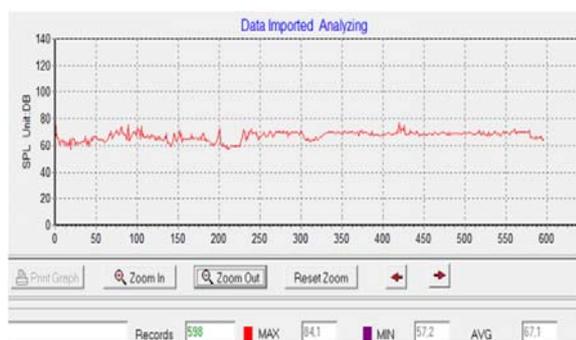


Figure 2. Sample of noise measurement in the F brand bus.

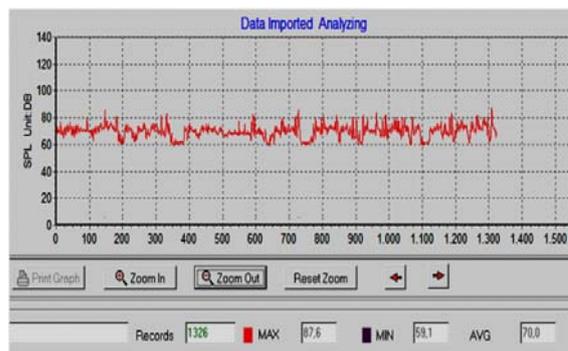


Figure 3. Sample of noise measurement in the O brand bus.

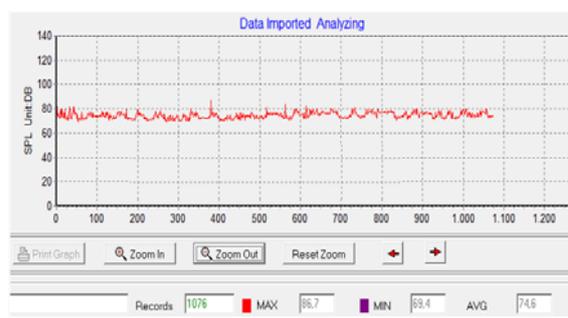


Figure 4. Sample of noise measurement in the P brand bus.

Average noise level around the urban area is about 50-60 dB(A), for this reason, lowest noise exposed bus driver group can be consider as control group.

According to SF-36 form evaluations, the quality of life of drivers exposed to high noise levels was decreased ($P < 0.01$) (Table 1a, Table 2). The SF-36 subscale scores indicated physical role limitations, emotional role difficulties, and pain and vitality (energy), were lower in P group drivers than in the F group. Pain and vitality (energy) were lower in the O group than the F group ($P < 0.05$) (Table 2).

According to the psychiatric SCL-90-R form analysis, observed psychiatric symptoms were more pronounced in the groups exposed to high noise levels than in the other groups (Table 2). All SCL-90-R subscale scores in the P group were higher than in the F group ($P < 0.001$). In the O group, psitotism, obsessive compulsive, interpersonal sensitivity, depression, anxiety and hostility scores were higher than in the F group ($P < 0.01$) (Table 3).

Quality of life and psychology of the drivers seems affected by the shape and level of noise.

Discussion

Despite the controversial results, previous studies have shown that noise can cause an increase in psychological stress and decrease in quality of life.¹⁹⁻²¹ In a study investigating the effects of noise on mental health in the Japan, 5963 people living in areas near the military airport were found to have an increased likelihood of mental instability and depressed mood if exposed to noise over 70 dB(A).²⁰ A relationship between noise,

irritability and mental health has not been observed in a similar study conducted on 6486 people.²¹ In these studies, it was demonstrated that mental health symptoms can be triggered by excessive noise.

Controversial results, neglected workers health and neglected occupational safety are encouraging us to work on environmental noise pollution detection and to define negative health effects in the Turkey.

In the light of previous experiences, this study was

Table 1a. Demographic properties of groups (P, O and F). Word similarity indicates to statistical similarity (a, b, ab).

d	P			O			F			P
	Mean	St.Dev	Min-Max	Mean	St.Dev	Min-Max	Mean	St.Dev	Min-Max	
Age	29,02 b	6,57	19-46	31,74 b	8,80	19-56	37,86 a	9,47	22-65	,001
Working Time (Year)	9,04 a	5,83	1-25	10,45 a	7,98	1-30	11,90 a	9,77	0,5-45	,196
Working Time (Daily hours)	11,22 a	3,86	3-18	10,52 a	3,61	2-20	4,70 b	3,63	1-15	,001

Table 1b. Measured noise levels in P, O and F brand buses (dB(A)).

Measured Noise dB(A)	P		O		F	
	Mean	St.Dev.	Mean	St.Dev.	Mean	St.Dev.
Measured Noise dB(A)	65,16	1,7	70,86	1,02	75,33	1,1

Table 2. Descriptive statistics of SF-36 form and comparison results for groups (P, O and F). Word similarity indicates to statistical similarity (a, b, ab).

	P			O			F			P
	Mean	St.Dev	Min-Max	Mean	St.Dev	Min-Max	Mean	St.Dev	Min-Max	
Physical Function	26,20 a	4,40	10-30	26,39 a	3,73	15-30	27,35 a	3,35	10-30	,203
Role Physical	5,98 b	1,69	4-8	6,83 a	1,81	4-10	6,77 a	1,63	4-8	,025
Role Emotional	4,16 b	1,31	3-6	5,19 a	1,35	3-9	5,11 a	1,34	3-9	,001
Social Function	7,05 a	1,81	3-10	7,25 a	2,10	3-10	7,74 a	1,66	4-10	,109
Pain	8,33 b	1,87	5-12	8,15 b	2,30	2-12	9,15 a	1,97	4-12	,018
Vitality (Energy)	14,24 b	2,80	8-21	14,98 ab	3,06	10-22	15,81 a	2,75	11-23	,015
Mental Health	19,87 a	4,23	10-28	20,05 a	3,74	7-28	20,69 a	3,25	13-27	,439
Common Health	19,46 a	4,56	11-28	20,59 a	4,60	10-29,4	20,61 a	4,37	11-30	,355

Table 3. Descriptive statistics of SCL-90-R form and comparison results for groups (P, O and F). Word similarity indicates to statistical similarity (a, b, ab).

	P			O			F			P
	Mean	St.Dev	Min-Max	Mean	St.Dev	Min-Max	Mean	St.Dev	Min-Max	
Somatization S.	1,07 a	,65	,08-2,75	0,89 ab	,68	,00-3,75	0,69 b	,44	,00-2,25	,002
Obsessive Compulsive S.	1,04 a	,67	,10-2,80	0,81 b	,43	,00-1,80	0,57 c	,38	,00-1,40	,001
Interpersonal Sensitivity S.	1,06 a	,51	,20-2,20	1,04 a	,50	,00-2,30	0,64 b	,36	,00-1,60	,001
Depression S.	0,84 a	,57	,00-2,38	0,69 a	,52	,00-1,85	0,46 b	,39	,00-1,62	,001
Anxiety S.	0,91 a	,62	,00-3,10	0,80 a	,63	,00-2,70	0,46 b	,40	,00-2,10	,001
Hostile S.	1,15 a	,78	,00-3,00	1,02 a	,72	,00-2,50	0,61 b	,52	,00-2,17	,001
Phobic Anxiety S.	0,55 a	,57	,00-2,00	0,44 ab	,42	,00-1,43	0,31 b	,37	,00-1,29	,021
Paranoid S.	1,04 a	,63	,00-2,33	1,00 ab	,49	,00-1,83	0,78 b	,59	,00-2,83	,031
Psikotizm S.	0,66 a	,40	,00-1,80	0,62 a	,46	,10-2,10	0,40 b	,39	,00-1,50	,001

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conducted on three different driver groups who they exposed to varying noise intensities. The F group drivers had exposed to an average of 65.16 dB(A) noise, the O group to 70.86 dB(A) noise and P group to 75.33 dB(A) noise. Psychological symptoms using the SCL-90-R and quality of life measurements using the SF-36 were assessed amongst the groups. Higher noise levels were correlated with an increase in psychiatric symptoms and decreases in the quality of life.

The SF-36 results indicated that pain scores were lower in the P group than in the F group. Emotional role difficulties were lower in the O group than in the F group.

All of the subscales of the SCL-90-R were statistically importantly higher in the P group than in the F group. Obsessive-compulsive, interpersonal sensitivity, depression, anxiety, hostility and psychoticism scores were higher in the O group than in the F group.

In terms of psychiatric symptoms, the maximum noise level more important factor than the average value of the noise was implied before.²²⁻²³ In a study conducted on 253 people in Belgrad about traffic noise, more fatigue, depression, irritability and headache complaints had been observed in people exposed to noise levels above 65 dB(A) compared to people exposed to under 55 dB(A) of noise.²² The subjects exposed to higher noise levels also had a longer duration of sleep entry, woke up at night more often, had a lower sleep quality and had fatigue after sleep more often. In a another study conducted on the effects of traffic noise on 366 women, noise exceeding 70 dB(A) was found to cause depression, fatigue and irritability.²³

Also the formation of psychiatric symptoms in response to high levels of noise has been reported previously.^{24,25} In a study that examined the relationship between noise sensitivity and psychiatric diseases, increased sensitivity was found to create a predisposition for minor psychiatric disorders.²⁵ According to this view, noise sensitivity is effective factor for effect of noise on degree of anger; however, this causal relationship is not completely solved. Van Kamp et al. did not find a strong correlation between noise sensitivity and anger but did find that the noise contributes to resentment. Irregardless of the noise level, higher anger scores were found in highly sensitive people.²⁶

In studies examining the relationship between noise and psychiatric disorders, increased use of sedative, antihypertensive and antisid drugs have been found in people living in areas with high noise.^{27,28} At the same time, these individuals have been identified more

frequently and referred to a family physician to prescribe psychiatric drugs.

In accordance with our results, some studies provide evidence that noise negatively affects mental health. In contrast, several studies have not shown a relationship between noise and psychological complaints. For example, in a study conducted on 267 printing employees, a correlation was not found between noise pollution and psychological complaints, including noise-induced anxiety, depression, aggression and psychological symptoms such as job satisfaction in the city of Tehran.²⁹

Another example, a relationship has not found between traffic noise and minor psychiatric disorders in the Caerphilly Prospective Study (CAPS).¹⁶ Beside these, a weak correlation between noise and mental health was found in the UK. In this study, the traffic noise was found to be more important than traffic density.³⁰

In a study which evaluated health functions by using the SF-36 screen, significant difference were not found between the general health, physical function, mental health and social function of 99 people exposed to 72-75 dB(A) of noise and 239 people exposed to 55-63 dB(A) of noise living nearby main city avenues. The threshold value of noise seemed to play a more important role on mental health. Also, defined somatic symptoms associated with noise rather than psychological symptoms is emphasized by Ware et al.¹⁸

Finally, we studied noise pollution levels in the buses and effects of continuous noise on the psychology of drivers. Some of buses had produced high noise in different forms of frequency and associated with to this, a decrease in the quality of life with an increase of significant psychiatric symptoms in drivers who exposed to continuous noise were observed. As well as, level of noise, changing difference between maximum and minimum values of noise (Frequency of noise level) seems to be effective on mental health.

As observed, longer periods of continuous work was also found to reduce cognitive functions; therefore, a reduction of daily working hours and uses of new buses with sound-reduction could be helpful in improving the psychological problems of the drivers and mental health of public.

Public health and quality of life is threatened by traffic noise. Especially, public transport drivers are vulnerable due to long and stressful work shifts. So, regulating the working conditions of drivers will positively affect their quality of life.

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