Audiometric Assessment of Bistoon Tile Factory Workers Based on Noise Exposure in 2009

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Abstract

Introduction: Noise is a type of energy when exceeds T.L.V., It can cause hearing loss, especially in working environments. As factory workers are at high risk of noise, the present study evaluated the Bistoon Tile Factory workers hearing losses.

Methods and Materials: In this analytical cross-sectional study, workers' noise L_{eq} were calculated according to I.S.O. standards and their audiometry results were derived from their health files. Data was analyzed by statistical tables and chi-square test by SPSS 21.

Results: There is no statistically significant relation between age and work history and hearing status of the workers, but a significant statistical relationship existed between noise L_{eq} exposure and audiometry status. The persons with more noise exposure than standard values had bad audiometry status.

Conclusions: Large body of research has indicated that noise has effect on audio system, and in the present study, however the workers age and work history were not long enough to detect an exposure to L_{eq} of higher than the standard level, a high exposure to loud noise reminded us that considering the issue, workers would prove important in the context of occupational health.

Keywords: Audiometry, Noise L_{eq}, Tile industry.

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Introduction

Noise, a type of energy, is air pressure vacillation in an elastic environment (1) which moves as wave (2). This kind of energy not only has many profits but also has many hazards, especially when it exceeds its T.L.V(Threshold Limit Value),announced by national and international safety and hygiene organizations (3). So it is one of disease factors and can be the cause of many physiological disorders such as hearing loss (4), occupational deafness (5), increasing blood pressure, abnormalities and physiological difficulties, occupational accidents and noise type. It can also be the cause of pregnancy disorders such as abortion (6). Noise-induced hearing loss after age-related hearing loss is the most common cause (7).

Kermanshah-Bistoon Tile Factory has been established in Kermanshah to Bistoon road. It produces tile and ceramic .The factory consists of many units such as spray saloon, drier, glazed saloon, packing unit, electric power station, warehouse, knapping-hammer, repair, etc. The workers in this factory based on their jobs are at the exposure of many different hazards. One of the important factors of hazard is the noise of many apparatuses such as glazed saloon, knapping - hammers, mixers, rails, etc.

The combination of noise of these apparatus exceeds that of T.L.V, so workers with extended period of time of exposure would definitely be affected; however, some workers are exposed to noise less, or work in a place with lower T.L.V.

Based on studies by Mirmohammad in Meybod Tile Factory, Yazd (8), Abedi in Isfahan Airport (9), Ahmadi at Qazvin Bus Strainers (10), Keshtkar in one of Iran's cultivation- industry farms (11) about noise, it had been demonstrated that noise had many effects on workers in these places.

Since a number of Bistoon Tile Factory workers are exposed to this disease factor, and since their hearing status has not been evaluated according to their dose of exposure to noise, the present study measured noise equivalent level (sl_{eq}) and investigated its possible relationship with and impact on hearing status of the workers in industrial complex. Given the high importance of human hearing receiving effect from noise, and since no research had been conducted on the industrial complex, the present study carried out a desired research, since it would help prevent the contributing factors to hearing loss and protect the vulnerable workers through working shifts, providing proper individual protection facilities.

Methods and Materials

In this analytical cross–sectional study the hearing status of all Bistoon Tile Factory workers (61 persons) were assessed in 2009. Workers were at the exposure of fluctuating noise (±10 - ±15 dB(A)), and we calculated the L_{eq} for all of them. We created similar noise stations with dimension of 3×3 meters. Workers' presence at the stations was recorded indirectly by chronometer that was calibrated before. Our experts collected data and information for two months and twenty days by calibrated chronometers. We used the IEC 651 ANSI S104 type 2 Noise Level Meter (S.L.M.) for measuring noise pressure level with precision of 1.5 dB (A). S.L.M was calibrated before measuring. The measurement weight was A at the slow status and we kept the digits after 3 seconds and it was for all noise stations. For calculating L_{eq} we used the following formula.

$$L_{eq} = 10 \log \left[\sum_{i=1}^{n} P_i \times 10^{\frac{L_i}{10}} \right]$$

P_i denoted the workers' presence time in the noise stations and each eight hours of work noted a unit.

The audiometry data was acquired from their hygiene files for three years of 2007 to 2009. Hearing threshold was based on air conduction for left and right ears (both

ears) at the frequency of 250, 500, 1000, 3000, 4000, 6000, 8000 Hz. This research was based on American National Standards Institute (12) listed in the following table.

Results

Workers averaged 35.9 years (± 8.9 years standard deviation). Workers' average working history was 13.5 year (± 7.7 years Standard Deviation). Average L_{eq} was 78 dB (A) (± 10.3 dB (A) standard deviation) for all noise stations. Average hearing loss was 41-55 dB (A), half of which had normal hearing (Table 1).

Most of research subjects were young and their age was 25-29 years and their hearing status was normal (Table 2). There was no evidence of significant statistical relationship between age and hearing loss (P=0.457). This weak relation could be attributed to the low age average and experience.

Relatively large percentage of workers with normal hearing had a work history of 5-9 years (Table 3). Subjects' experience showed no statistically significant differences in terms of their hearing status (p=0.488)

Noise equivalent level for moderate to severe hearing loss group was more than that of other groups (P<0.001) which indicted the effect of noise on hearing system (Table 4).

Table 1: American National Standards Institute hearing status

Average of threshold rate	Hearing status
Normal hearing	10-15
Slight hearing loss	16-25
Mild hearing loss	26-40
Moderate to severe hearing loss	41-55
Sever hearing loss	56-70
Profound hearing loss	71-90
Total hearing loss (Deaf)	>90

The collected data was analyzed by statistical tables and χ^2 test in SPSS 21 software.

Table 2: The hearing status of the Bistoon Tile Factory workers

Hearing position	Threshold average rate	N	%
Normal	10-15	32	46.52
Slight hearing loss	16-25	17	27.86
Mild hearing loss	26-40	8	13.13
Moderate to severe hearing loss	41-55	4	6.55
Total		61	100

Table 3: The hearing status of the Bistoon Tile Factory based on age (year)

Age (year)	Hearing position of the workers									
	Normal		Slight hearing position		Mild hearing position		Moderate to severe hearing position		Total	
	N	%	N	%	N	%	N	%	N	%
25-29	11	55	6	30	3	15	0	0	20	32.8
30-34	10	58.8	4	23.5	1	5.9	2	11.8	17	27.9
35-39	3	42.9	4	57.1	0	0	0	0	7	11.5
40-44	1	50	0	0	1	50	0	0	2	3.3
45-49	6	54.5	2	18.2	2	18.2	1	9.1	11	18
50+	1	25	1	25	1	25	1	25	4	6.6

Table 4: hearing status based on work history in Bistoon Tile Factory workers

Work history (year)	Hearing position									
	Normal		Slight hearing position		Mild hearing position		Moderate to severe hearing position		Total	
	N	%	N	%	N	%	N	%	N	%
0-4	1	3.1	1	5.9	0	0	0	0	2	3.3
5-9	12	37.5	5	29.4	4	50	1	25	22	36.1
10-14	4	12.5	1	5.9	0	0	0	0	5	8.2
15-19	7	21.9	7	41.2	0	0	1	25	15	24.6

Table 5: Hearing status distribution of the Bistoon Tile Workers based on L_{eq} dB (A)

L_{eq} dB (A)	Hearing position									
	Normal		Slight hearing position		Mild hearing position		Moderate to severe hearing position		Total	
	N	%	N	%	N	%	N	%	N	%
65 – 69	18	56.2	3	17.6	0	0	0	0	21	34.4
70 – 74	2	6.2	4	23.5	0	0	0	0	6	9.8
75 – 79	1	3.1	3	17.6	0	0	0	0	4	6.6
80 – 84	6	18.8	2	11.8	5	62.5	0	0	13	21.3
85 – 89	1	3.1	2	11.8	2	25	0	0	5	8.2
90 – 94	4	12.5	3	17.6	1	12.5	4	100	12	19.7

Discussion

Given the lower average age of the subjects, although workers were exposed to high pressure noise, their hearing vulnerability was not so significant, indicating the long-term noise impact, which comes to surface in long period of working. Faramarzi et al indicated that high noise pressure level (86.4±12.3 dB (A)) can damage this system (13). Research on noise in three oil producing companies in northeast India indicated that26 per cent of workers were exposed to noise level more than 85 dB (A) (14). Singh et al showed that noise pressure level for different part of the Iron And Steel Factory has been more than 90 dB (A) (15). Hafez Danish et al indicated that L_{eq} for the workers in Pakistan Textile Factory was between 88.4-104 dB (A) and the workers suffered hearing loss (16).

The present study indicated that people with lower age and experience, had normal hearing. Relatively large percentage of workers had work experience of about 9-5 years. So we could not prove a significant relationship between age, work history and hearing loss, but moderate to severe hearing loss among workers was higher than others that indicated the effect of noise on hearing status. Danish et al showed that hearing loss was significantly associated with the experience of over 10 years (16).

Workers with exposure to noise with dose of higher than the level permitted by authoritative organizations, were obviously more susceptible compared to workers with same age and experience, however their hearing loss was not severe and noise did not have significant effect on their hearing, nevertheless, it indicated the effect of noise on hearing. There was no statistically significant relationship between age, work history and hearing loss, attributable to their lower age average and work history, but the L_{eq} of the group with hearing loss at the range of 41-55 dB (A) was more than others.

Workers with high work history were older and had higher L_{eq} which suggests a gradual loss of hearing based on age and years of working in workplaces with noise. Workers with no history of hearing loss obviously flawed in this respect so it also

suggested the impact of incremental volume over time and its harmful effects. Failure to disclose business records and health and hiding it from the research by subjects can be a constriction of this study, so researchers should take this issue into consideration.

Conclusions

The present study indicated that, although workers did not have higher age and work history, noise is able to apply its chronic effects, due to the high-dose volume received; this partially confirmed the importance of worker's health.

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