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Personal Habits as a Risk Factors for Hearing Loss Among Plant Workers at Noisy Aluminum Industry in Dubai

Hussein H. Y.[1, *], Al Faisal W.[1], Al Marashdah A. M.[2], El Sawaf E. M.[2], Wasfy A. S.[3]

[1]Health Affairs Department, Primary Health Care Services Sector, Dubai Health Authority, Dubai, UAE
[2]Health Centers Department, Primary Health Care Services Sector, Dubai Health Authority, Dubai, UAE
[3]Research and Statistics Department, Ministry of Health, Dubai, UAE

Abstract

Background: NIHL Noise induced hearing loss refers to the damaging effect of noise on hearing. (42) In the occupational setting, hearing impairment is generally defined as "a binaural pure-tone average for the frequencies. *Objectives:* To study the impact of personal habits on hearing loss among plan workers who are exposed to noisy environment at Aluminum industry. *Methodology:* A cross sectional study was conducted in Dubai Aluminum Company Limited (DUBAL). All workers in DUBAL were targeted in the study. Sample size was 400 workers with 100% response rate. Stratified random sampling technique was used. Two groups were selected according to noise level exposure. *Results:* The risk of hearing loss among plant workers relative to administration workers increases from 1.71 in the age group <40 years to 3 times in the age group 40-<50 years and attained its maximum value at 50 years or more though it remained insignificant in all age groups. After adjusting for age, no significant higher risk could be found among plant workers in comparison with the administration group. The same was observed after adjusting for sex, marital status, and nationality. On the other hand after controlling for education, the risk of hearing loss was significantly higher among plant workers (three times that of administration workers) for only the university educated group but not for the school education level. the risk of hearing loss for plant workers in contrast to administration workers after adjusting for the effects of workers' habits. After controlling for the effect of exposure to non-occupational loud sounds, the risk was significantly higher among plant workers in contrast to administration workers (about 13 times), for the exposed group but not risk was detected in the non-exposed group. Controlling for other variables. *Conclusion:* The study concluded that personal habits have significant risk and strong impact on hearing loss among plan workers at noisy environment in Aluminum industry. Health education program about the additional risk, administrative and technical measurements has to be strictly applied.

Keywords

Personal Habits, Risks, Hearing Loss, Aluminum Industry

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1. Introduction

NIHL Noise induced hearing loss refers to the damaging effect of noise on hearing. (1) In the occupational setting, hearing impairment is generally defined as "a binaural pure-tone average for the frequencies of 1000, 2000, 3000 and 4000 Hz of greater than 25 dBHL". (2-4*)* While this definition is widely used, it does not correspond to the WHO definition of disabling hearing loss (i.e. with an associated disability weight, and corresponding to a quantifiable burden of disease). This

* Corresponding author
E-mail address: hyhussain@dha.gov.ae (Hussein H. Y.)

level of hearing impairment is defined as "permanent unaided hearing threshold level for the better ear of 41 dBHL or greater for the four frequencies 500, 1000, 2000 and 4000 Hz". (5) Based on exposure levels, about one out of every four workers will develop permanent hearing loss. (6)

According to data from the Workers "Compensation Board (1998) in British Columbia, almost thirty percent of young adults entering the workforce have already suffered some hearing damage due to noise. (7, 8) Occupational NIHL can significantly influence worker communication and safety and can have a tremendous impact on the lives of workers. Typically, the first sign of hearing loss from noise exposure is a notching of the audiogram at 3,000, 4,000, or 6,000 Hz, with recovery at 8,000 Hz. In early stages of NIHL, the average hearing thresholds at 500, 1,000, and 2,000 Hz are better than the average at 3,000, 4,000, and 6,000, and the hearing level at 8,000 Hz is usually better than the deepest part of the notch. This notch is in contrast to age-related hearing loss, which also produces high frequency hearing loss, but in a down-sloping pattern without recovery at 8,000 Hz. (6) a maximal level in about 10 to 15 years.

Concerning auditory effects due to work site noise, many researches were conducted in many countries. Several studies in Canada revealed that occupational noise was found to be the most frequent cause of hearing alterations among adults with estimates of eight to twelve adults in a thousand in the industrialized western region of that country. (9) Moreover, a study among construction workers in USA showed that there was an adverse effect of occupational noise exposure on hearing levels at 4 and 6 kHz in a population of relatively young adults with about 0.7 dB loss in threshold of hearing level. (10) In addition, a study held in UK revealed that 2% of working aged adults reported severe hearing difficulties, the problem being greatest in middle aged men. (11) A study by Palmer and Griffin in 2002 mentioned severe deafness among 153,000 male and 26,000 female British workers because of workplace noise. (11) A Taiwanese study showed that the prevalence of NIHL was as high as 56.8%, which was similar to the prevalence among American labors in nuclear weapons facilities (59.7%). (12) A study was conducted in Dubai, revealed that, the mean estimated hearing disability for the foundry workers was 8.59% which was significantly higher compared with that for the workers at the bottling plant (4.63 %). (13)

A Nigerian study showed that within 4-8 years of worksite noise exposure, over 90% of the workers had developed temporary or permanent shift in their hearing threshold. By 14 years or over, all the evaluated workers had developed hearing impairment. (14) Moreover, in a study conducted in Turkey, hearing loss in textile workers compared with control was more evident at frequencies of 4 and 6 kHz. (15)

2. Objectives

To study the impact of personal habits on hearing loss among plan workers expose to noisy environment at Aluminum industry.

3. Methodology

A cross sectional study was conducted in Dubai Aluminum Company Limited (DUBAL) which owns and operates one of the world's largest aluminum smelters. The study sample was collected from workers in DUBAL Company. All workers in DUBAL were targeted in the study. Those with history of ototoxic drug use, diabetes, severe or frequent ear infections, ear trauma, conductive or sensory hearing loss with a known etiology except for noise exposure were excluded. The sample size was calculated by using computer program EPI-Info version "6.04". Based on the preliminary data given, the minimum expected sample size was 334. Our sample size was 400 workers with 100% response rate. Stratified random sampling technique was used. Two groups were selected according to noise level exposure: The first group (200 workers) in which the employees were classified according to the noise level exposure into three strata: An equal allocation from each stratum was obtained because the strata sizes were approximately similar. Another group was selected from the administrative department where noise level is minimal (200 worker) The simple random sampling was achieved.

4. Results

The difference between administration and plant workers concerning the risk of hearing loss for each stratum of sociodemographic data is presented in table (1). The risk of hearing loss among plant workers relative to administration workers increases from 1.71 in the age group <40 years to 3 times in the age group 40-<50 years and attained its maximum value at 50 years or more though it remained insignificant in all age groups. After adjusting for age, no significant higher risk could be found among plant workers in comparison with the administration group. The same was observed after adjusting for sex, marital status, and nationality. On the other hand after controlling for education, the risk of hearing loss was significantly higher among plant workers (three times that of administration workers) for only the university educated group but not for the school education level.

Table (2) shows the prevalence of hearing loss by worker's habits. The only variable which showed significant effect on the risk of hearing loss is the regular use of head phones.

Users have a risk of hearing loss that equals 2.56 that among non users.

Table (3) demonstrates the risk of hearing loss for plant workers in contrast to administration workers after adjusting for the effects of workers' habits. After controlling for the effect of exposure to non occupational loud sounds, the risk was significantly higher among plant workers in contrast to administration workers (about 13 times), for the exposed group but not risk was detected in the non exposed group. Controlling for other variables, the risk remained the same.

Table 1. Hearing loss among study workers by demographic data, Dubai, 2010.

Personal data		Hearing loss						P	OR	95% CI	
		Administration (200)			Plant (200)						
		Total	No.	%	Total	No.	%				
Age (years)	<40	124	4	3.2	111	6	5.4	0.409	1.71	0.47	6.24
	40-	56	2	3.6	69	7	10.1	0.157	3.05	0.61	15.30
	50+	20	1	5.0	20	4	20.0	0.151	4.75	0.48	46.91
Marrital status	Unmarried	52	6	4.1	21	15	8.4	0.112	2.16	0.82	5.73
	Married	148	1	1.9	179	2	9.5	0.139	5.37	0.46	62.68
Educational level	School	27	2	7.4	72	6	8.3	0.880	1.14	0.21	6.01
	University	148	5	2.9	128	11	8.6	0.029	3.16	1.07	9.33
Nationality	Local	62	2	3.2	31	1	3.2	1.000	1.00	0.09	11.47
	Nonlocal	138	5	3.6	169	16	9.5	0.067	2.78	0.99	7.80

Table 2. Hearing loss according to habits, Dubai, 2010.

Habits		Hearing loss				OR	95% CI	
		Yes		No				
		No.	%	No.	%			
Current smoking	Yes	5	6.8	68	93.2	1.19	0.43	3.30
	No	19	5.8	308	94.2	1.00		
Duration of smoking (years, No: 73)	≤10	3	6.8	41	93.2	1.00		
	>10	2	6.9	27	93.1	1.01	0.16	6.46
Current alcohol consumption	Yes	9	6.5	130	93.5	1.14	0.48	2.67
	No	15	5.7	246	94.3	1.00		
Exposure to non occupational loud sound	Yes	14	6.3	2.9	93.7	1.12	0.49	2.58
	No	10	5.6	167	94.4	1.00		
Regular use of head phone	Yes	17	8.5	183	91.5	2.56	1.04	6.32
	No	7	3.5	193	96.5	1.00		
Hoppy of shooting	Yes	2	3.8	50	96.2	1.00	0.38	7.40
	No	22	6.3	326	93.7	1.69		

Table 3. Hearing loss among study workers by habit and place of work, Dubai, 2010.

Habits		Hearing loss						P	OR	95% CI	
		Administration (200)			Plant (200)						
		Total	No.	%	Total	No.	%				
Current smoking	Yes	26	1	3.8	47	4	8.5	0.450	2.33	0.25	21.98
	No	174	6	3.4	153	13	8.5	0.052	2.60	0.96	7.02
Duration of smoking (years, n=73)	≤10	15	-	0.0	29	3	10.3	0.540	4.09	0.20	84.64
	>10	11	1	9.1	18	1	5.6	0.715	0.59	0.03	10.48
Current alcohol consumption	Yes	43	1	2.3	96	8	8.3	0.183	3.82	0.46	31.53
	No	157	6	3.8	104	9	8.7	0.101	2.38	0.82	6.91
Exposure to non occupational loud sound	Yes	105	1	1.0	118	13	11.0	0.002	12.88	1.65	100.22
	No	95	6	6.3	82	4	4.9	0.680	0.76	0.21	2.79
Regular use of head phone	Yes	58	1	1.7	75	6	8.0	0.108	4.96	0.58	42.38
	No	142	6	4.2	125	11	8.8	0.127	2.19	0.78	6.10
Hoppy of shooting	Yes	25	-	0.0	27	2	7.4	0.165	5.00	0.23	109.41
	No	175	7	4.0	173	15	8.7	0.073	2.28	0.91	5.73

5. Discussion

It was found that extra exposure to worksite noise during the overtime hours may pose an effect on the development of NIHL. The study results revealed an apparent but not significant higher risk of hearing loss associated with having 10 hours or more overtime per week. Although unlikely and unexpected, it was detected that in contrast to the low noise exposure group, the percentage of workers taking 10 hours or more overtime per week, was significantly higher among the moderately high and high noise exposure groups. In a cross

tabulation between response of worker to whisper test and overtime, Ashraf et al., (2009) (16) proved that there was a higher frequency of hearing loss in workers who work overtime than those who don't because of more exposure to noise. Furthermore, the plant workers with past history of occupational noise exposure manifested apparent higher risk of developing NIHL compared with workers with no - similar past history. This finding may raise an assumption of possible cumulative effect of noise exposure on hearing level. (17)

Of no possible importance, past exposure to noise being more prevalent among the low noise exposure group. Having this set of evidences, we can conclude that duration of exposure to work site noise expressed either as duration of current employment in years, hours of overtime or even the years of past employment in noisy jobs may have a counterproductive effect on the auditory efficiency of the workers. Use of ear protective tools is another factor that likely may have an association with the development of hearing loss at work site. Our study brought out that, using ear muffs at work either at current or at past occupations carried apparent higher risk of development of hearing loss. At odds with this finding, same study found that ear muffs were usually used by workers at higher noise levels where ear plugs were preferred by workers at low levels of noise exposure. This observation simply can be explained by the regulations of DUBAL that define ear muffs as safety tool for workers at high noise exposure levels. The efficiency of different ear protectors is a debatable issue and still under lot of researches, though it was reported that under certain conditions, ear plugs provide the most effective protection although the attenuation is higher for earmuffs than for earplugs. (18)

Regarding some personal habits in relation to the development of NIHL, although expressed no association, current smoking and habitual alcohol drinking were found to be higher among plant workers compared with the administration workers. This was in agreement with a study conducted in Abu Dhabi which found that industrial workers had higher proportion of smokers than non-industrial workers.(19) Regarding alcohol drinking, Marchand (2008) (20), found that compared to non-qualified blue-collars, both low-risk and high-risk drinking are associated with qualified blue-collars, semi-qualified white-collars, and middle managers; high-risk drinking is associated with upper managers. How hearing level could be affected by worker's hobbies was also analyzed.

The potential effect of additive exposure to other non occupational sources of noise was elaborated. Although exposure to non occupational loud sounds (such as loud music) was not significant among the entire workers but was significantly related with the development of NIHL among plant workers in contrast to administration workers with nearly 13 times the risk. A study conducted in Japan by Nomura et al., (2005) (21) among Japanese metal workers, revealed that workers with both exposure to occupational and non occupational noise such as noisy hobbies and listening to loud music, were at higher risk of hearing loss. Also, use of head phones during listening to music was studied. The users among the entire study sample had significant 2.56 times the risk of hearing loss compared with the non users. Moreover, the risk was apparently higher among users of the plants compared to the administration group. This can be explained by the fact that many portable headphone cassette radios produce peak outputs of more than 100 dBA. Temporary threshold shifts could result from listening levels near the maximum output. Permanent sensorineural loss may result with repeated exposure. (22)

Moreover, individuals who listen to 15 minutes of music at 100 dB using personal music players may be exposed to the same level of loudness as industrial workers exposed to 85 dB in an 8 hour day. (23) A study conducted in Saudi Arabia by Ahmed et al., (2001) (24) to determine the prevalence of hearing loss and other risk factors associated with occupational noise exposure showed that, hearing loss was greater amongst those who used headphones to listen recorded cassettes. Although highly likely, those persons who practice gun fire shooting as a hobby may be at a higher risk to develop hearing loss; our results featured this hobby as a non significant contributing factor either among the entire study workers or among the plant workers. At odds with this result, Stewart et al., (2001) (25) and Seixas et al., (2004) (10) reported higher rate of hearing loss among regular gun fire shooters. Regular use of firearms, is a well known non occupational risk factor for NIHL. (26) Apart from noise induced hearing loss, many other health problems likely to be associated with exposure to noise at work site were studied as well. First of these health problems, was headache. When plant workers are stratified by level of noise exposure, a significant difference was encountered. Higher percentage of those complaining of headache due to noise was found at the high exposure level than at the moderately high and at low noise exposure level. Headache was proved to be a common non auditory deleterious health effect among workers exposed to noise at work site by many researchers. (27-29)

6. Conclusion

The study concluded that personal habits have significant risk and strong impact on hearing loss among plan workers at noisy environment in Aluminum industry. Health education program about the additional risk, administrative and technical measurements has to be strictly applied.

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