

Hearing loss in a textile factory

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ABSTRACT

Objective: To compare the prevalence rate of hearing loss at different levels of noise in a textile factory and to find out the levels of hearing loss according to duration (years) of employment in the factory.

Methods: Seventy workers exposed to different levels of noise were matched with 70 persons in the community who were not exposed to occupational noise. Noise levels dB(A) were measured at different locations in the factory. Hearing was assessed in all participants. Few cases were excluded from the study because hearing loss was due to factors other than exposure to noise.

Results: The prevalence rate of hearing loss was higher among the exposed group ie. 30% in the exposed group

and 8% in the non-exposed group. Hearing loss increased with increasing level of noise reaching 73% in the 95dB (A) area. Average hearing loss was highest amongst those who were employed for 25 years or more, reaching 39% dB(HL).

Conclusion: The findings of this study highlighted the magnitude of the problem, the necessity of the application of preventive measures and the need for more studies in this field.

Keywords: Occupation, noise, hearing loss, textile factory.

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Hearing loss due to chronic exposure to noise-induced hearing loss (NIHL), has been associated with industry for many years. The results reported from many industrialized countries¹ are alarming to authorities all over the world including Jordan. The management of cases of NIHL is proved to be hopeless.^{2,3}

Most of the western countries have their own regulations and rules for the protection of workers in noise-producing factories.⁴ Occupational noise is known to be a cause of NIHL. The United States Department of Occupational Safety and Health Administration (OSHA) developed the Hearing Conservation Amendment that limited occupational exposure to noise.⁵ The recommended permissible noise levels and duration of noise exposure are shown in Table 1. Where actual noise exposures exceed those prescribed, steps should be taken to reduce noise levels for employees working in those areas. The current regulations will protect 85% of

the individuals exposed to recommended noise levels. The remaining 15% could be attributable to individual susceptibility to noise,⁶ the effect of melanin concentration in the cochlea⁷ and aging.⁸

The industrial section in Jordan is rapidly growing. Workers in certain industries are concerned about developing NIHL as compared with other lower noise levels industries or with the general population. The size of the problem in Jordan is unknown. In this study, an attempt was made to find out the prevalence rate of NIHL among the workers of one of the textile factories. The association between hearing loss and both the level of noise at different sites in the factory and the duration of employment in the factory will be investigated.

Methods. The study was carried out in one of the textile factories in Jordan. Seventy workers were randomly selected from the factory and were individually matched with 70 persons from the

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community who were not exposed to occupational noise. Matching was carried out for both age and sex. Such a procedure will eliminate the effect of age and sex on hearing loss.⁹ Table 2 shows the distribution of the 2 groups (exposed and non-exposed to noise) according to age and sex.

Noise levels in dB(A) were measured at different sites of the factory by using a sound level meter (CEL.UK) set for (A) weighing scale slow response and was calibrated to read correctly and conforms to the ANSI 1971.

Four cases of hearing loss in the exposed group and 6 cases in the non-exposed group were excluded from the study as it was believed that hearing loss in these cases was due to factors other than exposure to noise (otitis media, presbycusis, previous exposure to noise).

Relative risk (RR) and tests of significance¹⁰ were used to find out the degree and level of significance of the association between hearing loss and both the level of noise and duration of employment in the factory. P value less than 0.05 was considered significant. Attributable risk percentage (AR%) was used⁹ to find out the percentage of the disease (NIHL) in the exposed group that can be prevented if their exposure to noise decreases.

Results. The recommended permissible noise levels and duration of noise exposure are shown in Table 1. Table 2 shows that the 2 groups were similar in age and sex. Fifty seven in each group were males and 13 were females. The average ages for males and females in the exposed group were 38 and 31.5 years and they were 39.7 and 30.7 years in the non-exposed group.

Table 3 shows that 30% of the exposed group were suffering from hearing loss as compared to 8% in the non-exposed group (RR=3.9, AR%=74.3%, P<0.05).

Table 4 shows that hearing loss was lowest (3%) at the noise level of 46-73 dB(A) while it was highest (73%) at the noise level of 95 dB(A). Relative risk was 27% and AR% was 96%. When the noise level was 77 dB(A) the RR decreased to 16% and the AR% was 94%.

Table 5 shows that the mean loss of hearing was 26.5 dBHL for those working up to 14 years in the factory as compared to 38.8 dBHL in those who worked in the factory for 25 years or more. The difference was significant (P<0.05).

Discussion. This study was carried out in one of the textile factories in Jordan to explore the problem of hearing loss among its workers.

The prevalence rate of hearing loss in the exposed group was 30% as compared to 8% in the non-exposed group. The exposed group were 4 times more likely to develop hearing loss when compared to the non-exposed group (RR=3.9, P<0.05). Three

Table 1 - Recommendation for permissible noise exposures and duration.

Duration (hour/day)	Sound level dB(A) slow response
8	90
6	92
4	95
3	97
2	100
1 1/2	102
1	105
1/2	110
1/4 or less	115

Source: US Department of Labor, Occupational Safety & Health Administrations (1983). Occupational Noise Exposure, Hearing Conservation Amendment. Federal Register, 48, 973809785.⁵

Table 2 - Distribution of participants in the 2 groups according to mean age and sex.

Category	Exposed	Non-exposed group
Male	57	57
Female	13	13
Mean age for males	38	40
Mean age for females	31.5	31

Table 3 - Distribution of cases of hearing loss in the 2 groups

Groups	Hearing loss No. (%)	No hearing loss No. (%)	Total No. (%)
Exposed	20 (30)	46 (70)	66 (100)
Non-exposed	5 (8)	59 (92)	64 (100)

RR=3.9
AR%=74.3%
P<0.05 by applying chi square test No.(%)=Number/Percentage

Table 4 - Distribution of cases of hearing loss in workers according to levels of noise dB(A).

Noise levels dB(A)	Hearing loss No. (%)	No hearing loss No. (%)	Total No. (%)
46-73	1 (3)	36 (97)	37 (100)
77	3 (43)	4 (57)	7 (100)
95	16 (73)	6 (27)	22 (100)
Total	20 (30)	46 (70)	66 (100)

95 (dB) group vs 77 (dB) group: RR=1.7, AR%=41%, P<0.05
95 (dB) group vs 46-73 (dB) group: RR=26.9, AR%=96.3%, P<0.05
77 (dB) group vs 46-73 (dB) group: RR=15.9, AR%=93.7%, P<0.05
Note: Fisher's exact test was applied No.(%)=Number/Percentage

Table 5 - Distribution of the 20 cases of hearing loss according to mean hearing loss and duration of employment in the factory.

Duration of employment	No. (%)	Mean hearing loss dB HL
5-14 years	6 (30)	26.5
15-24 years	6 (30)	32
≥25 years	8 (40)	39
5-14 group vs 15-24 group: P<0.05 5-14 vs ≥ 25: P<0.05 15-24 vs ≥ 25: P<0.05 Note: T student test was applied No.(%)=Number/Percentage		

quarters of the problem can be eliminated if workers in the factory were protected from noise (AR%=74%). Workers exposed to 95 dB(A) were 27 times more likely to develop hearing loss when compared to those exposed to 46-73 dB(A) level (RR=26.9, P<0.05). More than 95% of the problem in the 95 dB(A) level can be eliminated if noise decreases to 46-73 dB(A) level (AR%=96%). It was clear that one third of workers were exposed to 95 dB(A) noise level probably for more than 8 hours per day. This was against the industrial standards which limits the exposure to 95 dB(A) for not more than 4 hours per day.⁵

Noise-induced hearing loss progresses rapidly during 8-10 years of exposure after which it slows down and stabilizes.¹¹ In our study, 70% of the cases were employed in the factory for at least 15 years and 40% of cases were employed in the factory for at least 25 years. This variable (duration of employment) adds another burden to the league of hearing loss. The mean hearing loss was increasing with the increase in duration of employment reaching 38.8 dBHL in those working for at least 25 years.

It can be concluded that one third of workers were exposed to 95 dB(A) and three quarters of this group were suffering from hearing loss. The prevalence rate of hearing loss was increasing with the increase of both the level of noise and the duration of employment. These results support the notion of commutative effect of noise exposure on hearing. As there is no specific treatment of NIHL,^{2,3} preventive measures should be adopted accordingly in order to reduce the size of the problem in the future. The implementation of OSHA amendment of occupational noise exposure regulation⁵ is expected to reduce the number of American workers with occupational hearing impairment from more than one million to 261,000 by the year 2020.¹² The results of our study highlighted the need for a local national

authority to establish rules and regulations as a basic requirement for an effective hearing conservation program. Such a program is strongly needed because the noise exposure levels in many other factories are expected to exceed the international permissible limits.

Finally, we recommend the adoption of the following principles by factories or any other parties where noise exposure is hazardous to their employees: 1. Baseline audiogram and periodic screening of the workers; 2. Personal hearing protection by using protective devices; 3. Engineering control by maintenance of machines and equipment, isolation of machines, substitution of machines, sound absorption and damping supports; 4. Administrative control by rotating jobs, transferring employees, and scheduling machine operating times; 5. Encouraging education of workers to increase their awareness of the hazards of noise exposure; 6. Continuous analysis and assessment of noise exposure; 7. Continuous analysis of the effectiveness of the hearing conservation program.

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