

Complete Survey of Biston Sugar Production Factory's Occupational Hearing

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Abstract: Excessive noise of environment and related injuries accounted as one of the most challenging health problems in industries and factories. The study is dedicated to follow Biston sugar production factory's occupational hearing ability and probable resultant of hearing loss, which is located in Kermanshah. This study is qualitative-cross sectional, in which 32 employees involved in 2009. Equivalent sound level (L_{eq}) measured by a typical sound level meter device, IEC 651 ANSI S104 Type 2. Also, more results like otoscopic and audio metering, excluded from their health records and obtained data are analyzed by SPSS 21. Noise frequency which ranges in 3 to 4 kilohertz has and additive effect on hearing threshold in a way that hearing loss in very low or high frequencies can be reached to 46.5%. For the employees in this branch of industry Noise Induces Hearing Loss is 11.7%. Increased experience in noisy environment and also aging make hearing loss more probable. In addition tinnitus can be a good sign of this reduction and people with tinnitus are not in a good hearing situation. Based on the long experience of the factory and hearing loss spreading, care and protection of hearing system must be done, so utilizing health services of professional experts can be helpful.

Key words: Hearing Status • Noise • Hearing Loss • Sound Pressure Level • Equivalent Sound Level

INTRODUCTION

Today, noise is one of the environmental and industrial pollutants. Whatever there is not any accurate statistics about number of workers who are in the danger of this pollutant; Based on National Institute for Occupational Safety and Health (NIOSH) Approximately 30 million workers are exposed on to noise levels or toxicants that are potentially hazardous to their hearing system [1] and this statistics even reach to 35 million in European countries [2]. Exceeded noise level that pass allowable threshold declared by international and national organization can have several effects and complications and be as a risk to employee's health [3]. Top of these

problems is Noised Induced Hearing Loss (NIHL). At the beginning, the problem is unfolded in high frequency noises but if this condition continued also in low frequency noises workers faced with the same problem [4]. Work environment problems simply can be inhibited and noise level can be reduces, but if hearing loss developed restoring healthy condition did not be so simple. This makes authorities to have special attention to patients and employment effects. Obviously if hearing problem developed to the low frequency noises patients will have difficulty to understand normal daily voices; also, not only the chance of occupational problems increases but social problems resonant and sometimes this caused to interfamily problems.

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Since the employees in this industrial complex also in the danger of excessive noise and till now there is not any specific study dedicated to them, we decide to survey hearing status of the employees on this industrial complex. In this way we put a very small step in gathering statistical information about Iranian employees hearing problem.

MATERIALS AND METHODS

This study is qualitative-cross sectional and implement on all employee (32 persons) exposure to high level of noise in Biston sugar production factory, Kermanshah, Iran. By designing special forms, history of hearing related problems of these employees and noise level of their workplace gathered. For calculating noise level and finding equivalent dose of noise regarded to sectional area of work environment, preciseness of work and sensitiveness of measurements, audio stations in 3×3 (9 square meters) dimension developed and for prohibiting any disruption, all of the stations are the same type. Presence of each employee based on direct and indirect observations recorded by experts, who were justified before and by chronometer. Experts who used calibrated chronometers asked to gather information in the period of two month and 20 days. This is important that employees did not aware that they are under study. For recording the sound pressure level, digital sound level meters IEC 651 ANSI S104 Type 2 with accuracy of ±1.5dB were used. Before the beginning of measurement procedure, sound level meters were calibrated. Measuring canal was A canal in slow mode. In every station after 3 second holding sound level recorded. For calculating dose level followed formulae was used:

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

Here, P_i represents time that converted to a scaled parameter, each unit in that scale represents 8 hours' work for each employee. Based on legislator organizations and authorities allowable Threshold Limit Value (T.L.V) is in the range of 80-90 db. Although this amount is so high and if the average sound level in environment is 85 dB, hearing loss is expected [5]. Otoscopic and audio metering results extracted from the health records. Also, hearing tests done in standard acoustic room by using audio metering devices located in occupational medical science laboratory, medical university of Kermanshah. In designed tests hearing threshold measured by air conduction method in both ears and in the series of

Table 1: American National Standards Institute hearing status

Hearing status	Average of threshold rate
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

frequencies like 250, 500, 1000, 3000, 4000, 6000, 8000 hertz. The reference of this testing method is American National Standards Institute that classified hearing status of peoples like Table 1 [6].

In the questionnaire provided to employees, they are asked about age and experience. Furthermore they are asked about tinnitus and history of diseases like Mumps, scarlet fever, measles, head and ear trauma and also fractures in this area with the aid of reveal role of frustrating factors. For analyzing results SPSS 21 is used. T-student, χ^2 tests with 95% reliability done for evaluating relation between hearing status and amount of noise in the working space of that specific person.

RESULTS

The mean age of employees is 35.8 ± 8.7 with the minimum of 23 and maximum of 63. The mean experience of employees is 7.8 years with the maximum of 13 and minimum of 2. All the included employees are male, however there are female members in factory but all of them in a way be involved with paperwork so not included in this study. 25 out of 32 (bit more than 75%) have sound pressure level more than 85 dB, meaning that noise in their workplace is exceeded and the rest of people (a little less than 25%) are working in posts with low noise level. Although there is not any meaningful difference in their experience and age but in the point of view of noise dose and tinnitus there are considerable difference.

Also in the group who is subjected to higher amount of noise, hearing ability in whole frequency ranges is rather worsen than other group. The difference in the frequencies 2000, 3000 and 4000 for the left ear and 3000 and 4000 Hz frequencies for the right ear was much more pronounced (Table 2). Average aura for each ear calculated based on high and low frequencies and results declared that noise causes hearing loss in both ears. Hearing loss in high frequencies is meaningful for both ears and low frequencies just for the left ear. Also there is relation between hearing loss and sound pressure level (Fig. 1, Fig. 2). In other words, increased value of sound

Table 2: Comparison of the average hearing status in various frequencies for right and left ears with respect to sound pressure levels higher and lower than 85 dB

Frequency	Left ear			Right ear		
	Sound pressure level			Sound pressure level		
	< 85 dB	> 85 dB	P-value	< 85 dB	> 85 dB	P-value
250	23.16 ± 13.58	24.53 ± 12.95	0.817	23.15 ± 13.85	22.87 ± 11.88	0.96
500	23.34 ± 14.48	23.98 ± 13.54	0.926	23.88 ± 16.50	23.68 ± 12.05	0.975
1000	23.21 ± 11.54	24.36 ± 11.52	0.826	21.98 ± 12.65	24.36 ± 15.41	0.722
2000	13.68 ± 11.90	15.89 ± 11.66	0.687	15.26 ± 14.69	14.85 ± 13.77	0.953
3000	14.76 ± 14.46	18.38 ± 16.11	0.599	12.73 ± 14.86	16.76 ± 14.11	0.518
4000	17.79 ± 15.91	21.23 ± 15.89	0.671	17.58 ± 17.82	22.51 ± 15.80	0.637
6000	21.11 ± 16.88	21.98 ± 18.00	0.911	20.79 ± 18.83	23.65 ± 18.88	0.731
8000	22.21 ± 19.37	22.89 ± 18.76	0.954	22.69 ± 19.26	23.55 ± 18.83	0.917

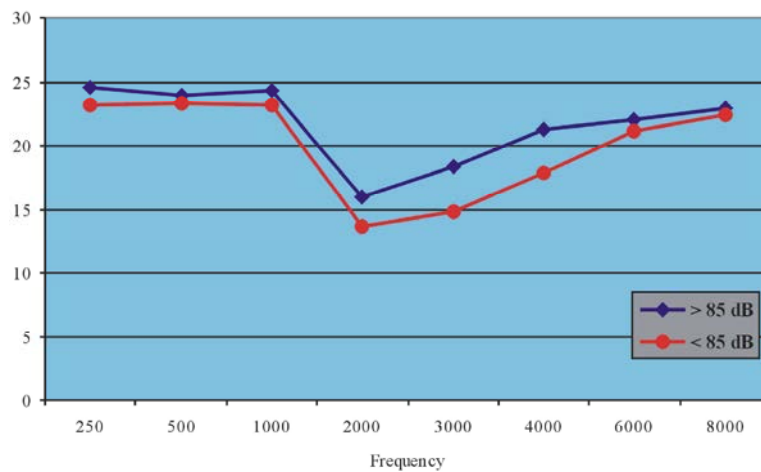


Fig. 1: Hearing status in various frequencies for left ears with respect to sound pressure levels higher and lower than 85 dB

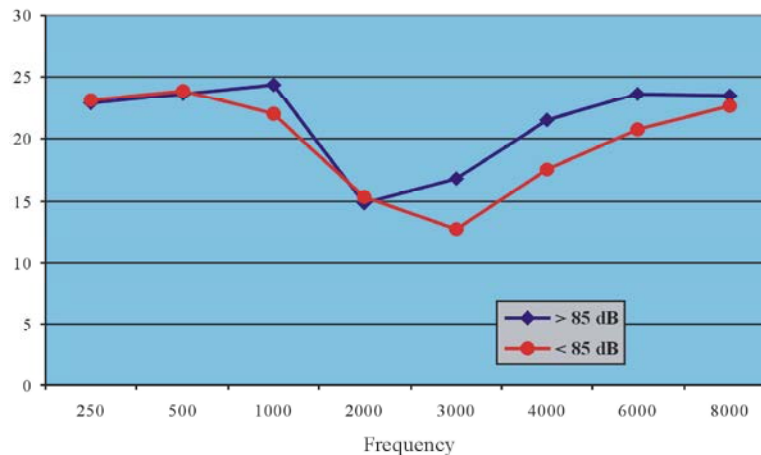


Fig. 2: Hearing status in various frequencies for right ears with respect to sound pressure levels higher and lower than 85 dB

pressure level caused increased value of hearing loss in both ear and whole frequency ranges, but this difference for left ear is so meaningful.

Any meaningful result did not found between hearing status of left and right ears with employees experience, in other words, confronting with high quantity of voice in

several years. Maybe low experience has effect on that, but generally if the quantity of voice is higher, NIHL is higher. Peoples with tinnitus are in bad condition with respect to people did not suffer from that and this is obvious in the whole range of frequencies.

DISCUSSION AND CONCLUSION

By increasing age gradually hearing status worsens, in a way that hearing loss with regard to NIHL is more prevalent in elder people and lot of people for receiving suitable treatment, recourses to health centers. Hearing loss classified as job related problems and there are a lot of people who suffer from that. These types of problems will provoke social and also interfamily problems and cause to mental disorders beside placed heavy financial costs on the person, family, productive-industrial and governmental centers [7]. Based on a survey in Saudi Arabia, Ahmad 2001, hearing loss induced by noise is a major health problem; they reviewed 269 workers who exposure to high noise level. They have special emphasize on programs for preventing this problem. They declared that hearing loss in high frequencies is much more obvious [8]. Hearing loss in high and low frequencies reached to 37.5% and 43.8%, respectively. Job conducted a survey on French workers (18-24 years old), results show that hearing loss for high and low frequencies for young workers are 15% and 9%, respectively [9] and Toh reviewed military personnel in Singapore and indicate hearing loss by 3.7% [10]. In another study handled by Ahmad hearing loss is reported 38.3% and 4.5% (8).

Spread of NIHL depends on various factors and these factors are different in dissimilar industries. Hearing loss in American building industry reported to be 60% [11] and in metal industry of Saudi Arabia is 38% (8). Another important point is that tinnitus and hearing status are dependent in whole frequency range. So experts and health instructors must have periodic examination and consider tinnitus as an important alarm of hearing loss.

Noise is a pathogenic factor and not only impair hearing system but also have several adverse effects. It is one of the problems that our industry majorly affected. So workers enclosed in these industries are no exception. So preserving hearing system is important and hearing loss prevention have specific important. Beside implementation of conservation programs, workers education must be done and they must be forced to use protective devices in noisy workplaces.

REFERENCES

1. Franks, J.R., M.R. Stephenson and C.J. Merry, 2004. Preventing occupational hearing loss-A practical guide.-(DHHS [NIOSH] Publication 96-110). Cincinnati, OH: National Institute for Occupational Safety and Health.
2. Sulkowski, W.J., W. Szymczak, S. Kowalska and M. Sward-Matyja, 2004. Epidemiology of occupational noise-induced hearing loss (ONIH) in Poland. *Otolaryngol. Pol.*, 58(1): 233-236.
3. Jack Katz, Robert F. Burkard and Larry Medwetsky, 2002. *Handbook of Clinical Audiology*. Lippincott Williams and Wilkins
4. May, J.J., 2000. Occupational hearing loss. *Am J. Ind. Med.*, 37(1): 112-120.
5. www.physicsforums.com/showthread.php/t.
6. Gelfand, S.A., 2009. *Essentials of Audiology*. 3rd ed., Thieme Medical Publishers, Inc.
7. Famili, Gh.H., K. Karamifar and A.F. Fayaz, 2003. The Diagnosis of Noise-Induced Hearing Loss and its Resulting Disability in Medico-Legal Setting. *Scientific Journal of Forensic Medicine*, 9(31): 147-153.
8. Ahmed, H.O., J.H. Dennis, O. Badran, M. Ismail, S.G. Ballal, A. Ashoor and D. Jerwood, 2001. Occupational Noise Exposure and Hearing Loss of Workers in Two Plants in Eastern Saudi Arabia. *Ann. Occup. Hyg.*, 45(5): 371-380.
9. Job, A., M. Raynal, A. Tricoire, J. Signoret and P. Rondet, 2000. Hearing status of French youth aged from 18 to 24 years in 1997: a cross-sectional epidemiological study in the selection centres of the army in Vincennes and Lyon. *Rev. Epidemiol Sante Publique*, Jun., 48(3): 227-237.
10. Toh, S.T., P. Lu, M. Ong and B. Seet, 2002. Prevalence of hearing disorders in Singapore military conscripts: a role for routine audiometry screening. *Singapore Med. J. Dec.*, 43(12): 622-627.
11. Hong, O., 2005. Hearing loss among operating engineers in American construction industry. *Int. Arch. Occup. Environ. Health*, 78(7): 565-574.