Review Article

Occupational Noise Induced Hearing Loss in India – A Capsule

RoopakVR*, Gurumani S**, Valli R***

Final year postgraduate*, Professor and HOD**, Professor***, Department of Otorhinolaryngology, Shri Sathya Sai Medical College and Research Institute, Sri Balaji Vidyapeeth University, Thiruporur, Kancheepuram, Tamil Nadu.

Dr. Roopak Visakan Raja is an Ent surgeon, who has just completed his M.S from Shri Sathya Sai Medical college and Research Institute.He is interested in pursuing further studies in skull base surgery and facial plastics. He has also done an ICMR approved study on noise pollution and its impact on hearing among people .

Corresponding author - Dr. Gurumani S - (srigurumani@rocketmail.com)

Chettinad Health City Medical Journal 2019; 8(3): 12 - 16

Abstract

Background : Noise being a major component of dynamic space, is one of the most invasive aspects of the urban environment. Excessive noise is displeasing to human, animal and environment. This study aims to review various articles which assesses the audiological status of the various people involved in different occupation who are exposed to such high noise.

Methodology : Articles were searched through the search engines like PubMed, Medline and Google scholar. Studies that were conducted in India within the last 20 years were included using MeSH words like - hearing loss, occupational hazard, India, noise induced.

Results : There was hearing loss in one or the other form in varying degrees on reviewing all the occupations. The findings of this review search and analysis states that very little studies are available relating to occupational noise and hearing impact. Majority of them are objective response studies and only a small portion of them quantify the noise exposure-effect chain.

Conclusion : Standardized protocols for studies involving noise induced hearing loss must be incorporated for better understanding of the noise exposure and effect relationship and for proper implication of protective and preventive measures in various occupations.

Introduction

Noise is defined as unwanted sound according to the environmental protection act. Excesive noise causes disturbance to physical, mental and social health. Noise annoyance is seen as the major effect of noise, which can include feelings of nuisance or disturbance.[1] Noise interferes with basic activities such as sleeping, resting, studying and communicating, it can also cause heart disease, mental health problems and hearing damage.[2,3] Continued or repeated exposures to high intensity sound can cause acoustic trauma to the ear resulting in hearing loss (NIHL), ringing in the ears, occasional dizziness.[4] Worldwide, 16% of the disabling hearing loss in adults is attributed to occupational noise.[5] Non-auditory health effects of noise pollution include unexpected muscle reactions, palpitations, dilation of pupils, adrenalin secretion and thyroid hormone production, constriction of blood vessels, and movements of stomach and bowel. Noise damages mental health by making people anxious, angry, dissatisfied, and fatigue. Noise pollution can cause aggression, hypertension, high stress levels, tinnitus, sleep disturbances, and other harmful effects.[6-9]

Hearing loss caused by exposure to recreational and occupational noise results in devastating disability that is virtually 100 percent preventable. Noise - induced hearing loss is the second most common form of sensori-neural hearing deficit, after presbycusis (age-related hearing loss).[10] Shearing forces caused by any sound have an impact on the stereocilia of the hair cells of the basilar membrane of the cochlea; when excessive, these forces can cause cell death. Avoiding noise exposure stops further progression of the damage. Noise-induced hearing loss can be prevented by avoiding excessive noise and using hearing protection such as earplugs and earmuffs. Patients who have been exposed to excessive noise should be screened. When hearing loss is suspected, a thorough history, physical examination and audiometry should be performed.

If these examinations disclose evidence of hearing loss, referral for full audiologic evaluation is recommended.[10]

Hearing loss due to noise usually occurs in two forms, they are

1. Noise-induced hearing loss: It is a type of sensorineural hearing loss that begins at higher frequencies (3 kHz to 6kHz) and gradually develops as a result of chronicexposure toexcessive sound. Even though the loss is typically symmetric and bilateral, noise from such sources asfirearms or sirens may produce

an asymmetric loss. Impairment of hearing at high frequencies will initially cause a loss of clarity in perceived speech and then interfere with daily activities as hearing loss progresses. Hearing loss-related symptoms such as trouble in normal and telephone conversation, turning up the radio/television volume and tinnitus, usually occur in the early stages of NIHL.[11] Noise-induced hearing loss maybe temporary or permanent.

(a) Temporary threshold shift - hearing is impaired immediately after exposure to noise but recovers after an interval of time

(b) Permanent threshold shift - The hearing impairment is permanent and does not recover at all.

2. Acoustic trauma, a related condition, results from an acute exposure to short-term impulsive noise. Exposure to a sudden single burst of noise such as rifle shot or cracker burst can lead to sound levels of around 140 dB which may lead to rupture of Reissner's membrane or permanent damage to the cochlea or damage to ossicular status.

Methodology

Duration of Search: Research articles pertaining to occupational hearing loss in the last twenty years from 1999 to 2019 in India

Search Engines used: Pub-med, Medline and Google scholar

MeSH words used: hearing loss, occupational hazard, India,noise induced

Inclusion Criteria:

a. Studies conducted in India pertaining to noise induced hearing loss in relation to the various occupations involved

b. Studies which deal with permanent hearing loss

c. Studies conducted within the last 20 years

Exclusion Criteria :

a. Articles where full text was not freely accessed

b. Studies not conducted in India

Final selection of total number of articles

Total number of articles identified using the above mentioned methods (n=62)

↓

Total number of articles after eliminating duplicates and repetition (n= 49)

↓

Including only the freely accessed articles (n=38)

↓

Eliminating the articles not conducted in India (n=32)

↓

Including the articles with permanent hearing loss,

Results

Sl.No	Author name	Year	Occupation involved	Duration of exposure	Hearing loss	Age group	Methods	Limitations
1	Kumar et al[12]	2005	Farmers	5 years	40%	25-45	PTA	Only in tractor drivers
2	Narlawar et al[13]	2006	Iron and steel industry workers	<10 - >20 years	20.5%	20 -50	Tuning fork tests	Accurate hearing measurements not done
3	Singh VK et al[14]	1999	Police	2- 8 years	82%	20-50	PTA	Noise levels not measured
4	Jain A et al[15]	2017	Marble factory workers	10 years	46.7%	20-40	PTA	Noise levels not measured
5	Nair S et al [16]	2009	Air force personnel	0-30 years	22.9%	25- 55	PTA	Noise levels not measured
6	Khare AS et al[17]	2017	Industry workers	10-20 years	25.5%	25-54	PTA	Other confounding factors not included
7	Chauhan et al[18]	2018	Police	0-12	90.9%	20-59	Mobile application	PTA comparison not done
8	Dube KJ et al[19]	2011	Ginning industry workers	>1 year	96%	19-55	PTA	-

9.	Majumder J et al[20]	2018	Administrative workers	6-30 years	17%	20-60	PTA	Ambient noise levels not measured co-relation wih mobile devices not done
10	Balaji R et al[21]	2010	Bus drivers	All age groups		variable	HDI	Audiogram not used and definition of population not done
11	Manzoor J et al[22]	2016	Cricket bat industry workers	Variable	62.5%	18-50	Questionnaire	PTA not done and duration of exposure not defined
12	Oliveira et al[23]	2014	Iron ore workers	<10 years	36.18%	20 -35	PTA	Confounding factors not defined
13	Dhere AM et al[24]	2009	Saw and wind mill workers	Variable	28%,13%	>25	PTA	Control not defined
14	Prabhu GV et al[25]	2013	Shipbuilders	30 years	17%	19-59	PTA	Role of mobile sound devices and noise levels due to other sound not efined
15.	Singh LP et al[26]	2010	Small scale industry workers	Variable	100%	15- 45	PTA and questionnaire	No equal representation of all types of workers
16.	Singh LP et al[27]	2012	Steel industry workers	3-14 years	95%	22-38	PTA with questionnaire	-
17.	Singh AK et al[28]	2018	Handicraft workers	<5 -- >10 years	95%	21-46	PTA	Seasonal variation not included
18.	Al- omari et al[29]	2016	Pilots	1000-2000 flight hours	18.4%	23-55	PTA	Ambient noise levels need more appropriate measures

Discussion

All the occupations reviewed in our review suffered from hearing loss in one or the other form in varying degrees. The population in each study was exposed to noise levels above the tolerable level.[29]

This review discusses that researchers from India have scrutinized the problem of occupational noise and hearing, in terms of differences or similarities in methodological approach and subsequent reporting of the situation. The details of articles reviewed based on the selection criteria are highlighted in table 1.

It was noted from the current review that in 80% of the studies, the study population (number, age and gender) was very well defined, where as only in 72% cases the noise source, exposure pattern and duration, was observed.

Reporting of statistical methods and outputs was utilized by 85% of researchers.

These studies showed variations with respect to sample size which was used for subjective and objective valuations of hearing status and it was noted that only medium to large samples were incorporated, with sample size not < 50 reported.

To analyze the data with statistical tools from the papers reviewed was unrealistic, because of the limited number of papers identified with the desired topic. Also the variability in the papers in view of approach and reporting of the outputs made it statistically unusable.

Since various studies have shown significant hearing loss in various occupations it must be noted that a specific systemic protocol must be incorporated into these studies for more evidence based results like measuring the noise levels, eliminating confounding factor and appropriate measurement of hearing status.

Another important finding was that inspite of sub optimal noise level exposure there were instances of permanent hearing loss being reported which emphasizes the need for noise level measurements periodically.

Conclusion

Overall, this review, which is one of its kind in terms of occupational noise exposure-effect in India, would be a crisp and important article for the present and future researchers. It puts together twenty years of research (1999 - 2019) on the topic of occupational noise and how its exposure affects hearing of the people involved, which has been studied by various researchers.

This study provides various qualitative aspects and quantitative data of the studies and papers reviewed and hence would aid in further and future research as a guide. Even though this paper has been limited by publication bias i.e., there are many chances that lot of papers have not been printed or published.

Based on the reviewed articles, it may be concluded that, to generalize the pattern of the research theme and to combine outputs of results,although they put forth the same hypothesis of noise effects on human hearing, is quite difficult.

The studies identified were much wide ranging from their overall sample size, exposure data and randomness of sampling to exposure-effect output; the overall study approach and design varied across the articles considered. The low number of studiesidentified to be included forthis review, over a vast period of 20 years, does not permit a proper analysis of data obtained through this review. It is thus concluded that still extensive and focused research must be conducted in the future for better understanding of the scenario of noise induced hearing loss in India.

References

1) Passchier-Vermeer W, Passchier WF. Noise exposure and public health. Environ Health Perspect.2000; 108(1s):123-131.

2) Babisch W. Noise and Health. Environ Health Perspect. 2005; 113(1): A14–A15.

3) Stansfeld S, Haines M, Brown B. Noise and Health in the Urban Environment. Rev Environ Health. 2000;15(1-2):43-82.

4) Bredenkamp, J.K. 2000 Noise-induced hearing loss and its prevention. http://www.medicinenet.com/Noise_Induced_Hearing_Loss_and_Its_Prevention accessed .2019

5) Nelson DI, Nelson RY, Concha-Barrientos M, Fingerhut M.The global burden of occupational noise-induced hearing loss. Am J Ind Med. 2005 ;48(6):446-58.

6) Rosen S, Olin P. Hearing Loss and Coronary Heart Disease. Arch Otolaryngol. 1965 ;82:236-43.

7) Field J M. Effect of personal and situational variables upon noise annoyance in residential areas. Journal of the Acoustical Society of America. 1993;93: 2753-2763.

8) "Noise Pollution". World Health Organisation.

9) "Road noise link to blood pressure". BBC News. 2009-09-10. Retrieved 2010-05-20.

10) Rabinowitz PM. Noise-induced hearing loss. Am Fam Physician. 2000;61(9):2749-56, 2759-60.

11) Bhumika N, Prabhu G, Ferreira A, Kulkarni M. Noise-induced hearing loss still a problem in shipbuilders: a cross-sectional study in goa, India. Ann Med Health Sci Res. 2013;3(1):1-6.

12) Kumar A ,Mathur NN ,Varghese M ,Mohan D, Singh JK, Maharajan P. Effects of tractor driving on farmers in India. Am J Ind Med.2005 ;47(4):341-8

13) Narlawar UW, Surjuse BG, Thakre SS. Hypertension and hearing impairment in workers of iron and steel industry.Indian J Physiol Pharmacol. 2006;50(1):60-6.

14) Singh V.K, MethaA.K.Prevalence of occupational noise induced hearing loss amongst police personnel.Indian J Otolaryngol.1999; 51(2):23-26.

15) Jain A, N, Bafna G, Mehta B. Impact of Noise Exposure on Hearing Acuity of Marble Factory Workers.Indian J PhysiolPharmacol 2017; 61(3) : 295–301.

16) Nair S, Kashyap RC. Prevalence of Noise Induced Hearing Loss in Indian Air Force Personnel. Med J Armed Forces India. 2009;65(3):247–251.

17) Khare AS, Borade NG, Gupta YS, Ashok P. Effect of Duration of Service on Occupational Noise Induced Hearing Loss in Industry Workers. Indian Journal of Applied Research 2017; 7(10):8-10.

18) Chauhan, N.,Shah.J.Smart Phone Based Audiometry in City Traffic Police. Indian J Otolaryngol Head Neck Surg. 2018;70(3):342-345.

19) Dube KJ, Ingale LT, Ingal e ST. Hearing impairment among workers exposed to excessive levels of noise in ginning industries. Noise Health 2011;13:348-55.

20) Majumder J, Patel RC, K otadiya S, Shah P. Hearing threshold status and risk estimate of hearing impairment among administrative workforce. Indian J Occup Environ Med 2018;22(1):11-6.

21) Balaji R, Rajasegaran R, John NA, Venkatappa US. Hearing Impairment and High Blood Pressure among Bus Drivers in Puducherry. J Clin Diagn Res. 2016;10(2):CC08–CC10.

22) Manzoor J, Mamta, Rao RJ, Wani KA. Health impact and noise exposure assessment in the cricket bat industry of Kashmir, India. Int J Occup Saf Ergon. 2016; 22(4):473-478. Epub 2016.

23) Oliveira A, Cacodcar J, M otghare D D. Morbidity among iron ore mine workers in Goa. Indian J Public Health 2014;58(1):57-60.

24) DhereAM ,Pawar CB, Patil DA, Pawar JA.Noise induced hearing loss (NIHL) in saw mill and printing press workers in Akluj Town ofSolapur district.J Environ Sci Eng. 2009;51(3):187-90.

25) Singh LP, Bhardwaj A, Deepak KK. Occupational exposure in small and medium scale industry with specific reference to heat and noise. Noise Health 2010;12(46):37-48.

26) Singh LP, Bhardwaj A, Kumar DK. Prevalence of permanent hearing threshold shift among workers of Indian iron and steel small and medium enterprises: A study. Noise Health 2012;14(58):119-28.

27) Singh AK.Comparative assessment of shift in hearing threshold among handicraft operatives in India. Ergonomics. 2019 ;62(1):88-102.

28) Al-Omari AS, Al-Khalaf HM, Hussien NF. Associationof flying time with hearing loss in military pilots. Saudi J Med Med Sci.2018;6(3):155-9.

29) C.P.C.B., 2000. Ambient Air Quality in Respect of Noise. Central Pollution Control Board, New Delhi:Schedule-Part II, Sec. 3.