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RESEARCH ARTICLE

HEARING IMPAIRMENT AMONG SPINNING MILL EMPLOYEES.

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Abstract

The industrial revolution has modernised the companies with machines before kept only by man. In recent times, noise pollution is one of the most permeative problems in the occupational environment which affects workers in various professions. The aim of this study was to detect the degree of hearing impairment in the exposed mill employees and compare it with the non-exposed subjects. 53 workers in the age group of 15-40 years from a spinning mill were included in the study. Healthy individuals in the same age group who were not exposed to noisy workplaces were taken as controls. Pure tone audiometry was performed in both cases and controls in the sound proof audiometry room. The results observed was high prevalence of noise induced hearing loss of about 81%. Majority of them had minimal sensorineural hearing loss since their duration of exposure is between 3 – 5 years. A dip at 4 kHz frequency which is characteristic of noise induced hearing loss was observed in 54.71% of the workers. The study implies the need of awareness about health hazards due to excessive noise levels. Hearing conservation programmes in industry must give attention to many factors which include identification of hazardous noise by sound pressure means, usage of protective devices, engineering improvements to reduce noise production and administrative measures to regulate the exposure of personnel.

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Introduction:-

The industrial revolution has modernised the companies with machines before kept only by man. The technological development created bigger and noisier machines each time, which contributed substantially to aggravate the problem of noise. In recent times it is one of the most permeative problems in the occupational environment which affects workers in various professions. Throughout the world, occupational noise exposure is responsible for about 16% of hearing loss in adult population. Small scale industries like textile, sawmills, printing and mining etc. are responsible for excessive noise and exposure of workers to hazardous noise levels. In India there are large numbers of agro based small scale industries. The workers in these industries are exposed to higher noise levels prevailing at the workplace environment during duty hours. Such high levels of noise can affect hearing threshold. Also it is associated with disorders of gastrointestinal, nervous and cardiovascular system. It causes many psychological problems which ultimately leads to stress. Hypertension and stress are attributed to disorders of the nervous system. This study is conducted in Coimbatore, the city known as Manchester of Tamilnadu where many spinning mills are located. The workers are subjected to a risk of loud noise for prolonged duration. This could affect not only their hearing acuity but also may reduce social interaction, social responsibility, diminish helping behaviour and increase aggressive response.

The intended result of this study is to detect the noise levels in the cotton spinning industry and to identify the prevalence of hearing impairment among workers. The outcome of the present study will raise the level of awareness among industrialists and workers on health risks of their workplace environment, and this will help to

express clearly and exactly the strategies which will protect the workers from the hazardous sound prevailing in the industries.

Aims and objectives:-

1. To perform puretone audiometry in spinning mill workers in Coimbatore.
2. To detect the degree of hearing impairment in the exposed mill employees.
3. To compare hearing acuity between exposed workers and non-exposed subjects.

Materials and methods:-

This is a combined cross sectional and case control study. This study was performed in the Department of Otorhinolaryngology, Coimbatore Medical College Hospital, Coimbatore after obtaining ethical clearance. A total of 53 cases were included in the study of which 15 were males and 38 were females. They were of 15-40 years age group. They were randomly selected workers from a spinning mill located in Coimbatore. The industry employed around 150 employees. They work for 8-12 hours per day for 6 days in a week with 3 - 5 years of occupational noise exposure. Fifty three healthy individuals in the age group of 15-40 years of both sexes who were not exposed to noisy workplaces were included in the study. It included students, office workers, housewives etc. Their noise exposure level was within permissible limit.

Materials used for the study:-

Proforma - to record the details of cases and controls and to record the clinical findings.
Pure tone audiometer.

Exclusion criteria (for both cases and controls):-

Diabetes, Hypertension, H/O Ototoxic drugs, middle ear diseases like CSOM, Otosclerosis and Head injury.

Methodology:-

The study was carried out after explaining the procedures in detail and getting informed consent from the subjects. Ethical clearance was obtained from the Institutional Ethical Committee before the start of the study. The experimental protocol involved

1. Recording of detailed history including their age, number of years of exposure to noise, number of days of work per week, number of hours of work per day and the department in which they work in the spinning mill.
2. Clinical examination of the ear was performed by Otorhinolaryngologist. It included examination for the presence of cerumen in ear, structural assessment, mobility of tympanic membrane, abnormality of external auditory canal, otorrhoea, bleeding or foreign body.
3. Rinne's test was done in all subjects to compare air conduction with bone conduction of each ear separately. It is done by placing the base of the vibrating tuning fork over the mastoid process and the subject is asked to raise the hand when he stops hearing the sound. Then the vibrating tuning fork is held in front of the ear.
4. Weber's test was done in all subjects to study bone conduction. A vibrating tuning fork is placed in the middle of the forehead and subject is asked to indicate in which ear the sound is heard better or heard equally in both the ears or in the center of the forehead. This is expressed as lateralization of sound to a particular ear or not.
5. Pure tone audiometry was performed in both cases and controls in the sound proof audiometry room at the Department of Otorhinolaryngology, Coimbatore Medical College Hospital. The subjects were clearly instructed to respond even to faint sounds by raising their arms when the test tone is heard. Since this is a subjective test it was started after getting the full co-operation of the subject.

Hearing examination included pure tone bone and air conduction audiometry. Audiometry testing was performed in a sound proof room as per the recommendations of American Speech Language Hearing Association using MAICO MA 52 Clinical diagnostic audiometer.

Air conduction was tested with using supra aural earphones Telephonics TDH 39p in the better ear first at 1000 Hz for a duration between 1 and 3 seconds. The reason for starting at 1000 Hz is probably that 1000 Hz has the greatest test - retest reliability. To make sure that the subject is familiar with the procedure the tone is presented at 30 dB hearing level for subjects with normal hearing or around 30 dB more than the estimated threshold for a subject with a hearing disability, but never more than 80dB hearing level. If the tone is inaudible it is increased in 5 dB steps

until a response occurs. After the initial positive response, the tone is reduced in 10 dB till there is no further response.

The tone is reduced by 10 dB and increased by 5 dB till the subject responds at the same level on two out of three or four (i.e 50% or more) responses on the ascent. This is the hearing threshold level. The lowest level at which responses occur in at least half of a series of ascending trials with a minimum of two responses required at that level is defined as the threshold.

Then the next frequency is tested in a similar manner by starting at a clearly audible level and using a 10 dB down, 5 dB up sequence until the threshold criterion is satisfied. The various frequencies were tested in the following order: 1000, 2000, 4000, 8000, 250, 500 Hz. The second ear was tested and hearing threshold was obtained for both ears by this conventional Hughson-Westlak technique and expressed in decibel hearing level units (dB HL).

Bone conduction is tested by placing a bone vibrator B-71 over the mastoid prominence of the affected ear with the required area of the vibrator in contact with the skull. It is placed as near as possible behind the pinna without touching it and without resting on hair and held firmly in place by means of a headband. The same 5 up and 10 down sequence was used for each of the testing frequency. The subject was asked to raise his hands when he hears the sound in either ear or at the center. The other ear was tested in a similar manner.

The hearing threshold levels obtained for each frequency was plotted graphically on an audiogram.

Results:-

The present study was done in the Department of Otorhinolaryngology, Coimbatore medical college hospital, Coimbatore. Fifty three industrial workers (15 males and 38 females) of 15-40 years were recruited for the study. They were randomly selected from various departments in the spinning mill. The changes in hearing level threshold of the workers referred to as Exposed are compared to that of the control group referred to as Non-Exposed.

Table 1: Comparison of hearing loss between exposed and non exposed

		Age	SPL dB	R loss dB	L loss dB	Years of Exposure
Exposed	Mean	23.72	92.68	19.72	19.02	3.69
	SD	6.4	3.88	4.51	4.84	0.8
Non Exposed	Mean	27.13		10.31	10.93	
	SD	5.7		2.07	2.22	
t				13.81	11.05	
P				0.000025	0.00003	

SPL - Sound Pressure Level
ear hearing loss

R Loss - Right ear hearing loss

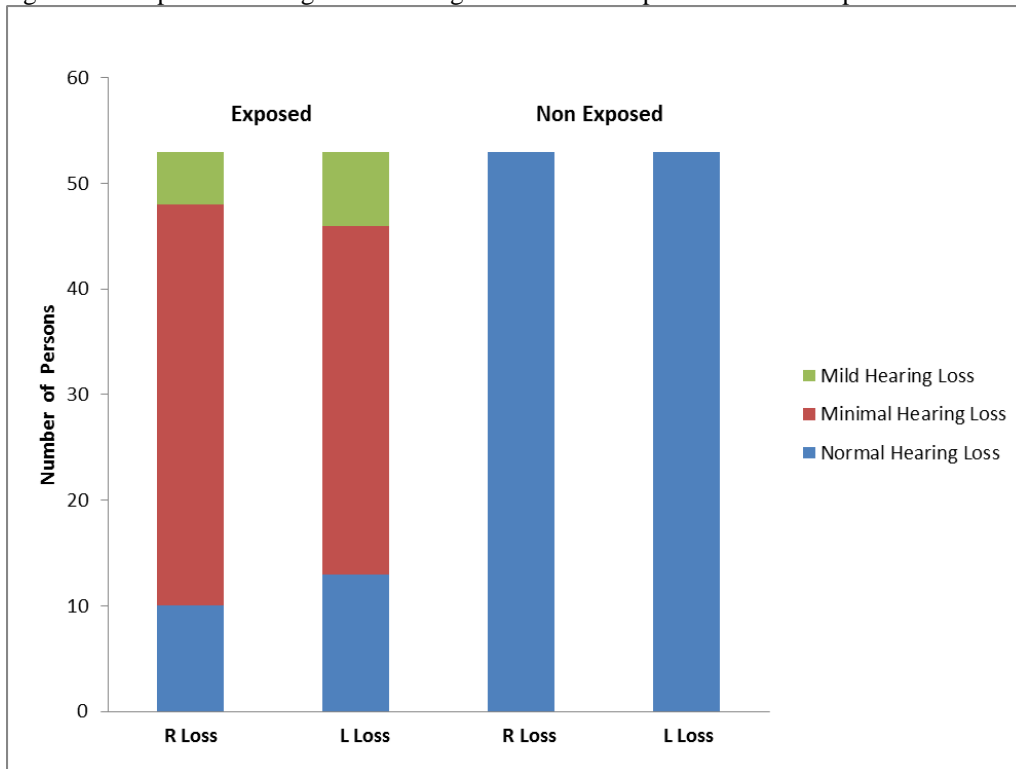
L Loss - Left

The above statistical analysis shows that there is a significant* ($p < 0.05$) hearing loss in both ears in individuals exposed to industrial noise when compared to industrial noise non exposed individuals.

Classification of severity of hearing impairment:-

Classification	Hearing Level (dB)
Profound hearing loss	>90
Severe hearing loss	71 to 90
Moderately severe hearing loss	56 to 70
Moderate hearing loss	41 to 55
Mild hearing loss	26 to 40
Minimal hearing loss	16 to 25
Normal hearing loss	-10 to 15

Figure 1: Comparison of Degree of hearing loss between Exposed and Non-Exposed individuals



R Loss - Right ear hearing loss

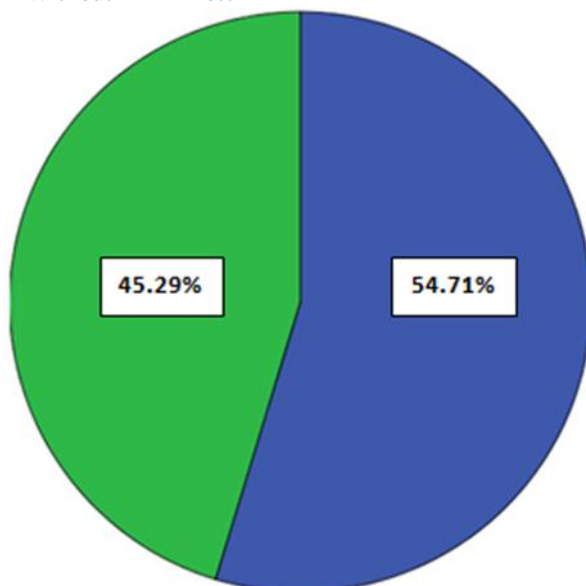
L Loss - Left ear hearing loss

The results of comparison of degree of hearing loss between exposed and non exposed individuals show that large number of exposed individuals have minimal hearing loss while the non-exposed have normal hearing loss as per the above classification.

Figure 2
Percentage Distribution of Prevalence of 4 kHz notch in Cases

Cases

- With 4 kHz notch
- Without 4 kHz notch



Discussion:-

The study of pure tone audiometry in 53 industrial workers in the age group of 18-40 years was done to assess the prevalence and degree of sensorineural hearing loss and to compare it with non exposed individuals.

The workers participating in the study spend around eight to twelve hours in a day for 6 days in a week in the spinning mill without using any personal protective equipment. They are exposed to noise levels between 85-97 dB. The previous studies showed people exposed to noise level above 85 dB suffer from noise induced hearing loss. Bhattacharya et al² reported similar higher noise levels (102-104dB) at the workplace of textile mill workers. Noise level at various sections of an Indian iron and steel enterprises was found to be greater than 90 dB permissible limits¹².

In this study it was observed that noise level in spinning industry exceeded the prescribed noise exposure limits of 85 dB for industrial workers in India. This contributes to the high prevalence of noise induced sensorineural hearing loss of 81% among industrial workers included in the study. The finding is generally consistent with the other studies in the published literature.

The study done by Chavalitsakulchai P et al⁵ in textile workers reported significant hearing loss. Maisarah SG et al⁹ observed 83% prevalence of sensorineural hearing loss in exposed industrial workers. The prevalence in weaving section was 84.5% as compared to 2.9% in administrative staff⁶. It was observed to be 45% in cement plant workers⁷, more than 90% in Indian iron and steel workers¹². Significant hearing loss in noise exposed workers were also reported by many studies.^{3,8,10}

This may be due to changes in micromechanical structures within the cochlea. It causes depolymerisation of actin filaments, swelling of striavascularis, afferent nerve endings and supporting cells. It is evidenced that both apoptosis and necrosis play a role in noise induced hearing loss. Acoustic overstimulation could lead to excessive release of glutamate. There is reduction in cochlear blood flow associated with acoustic stimulation. Specifically there are indications that stimulation with sound of moderate intensity increases cochlear blood flow and with sound of high intensity decreases cochlear blood flow. There is also some evidence that noise induced hearing loss and cochlear hypoxia precede changes in cochlear blood flow.

The present study has included industrial workers exposed to noise for a duration of 3-5 years. Even for this short duration of exposure the degree of hearing impairment observed during this study shows that minimal hearing loss is common (38 out of 53) among the spinning mill workers. Studies show that elevation in hearing threshold correlates with the duration of exposure. Szantsetal¹⁴ observed hearing loss exceeds 30 dB in miners with duration of exposure above 20 years. Similar results were revealed in other studies^{3,8,10}.

The prevalence of 4kHz notch in the present study was observed to be 54.71%. Sulkowski W et al¹³ observed 90% exhibited maximum loss at 4 kHz frequency. A study in Canadian workers¹ noted that the effect of continuous noise exposure was maximal in the region of 2 – 6 kHz. Maximal threshold shifts were observed at 4 kHz frequency in many studies.^{4,8,11}

A dip at 4 kHz may be due to more firmly fixed basilar membrane at the basal turn of cochlea subjected to noise torsion and more liable to degenerative changes or maybe it is due to hypofunction of middle ear musculature. It may also be due to hydrodynamic causes or because of loss efficient blood supply of this part of basilar membrane.

The study implies the need of awareness about health hazards due to excessive noise levels. Hearing conservation programmes in industry must give attention to many factors which include identification of hazardous noise by sound pressure means, usage of protective devices, engineering improvements to reduce noise production and administrative measures to regulate the exposure of personnel. Potential harmful effects of noise exposure to workers may also be decreased by reducing the number of working hours per day.

There is no known treatment for established deafness of noise damage, though treatment with plasma expanders has been advocated for acoustic trauma.

References:-

1. Abel SM, Haythornthwaite CA. The progression of noise induced hearing loss. A survey of workers in selected industries in Canada. *J Otolaryngol Suppl.* 1984 Apr; 13 : 2 – 36.
2. Bhattacharya SK, Saiyed HN, Roy A, Chatterjee SK. Hearing acuity in weavers of textile mill. *Indian J Med Res.* 1981; 74: 779 – 85.
3. Boateng CA et al. Industrial noise pollution and its effects on the hearing capabilities of workers : A study from saw mills, printing presses and corn mills. *Afr J Health Sci.* 2004; 11(1-2) : 55 – 60.
4. Celik O et al. Hearing parameters in noise exposed industrial workers. *AurisNasus larynx.* 1998 Dec; 25(4) : 369 – 75.
5. Chavalitsakulchai P et al. Noise exposure and permanent hearing loss of textile workers in Thailand. *Ind Health.* 1989; 27(4) : 165 – 73.
6. Davis H. A model for transducer action in the cochlea – Cold spring Harbor Symposia on Quantitative Biology. 1965; 30 : 181 – 9.
7. Hernandez – Gaytan SI et al. Prevalence of hearing loss and correlated factors in a cement plant. *SaludPublica Mex.* 2000 Mar – Apr; 42(3)
8. Hong O. Hearing loss among operating engineers in American construction industry. *Int Arch Occup Environ Health.* 2005 Aug; 78 (7): 565 – 74.
9. Maisarah SZ, Said H. The noise exposed factory workers : the prevalence of sensorineural hearing loss. *Med J Malaysia.* 1993 Sep; 48(3) : 280 – 5.
10. Omokhodion FO et al. Hearing impairment among mill workers in small scale enterprises in South West Nigeria. *Noise Health.* 2007 Jul – Sep; 9(36) : 75 – 7.
11. Osibogun A et al. Noise induced hearing loss among textile workers in Lagos metropolis. *Niger Postgrad med J.* 2000 Sep; 7(3) : 104 – 11.
12. Singh LP et al. Prevalence of permanent hearing threshold shift among workers of Indian iron and steel small and medium enterprises : a study. *Noise Health.* 2012. May – Jun; 14(58) : 119 – 28.
13. Sulkowski W et al. A permanent noise – induced shift in the auditory threshold in textile industry workers *Med Pr.* 1986; 37(3) : 175 – 86
14. Szanto C, Ionescu M. Hearing loss of workers in mining – a 6 year longitudinal study. *Z GesamteHyg.* 1990 Jan; 36 (1): 44 – 7.