Original Articles:
Occupational and Envaironmental Health

International Physiology
Vol. 3 No. 1, January - June 2015
DOI: https://dx.doi.org/10.21088/ip.2347.1506.3115.5

A Study to Evaluate the Effect of Occupational Noise on Hearing Threshold in Human Resources Occupationally Engaged in Organized Sector

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Abstract

Noise induced hearing loss, a permanent bilateral hearing impairment, represents one of the most common occupational disease. It is caused by sustained, repeated exposure to excessive sound levels. A study has been conducted to assess the impact of occupational noise, if any, on hearing status of human resources occupationally engaged in organized sector industry. Individuals working for at least a period of 5 years were approached. 45 consenting male human resources, aged between 31–40 years, working in different departments constituted the exposed group (EG). 51 male human resources were randomly selected from the same age group but working in the administrative office of the same sector to constitute the control group (CG). Results indicated that 68.6 % EG individuals and 16.2% of CG individuals had bilateral hearing impairment. From the present study it may be concluded that, the EG individuals are more affected in terms bilateral hearing impairment than that of their CG counterpart.

Keywords: Audiometric Test; Hearing Impairment; Human Resources; Occupational Noise.

Introduction

The oldest occupation of human beings in 4000 B.C. was hunting where men used to hunt with hand tools. The industrial revolution of eighteenth century had brought in new dimensions to the society which included creations of slums, overcrowding, social problems, communicable and industrial diseases. With industrialization, came louder machines; and perhaps noise become the most common occupational and industrial hazard [33]. The term noise is commonly used to describe sounds that are disagreeable or unpleasant, produced by acoustic waves of random intensities and frequencies [1]. Exposure to high level of noise has been found to be associated with hypertension incidence in the occupational population [24] in a dose-response manner. Not only that, high level of noise hinders communication [19] between workers and is also responsible for different types of adverse physical, physiological and psychological health effects [4]. Hearing loss due to occupational noise exposure has also been described as our most prevalent industrial malady [28] and it has been estimated that worldwide, approximately 16% of hearing disability is caused by occupational noise exposure [23]. Occupational noise is an integral part of the job especially in iron and steel industries that may cause severe hearing loss. Besides workers in industries such as mining, construction, printing, crushing, drop forging, iron and steel companies, and so on are at high risk of noise-induced hearing loss [22]. The progression to noise-induced hearing loss is a function of a few factors such as frequency, intensity and duration [14, 20]. Cumulative and repetitive exposure to high-intensity noise levels and long duration of contact with noise levels beyond the permissible exposure limit may aggravate the develop-ment of this occupational disease [9]. The major risk factor for noise-induced hearing loss is long term, unprotected exposure to levels of noise beyond 85 dB (A) [25]. Recently, concern raise about

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the prevalence of hearing impairment among employees of as a consequence of their exposure to noise. In this backdrop, the present study has been undertaken to assess the impact of occupa-tional noise exposure among the human resources occupationally engaged in organized sector industry.

Methods

The study was conducted on individual workers of age range 31–40 years, working in different sections of the organized sector industries, after obtaining necessary permission. 45 individual workers with a minimum working experience of at least 5 years, constituted the Exposed Group (EG). 51 individuals of comparable age range but working in administrative offices constituted the Control Group (CG). Human resources who previously worked in noise induced area in other place, and with self reported brain injury, middle ear infection, ototoxic medication, systemic disease, hereditary hearing loss, heavy smoker and alcoholic consumers [10] were excluded. Information about age (year), working experience (year), self reported past incidence of major illness of self and parents were recorded in pre-designed schedule. Physical data in terms of body height (cm) using anthropometric rod with an accuracy of 0.1cm, body weight (kg) using a pre- calibrated weighing scale with an accuracy of 0.1kg and with individuals in light clothing and without shoes, were measured and BMI was calculated. Audiometric test was carried out with a portable audiometer for obtaining the hearing threshold at different frequencies (0.25 kHz–8 kHz) [32]. The audiometric assessment was carried out on each individual at a time for both ears separately using the air conduction mode in pure tone. The background sound level was checked periodically. Hearing impairment was calculated. Obtained data were tabulated and used for further statistical analysis. Standard descriptive statistics (mean ± standard deviation) and Chi square test was carried out with the chosen level of significance being 0.05.

Results

In Table 1, the sample size (n), age (year), working experience (year), body height (cm) and body weight (kg) of the participants have been presented.

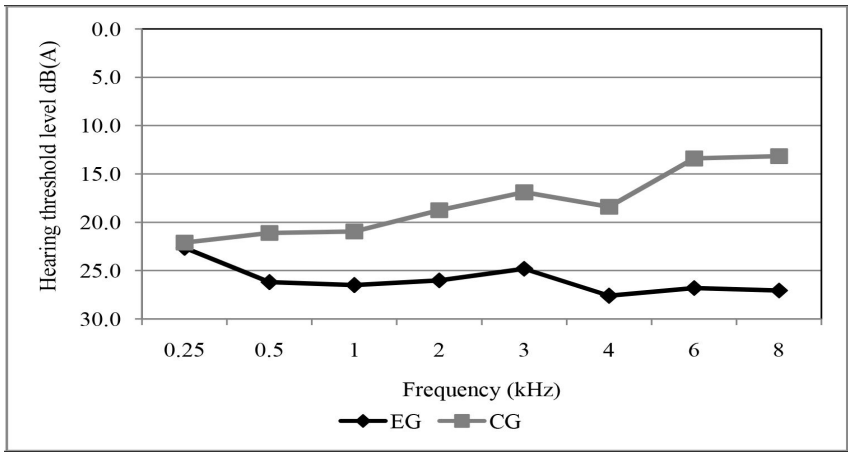
Table 1: Comparison of Basic profile of the EG and CG individuals

Variables	EG	CG
Sample Size	45	51
Age^(year)	36.3 ± 2.89	35.8 ± 5.51
Work Experience^ (year)	12.1 ± 2.77	11.9 ± 3.56
Body Height** (cm)	169.7 ± 8.29	165.3 ± 6.37
Body Weight^ (kg)	67.4 ± 9.35	65.3 ± 7.41

AM ± SD; ^ ns; **P<0.01

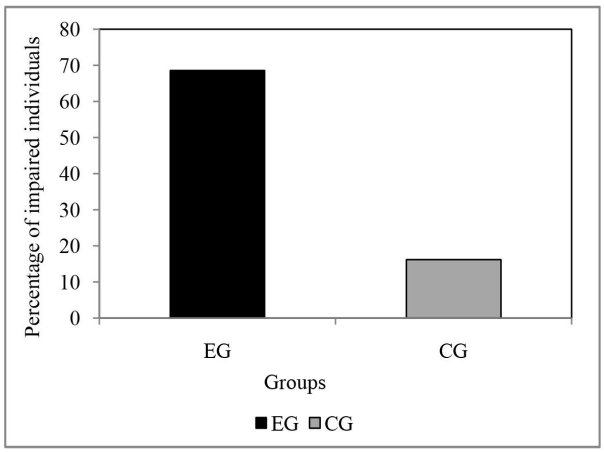
Average bilateral hearing threshold of study participants at different frequencies (0.25 kHz–8.0 kHz) has been presented in Figure 1.0.

Fig.1.0: Comparison between EG and CG individuals in respect of their average bilateral hearing threshold level



A comparison of bilateral hearing impairment status of the study participants has been presented in Figure 2.0.

Fig.2.0: Comparison between EG and CG individuals in respect of bilateral hearing impairment status



Discussion

With respect to population growth, it is inevitable that there will be an increasing need for more technology and industrial development in order to provide the needs of evolving communities. Mechanization of common processes enables creation of time-saving production lines, which contain inherent risks. It is found that people are getting affected to ill effect of noise in different countries [13, 15]. Even children are not spared and our country is neither an exception [17, 21]. The situation is even worse in occupation involving high noise [3, 30- 31].

Average hearing threshold of EG and CG individuals has been presented in Fig.1. In the present study it has been found that at speech frequency (0.5-2 kHz), for EG individuals, the average hearing threshold was from 26.2 to 26.0 dB (A) and for CG counterparts, it was from 21.1 to 18.8 dB (A). For EG individuals the average hearing threshold at higher frequencies (4–8 kHz) was from 27.6 to 27.1 dB (A), whereas for CG individuals it was from 18.4 to 13.2 dB (A). The characteristic notch in the left ear, generated from the average hearing threshold, of EG individuals has been observed at 4 kHz. Present trend of results are in consonance with earlier studies [18, 5]. A study on NIHL among jute workers confirmed that a dip at 4 kHz is the first sign of exposure to broad band, steady loud noise [29]. The first sign of NIHL is a V-shape dip or notch in the audiogram with the maximal hearing threshold level at 4 or 6 kHz. The various theories on the pathogenesis of dip at 4 kHz attributed it to vascular insufficiency at the 4 kHz region of cochlea, high amplitude of the traveling wave at that region of cochlea [2], resonance characteristic of ear canal to loud sound [27], weak attachment of basilar membrane at that region of cochlea and para ossicular conduction to basal turn of cochlea. The findings of another study revealed that, acoustic over stimulation results in Noise Induced Hearing Loss (NIHL) due to increase neurotransmitter release or due to decrease in cochlear blood flow. However other metabolic cochlear mechanisms that are focus of experimental investigations include outer hair cell plasma membrane fluidity [8]. A recent study also found an association between BMI status and audiometric notch; individuals with higher BMI value had audiometric notch at 4 kHz whereas individuals with normal BMI had audiometric notch at 6 kHz [6]. A comparison of bilateral hearing impairment status of EG and CG individuals at speech frequency has been presented in Figure 2.0. Among 45 EG individuals 68.6% had bilateral hearing impairment whereas among 51 CG individuals 16.2% individuals had bilateral hearing impairment. A significant difference ($P < 0.01$) has been observed between EG and CG individuals in respect of their impairment status. Similar trend of result has been observed in our earlier studies on human resources of organized transportation sector [7]. Earlier studies reported that 60% human resources occupationally exposed to noise in construction industry in USA [11], 84% of human resources occupationally exposed to noise in the steel factory in East Java [10] and 79.8% of the human resources occupationally exposed to high noise in US textile industry [26], had bilateral hearing impairment. Hearing loss was most commonly observed at 4 kHz whereas 6 kHz and 3 kHz were the second and third frequency indicators of NIHL [11, 16]. This might be the probable reason for majority people being unaware of their impairment status [11-12]. A study from Surat carried on textile industry workers has found that hearing status of the study participants have been affected both at higher and speech frequencies [32]. From the present study it may be concluded that the human resources occupationally engaged in organized sector, regularly exposed to high noise level, are more affected, compared to their CG counterparts.

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