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Original Research Article

Auditory and non-auditory health effects of noise exposure among people working near traffic junctions in Mysuru city, Karnataka

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ABSTRACT

Background: To assess the prevalence of health effects of noise exposure and the factors associated with it among people occupationally exposed to traffic noise in Mysuru city in Karnataka.
Methods: A community based crossectional study was conducted for two months in Mysuru city in Karnataka. The sample size was calculated to be 280 and study participants were recruited from 70 selected locations in the city including all major traffic junctions with signal or traffic police control, covering all regions in the city. Four samples were assessed from each location by history taking and the ambient sound level was recorded from each location using a sound level meter. Data were entered in microsoft excel and analysed using SPSS version 22.
Results: The prevalence of hearing loss among the study participants was 5.7% and 1.8% of people complained of tinnitus. Among the study participants, 8.9% had hypertension, 1.1% had cardiovascular disorders, 8.2% had sleeplessness, 6.4% had anxiety, 2.9% had irritability, and 5.7% reported a reduction working efficiency. The proportion of study participants with at least one health effect noise exposure was 26.07%. Only age group was significantly associated with the development of health effects among the exposed individuals.
Conclusions: An alarming proportion of people working near traffic areas in Mysuru city are exposed to higher levels of noise and more than 25% of them show symptoms of auditory and/ or non-auditory health effects of noise pollution.

Keywords: Noise pollution, Noise-induced hearing loss, Non-auditory health effects

INTRODUCTION

Noise pollution is an emerging public health problem with various auditory and non-auditory health effects.[1] Considering the distribution noise pollution and range of health effects caused by it, it is often called as the modern plague.[2] Potential sources of noise pollution like vehicles, industries, television etc. are distributed in occupational and domestic surroundings of modern man's life. Various guidelines have been set to regulate the ambient noise levels in the atmosphere. Health agencies have recommended allowable maximum noise levels for urban and occupational areas. The acceptable noise levels in residential areas range from 25 to 40 dB while in commercial areas a range of 35 to 60 dB and industrial areas a level of 40 to 60 dB is acceptable. Lower noise levels are recommended in hospitals and educational institutions ranging from 20 to 35 dB and 30 to 40 dB

respectively. The World Health Organization recommends a maximum level noise of 70 dB at commercial and traffic areas. People exposed to noise higher than this limit are warned for health effects including hearing loss.[1]

Noise pollution accounts for auditory and non-auditory health effects. Evidence has been collected on the effects of noise on hearing. Noise-induced hearing loss is associated with long term exposure to high levels of noise. Non-auditory effects such as hypertension, cardiovascular disorders, sleeplessness, anxiety, irritability and reduced work efficiency also are associated with high noise exposure.[1,3] This study attempts to assess the prevalence of health effects of noise pollution exposure and the factors associated with it among people occupationally exposed to traffic noise in Mysuru city in Karnataka.

METHODS

A community-based cross-sectional study was conducted in July and August 2019 in Mysore city. Based on an 81.2% prevalence of occupational noise-induced hearing loss among traffic police personals in Pune city observed Singh VK et al, the sample size was calculated to be 280, using the formula, $N=4pq/d^2$, where p is the prevalence, q=100-p, and d is the absolute precision of 5%. A non-response rate of 10% also was considered while finalizing the sample size.[4] The samples were allotted by simple random method. Among the traffic junctions and signals in the city, 70 spots were selected randomly after line listing. At least one junction from all administrative divisions of the city was selected. From each junction, 4 nearest workers were selected for the assessment. Persons working near the junction for at least one year, and minimum of 6 hours in a day in 6 days of the week were included and persons not willing to participate in the study were excluded. After obtaining consent from the study participants, a thorough medical history was obtained. History of symptoms of hearing loss, tinnitus and medical history of hypertension and cardiovascular disorders were noted and persons were asked about symptoms of irritability, anxiety, sleeplessness and reduced work efficiency. Any symptom or medical diagnosis developed or detected at least 6 months after the current occupation was recorded for analysis. The one-hour average noise level was recorded from each junction for comparison using a sound level meter (MASTECH MS6708 handheld industrial digital sound level meter 30~130dB analog bar display back light decibel tester) during the peak traffic hours (8.45 AM to 10.45 AM and 3.30 PM to 5.30 PM).

The data collected were entered into microsoft excel spreadsheet and was analyzed using licensed SPSS version 22. The descriptive data like demographic data and the proportion of health effects were expressed in percentages. The categorized data were analyzed and tested for association using inferential analytical tests like chi-square test.

RESULTS

Among the study participants, the majority were males (82.9%). The participants were categorized based on age groups and 38.6% belonged to the age group of 46 to 65 years. A proportion of 26.1% study participants were belonging to the age group of 15 to 30 years and 33.6% were belonging to 31 to 45 years. Among the sample group, 5 persons (1.8%) were aged above 65 years. Based on the type of area and the presence of important landmarks, the traffic junctions assessed were divided into four different groups. Of the 280 participants, 14.3% were working in residential areas while 55.7% were working in commercial areas. A proportion of 10% were occupied near places of worship while 8.6% were working around traffic junctions near hospitals and 11.4% were working near educational institutions (Table 1).

The maximum proportion of study participants were working in/ owning petty shops and street food stalls (42.9%). This was followed by salesmen/saleswomen (24.3%), auto-rickshaw drivers (15%), mechanics (8.6%), workers in petrol pumps (6.8%), and security guards (2.5%). The study participants were categorizes based on their years of experience at the locality and daily hours of exposure to the noise. Majority of study participants (61.4%) were working at their respective localities for less than 10 years. Among the samples, 23.2% were working for 11 to 20 years. While 10.7% of study participants were working for 21 to 30 years, 4.6% were working at the sites for more than 30 years. Of the study participants, 21.1% were exposed to traffic noise for 6 to 8 hours daily. While 21.8% were exposed to noise 9 to 10 hours a day, 44.6% were exposed for 11 to 12 hours and remaining 38.6% were exposed for more than 12 hours a day (Table 2).

Among the study participants, 61.4% were exposed to noise levels exceeding the recommended maximum and 38.6% were exposed to noise levels within the recommended maximum (Table 2). The prevalence of hearing loss among the study participants was 5.7% and 1.8% of people complained of tinnitus. Of the study participants, 8.9% had hypertension while 1.1% had cardiovascular disorders. The prevalence of sleeplessness was 8.2% and anxiety was 6.4%. While 2.9% complained of irritability, 5.7% of participants reported a reduction in working efficiency (Table 3). Among the study participants, 6.07% had at least one auditory effect of noise exposure while 22.5% had at least one non-auditory health effect. The proportion of study participants with at least one health effect noise exposure was 26.07% (Table 3).

The presence of at least one health effect of noise exposure was compared across different demographic and occupational categories and levels of noise exposure and

presence of association was assessed by performing chi-square test and fisher's exact test appropriately. The prevalence was more among males, geriatric persons, workers near hospitals, petty shop owners/street food vendors, persons exposed to the noise for more than 30 years and persons with daily exposure of 11 to 12 hours. However, a statistically significant association was noted only between the age group and the presence of at least one health effect. The maximum proportion of people with health effects of noise pollution was seen among the geriatric age group (40%). Among people aged between 46 to 65 years, 38.9% had health effects and among the age group of 31 to 45 years, the proportion of people with health effects was 26.6%. The proportion was minimum in the age group of 15 to 30 years with only 5.5% showing health effects. This difference was statistically significant with a p-value <0.001 on fisher's exact test. (Table 1 and 2).

Table 1: Distribution of study participants based on demographic and occupational characteristics and proportion of persons with at least one health effect of noise exposure across different categories.

Demographic and occupational characteristics		Total frequency (%)	Noise induced health effects (at least one) (%)	P value
Gender	Male	232 (82.9)	59 (25.4)	0.592*
	Female	48 (17.1)	14 (29.2)	
Age groups (years)	15-30	73 (26.1)	4 (5.5)	<0.001**
	31-45	94 (33.6)	25 (26.6)	
	46-65	108 (38.6)	42 (38.9)	
	>65	5 (1.8)	2 (40)	
Locations of work	Residential areas	40 (14.3)	11 (27.5)	0.462*
	Near places of worship	28 (10)	7 (25)	
	Near hospitals	24 (8.6)	7 (29.2)	
	Near educational institutions	32 (11.4)	4 (12.5)	
	Commercial areas	156 (55.7)	44 (28.2)	

* Chi-square test, **Fishers exact test.

Table 2: Distribution of study participants based on occupational characteristics and noise exposure and proportion of persons with at least one health effect of noise exposure across different categories.

Occupational characteristics and noise exposure		Number (%)	Noise induced health effects (at least one) (%)	P value
Occupation	Petty shops/street food vendors	120 (42.9)	35 (29.2)	0.924*
	Auto drivers	42 (15)	11 (26.2)	
	Salesmen/ saleswomen	68 (24.3)	15 (22.1)	
	Petrol pump workers	65 (6.8)	4 (21.1)	
	Mechanics	30 (8.6)	6 (25)	
	Security guards	13 (2.5)	2 (28.6)	
Years of experience at the location (years)	<10	172 (61.4)	38 (22.1)	0.067**
	11-20	65 (23.2)	20 (30.8)	
	21-30	30 (10.7)	8 (26.7)	
	>30	10 (4.6)	7 (53.8)	
Daily exposure in hours	6-8	59 (21.1)	16 (27.1)	0.414*
	9-10	61 (21.8)	11 (18)	
	11-12	125 (44.6)	37 (29.6)	
	>12	35 (12.5)	9 (25.7)	
Noise exposure	Above recommended maximum (70 dB)	172 (61.4)	48 (27.9)	0.377*
	Below recommended maximum (70 dB)	108 (38.6)	25 (23.1)	

* Chi-square Test, **Fishers Exact Test.

Table 3: Prevalence of different auditory and non-auditory health effects of noise exposure among the study participants.

Health effects		Frequency	
		N	%
Auditory effects	Hearing loss	16	5.7
	Tinnitus	5	1.8
Non-auditory effects	Hypertension	25	8.9
	Cardiovascular disorders	3	1.1
	Sleeplessness	23	8.2
	Anxiety	18	6.4
	Irritability	8	2.9
	Reduced working efficiency	16	5.7

DISCUSSION

The prevalence of self-reported hearing loss among the study population was 5.7% and 1.8% of participants complained of tinnitus. Of the total sample population, 6.07% had presented auditory effects of noise. The prevalence was, however, low when compared to the results of similar studies from India. Singh and Mehta observed a very high prevalence, 81.2% of sensory neural hearing loss among traffic policemen in Pune.[4] A similar high prevalence (87%) of reported hearing loss was shown among shopkeepers exposed to traffic noise in Jalgoan city centre by Ingle et al.[5] Another study among industrial workers showed a 39% prevalence of sensory neural hearing loss in workers exposed to noise levels above 87.3 dBA.[6] The health effects of noise shos an increasing incidence in increasing age groups. Rosenhall shows the increasing trend of hearing loss and tinnitus among older persons exposed to noise which is a similar observation to our study.[7]

The existing literature shows a clear relation between noise exposure and different non-auditory effects like hypertension, cardiovascular disorders, mental health effects, endocrine irregularities, etc.[8] According to this study, among the study participants, 8.9% had hypertension, 1.1% had cardiovascular disorders, 8.2% had sleeplessness, 6.4% had anxiety, 2.9% had irritability, and 5.7% reported a reduction working efficiency. Among the study participants, 22.5% had at least one non-auditory health effect. In a study done in the northern part of the country, 74% of respondents reported irritation, whereas 40.4% suffered noise-induced headache.[9] The effect of noise pollution in rising arterial blood pressure is supported by evidence from experimental studies.[10] The risk of developing cardiovascular diseases also rise on daily noise exposure above 65 dBA.[11]

CONCLUSION

Among the workers in Mysuru cty exposed to traffic noise, more than 60% are exposed to noise levels above the recommended maximum. The prevalence of hearing loss among the study participants was 5.7% and 1.8% of people complained of tinnitus. Of the study participants, 8.9% had hypertension while 1.1% had cardiovascular disorders. The prevalence of sleeplessness was 8.2% and anxiety was 6.4%. While 2.9% complained of irritability, 5.7% of participants reported a reduction in working efficiency. Among the study participants, 6.07% had at least one auditory effect of noise exposure while 22.5% had at least one non-auditory health effect. The proportion of study participants with at least one health effect noise exposure was 26.07%. Only age group was significantly associated with the development of health effects among the exposed individuals.

An alarming proportion of people working near traffic areas in Mysuru city are exposed to higher levels of noise and more than 25% of them show symptoms of auditory and/or non-auditory health effects of noise pollution. Hence preventive measures have to be designed and implemented by the authorities to regulate and control the noise exposure effectively and bring down the health effects.

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