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Vulnerability of bus and truck drivers affected from vehicle engine noise

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Abstract

The purpose of this study was to find out the vulnerability of bus and truck drivers due to constant exposure of vehicle-engine noise inside the vehicle cabin. Comparative results revealed that noise levels inside the cabin of buses and trucks were in the range of 88.6–102.4 dB and 87.95–103.4 dB, respectively. The health status of bus and truck drivers was assessed by measuring their systolic and diastolic pressure, pulse rate, BMI, digestion problem, hearing loss, vision problem, back pain and irritation. Paired *t*-test of the results revealed non-significant ($p < 0.05$) relation between systolic and diastolic pressure of both bus and truck drivers. The pulse rate of truck driver was significantly ($p < 0.01$) related with noise level inside the cabin of truck. The humidity level inside the cabin showed a positive relation with vehicle age ($p < 0.01$) and driving period ($p < 0.01$). This study clearly suggests that vehicle engine noise adversely affects the cardiovascular health of both bus and truck drivers.

Keywords: Bus and truck driver; Noise; Systolic–diastolic pressure; Cardiovascular

1. Introduction

Noise, defined as undesirable sound, is unknown to be a stress stimulus (Mondal, 2013) that can produce acute blood pressure (BP) elevation in animals (Baudrie et al., 2001) and humans in laboratory or occupational settings (Andren et al., 1983). Noise is most widely spread pollutant in work environment and living environments (Mondal and Ghatak, 2014; Tomei et al., 2000). Today noise pollution is one of the main forms of urban environmental pollution and is responsible for negative impacts that are harmful to the environment and the quality of community health (WHO, 2003). Several comprehensive reviews documented numerous adverse effects of noise exposure, including hearing impairment, annoyance, sleep disturbance and hypertension (Thompson, 1981, 1983; Passchier-Vermeer and Passchier, 2000). Among the several abnormalities under highly intensified noise environment, BP is one of the most important indicators and it is well established that BP is increased after exposure to industrial noise level greater than 95 dBA (Andren et al., 1980; Holand et al., 1999). As noise is usually experienced along with the vibration, there is a combined assault on the lorry and bus driver from both sources (Karimi et al., 2010). It is a grave matter of concern for bus and lorry drivers who already experience elevated stress from the traffic environment during busy schedule of the work (Whitelegg, 1955). Some longitudinal and cross-sectional studies showed that bus drivers had a high risk

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for cardiovascular morbidity and mortality (Netterstrom and Suadicami, 1993; Netterstrom and Juelm, 1988). Traffic noise is a major environmental pollution in developed and developing nations (Karimi et al., 2010). Vehicle drivers are the obligatory victim of such noise of high intensity for long duration. One study conducted by Patwardhan et al., (1991) in India has shown that about 89% bus drivers who were exposed to 89–106 dB (A) noise had abnormal audiograms i.e. they had impaired hearing. Another cross-sectional study conducted by Abdelmoneim (2003) on 62 long distance bus drivers and 46 city bus drivers reported that long distance bus drivers' workload and hearing impairment were significantly higher than those of city drivers. The prevalence of hearing loss and hypertension was also higher among the long distance drivers. Mukherjee (2003) investigated on the occupational confounding agents (Noise, heat, dust and volatile organic compounds) of bus drivers in Kolkata, India and indicated that the drivers undertaking three consecutive trips within Kolkata city had higher noise exposure than the recommended standard.

Keeping in view of above occupational hazards, a comparative study has been undertaken that deals with the cardiovascular phenomenon effect between bus and truck drivers who are constantly exposed to such heavy engine noise.

2. Methodology

2.1. Data collection

Data were collected from bus stands of two district towns (Tinkonia bus stand (23°14′47″ N, 87°52′10″ E) Burdwan and Suri Bus stand (23°54′13″ N, 87°31′41″ E) Suri, Birbhum, West Bengal). Noise reading was recorded when bus entered to the town and recording was completed before reaching the bus stand. But noise from the cabin of truck was collected during perking near the roadside (G.T. Road, Burdwan). Health related data were collected from the drivers of bus and truck through questionnaire immediately after reaching at bus stand and road side hotel, respectively.

2.2. Questionnaire

The questionnaire consisted of two segments. The first part comprised general socio-demographic data: driver's age(y); driving period(y); vehicle age(y); humidity level inside the cabin (%). The second part of the questionnaire contains physiological disorder of driver: vision problem; hearing problem; irritation; back pain and digestion problem.

2.3. Anthropometric measurement

Body height was measured to the nearest 0.5 cm. Body weight was measured on a digital scale to the nearest 0.1 kg. The drivers' body weights were measured in light clothes and bare foot. Body mass index (BMI) was calculated as a quotient between body weight in kilograms and squared body height in meters.

2.4. Blood pressure and heart rate measurement

Drivers' blood pressure was measured using a sphygmomanometer (Model No. 114601, Japan). Cuff size of 10.5×25.5 cm or 20×35 cm were used according arm measurement criteria (Kirkendall et al., 1981) concerning medical devices. Measurements were performed after a fifteen minute rest, in a sitting position, with the right arm at the heart level. Two measurements were performed on the right arm with a five minute interval. If the difference between measurements exceeds 5 mm Hg, the third measurement was performed, and mean values of systolic and diastolic pressures were calculated. Heart rate was counted by radial artery palpitation for 1 min. The measurement was performed by one trained scholar according to the study protocol. Drivers were not allowed to talk during measurement session.

2.5. Statistical analysis

Descriptive statistic is presented as mean value ± standard deviation (SD) for numeric variables. Differences between groups in parametric data were tested using student's *t*-test and one-way ANOVA followed by Least Significant Difference Test (LSD) and post hoc analysis. Mean Whitney *U*-test and Chi-square test were used for nonparametric data. Based on the results of univariate analyses, variable significantly related to blood pressure and heart rate was included in a multiple linear regression model and Pearson correlation study. A probability level of less than 0.05 was accepted as significant. Statistical analysis was done by using software SPSS 20 and Minitab 16.

3. Results and discussion

In this study the driving age was 45.65% in the range of 10–25 years and 54.34% in the range of 8–15 years. The study includes only the male subject with the body weight varying from 32 to 66 kg. 86% of bus drivers had a body weight ranging from 45 to 66 kg followed by 8% in the range of 37–66 kg and 4% in the range of 61–66 kg. The truck drivers had a lower body weight in the range of 32–55 kg, 71% had 41–50 kg, 10.5% had 32–40 kg and 10.5% had 41–50 kg.

Average humidity levels inside the cabin of bus and trucks were 86.31% and 84.03%, respectively. Humidity is an important factor so far as noise is concerned. The statistical results indicated that there is a significant difference ($p < 0.02$) between humidity level inside the cabin of buses and trucks (Table 1), although the noise from both buses ($R^2 = 0.0058$) and trucks ($R^2 = 0.0046$) does not show any strong relationship along with the humidity level