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Status of noise pollution in urban area of Dharan Sub-Metropolitan City and Inaruwa Municipality of Sunsari District, Nepal

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Abstract

The environmental noise level measurement in Dharan and Inaruwa cities of eastern Nepal were conducted and compared with the ambient noise standards provided by Government of Nepal. The noise pollution assessment was performed in autumn and winter seasons by the indicator average day time sound pressure level ($L_{d,}$ during 7.00 to 22.00 hrs) and average night time sound pressure level ($L_{n,}$ during 22.00 to 7.00 hrs). The L_d and L_n values at the commercial, silence and residential zones of Dharan were 78 to 82 and 72 to 73, 65 to 73 and 60 to 70, 65 to 76 and 62 to 64 dB(A) in autumn and 78 to 79 and 72 to 76, 64 to 71 and 58 to 68, 63 to 74 and 60 to 62 dB(A) in winter, respectively whereas for Inaruwa, measurement were 75 to 77 and 73 to 75, 59 and 57, 67 and 60 dB(A) in autumn and 66 to 70 and 63 to 68, 55 and 53, 65 and 58 dB(A) in winter, respectively. The results showed that noise levels exceeded the standard value at most of the sites.

Key words: Road traffic Sound pollution level, L_d, $L_{n,}$

Introduction

Noise pollution, a form of environmental air pollution is a threat to human health which is widespread and more severe than ever before. Because of urbanization, increase in population and growth in the use of powerful sources of noise continue to increase in magnitude and severity (Goines *et al.*, 2007). Hearing impairments like temporary and permanent hearing loss may be caused by noise of a high intensity volume. Noise is harmful not only to the behavior, well being and health of human but also affects the behavior and habit of animals (Yong, 2008). Non auditory effects of noise exposure on public health is increasing which leads to annoyance, disturbs sleep and causes daytime sleepiness, increases the occurrence of hypertension, cognitive impairment, physiological stress reactions, endocrine imbalance, and cardiovascular disorders (Babisch, 2011: Basner *et al*., 2014). In case of chronically exposed to high levels of road or air traffic noise a higher risk of cardiovascular diseases, including high blood pressure and myocardial infarction were suggested by epidemiological studies (Babisch, 2006). Noise can impact on male fertility also which effects testis weight, sperm parameters (count, viability, motility and morphology), sexual hormones, testicular tissue, oxidative stress and finally infertility (Nadri *et al*., 2016). The most severe non-auditory effect of noise pollution is sleep deprivation or fragmentation which in turn affects the cardiovascular system (Tsaloglidou

et al., 2015). Now it is recognized that noise pollution is a potential hazard to health, communication and enjoyment of social life and is becoming an indefensible interference and burden upon human comfort. Thus, it is necessary to conduct studies on noise monitoring especially for the vulnerable noisy spots in order to monitor the sound levels and suggest suitable abatement measures for controlling the noise pollution.

Materials and Methods

Study area

Eight measurement sites for Dharan and four sites for Inaruwa were selected for the sound pressure level measurement which were divided into commercial, residential and silence zones (Fig. 1a, 1b).

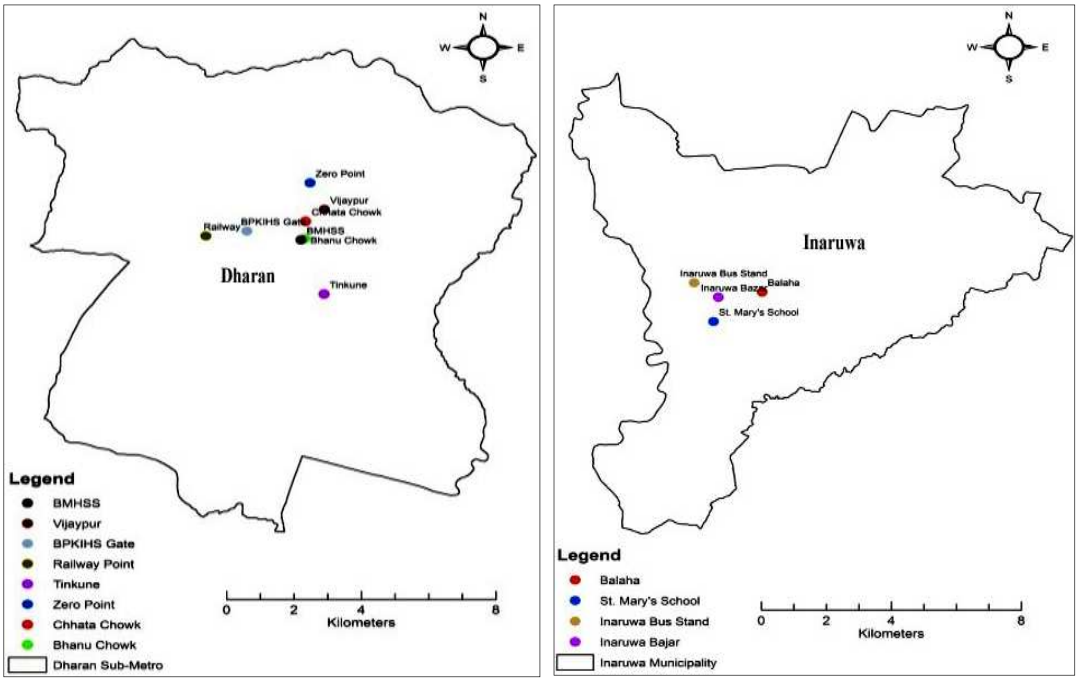

Figure 1. Map of study sites (a) Dharan Sub-metropolitan and (b) Inaruwa Municipality.

Measurement of Sound Pollution Level (SPL)

Digital sound level meter of model number SL 4010, manufactured by Lutron, Taiwan and calibrated at 94 dB(A) was used to record the SPL at different day time zones for instance, early morning, late morning, day time, evening and night time for each sampling sites. There was one set of data for each time zone for each measurement spot representing sound levels recorded at different time zone of the day, which depicts activity related sound level of that area. Such types of measurements were carried out for autumn and winter seasons separately. The data obtained by measurement were evaluated as average day time sound pressure level ($L_{d,}$ during 7.00 to 22.00 hrs) and average night time sound pressure level ($L_{n,}$ during 22.00 to 7.00 hrs). JIS Z 8731/1983(Methods of measurement and description of A-weighted sound pressure level) was followed during the operation and calculation of sound pressure level. The interpretation of noise levels were compared with national standard prescribed by Government of Nepal.

Results and Discussion

The potential sources of noise pollution were identified which were mostly vehicle and human activities in both cities. The ambient noise levels, day equivalent level L_d and night equivalent level L_n were observed for all the 12 sites. Furthermore, analysis of two cities noise pollution was also carried to identify the noisy spots by which recommendations can be made for implementation of suitable noise abatement measures.

The results showed that the L_d and L_n values at the commercial area of Dharan were 78 to 82 and 72 to 73 dB(A) in autumn and 78 to 79 and 72 to 76 dB(A) in winter which were similar in both monitoring sites and not significant seasonal variation but markedly exceeds the limit value 65 and 55 dB(A), respectively (MOSTE, 2012) (Fig. 2a, 2b)

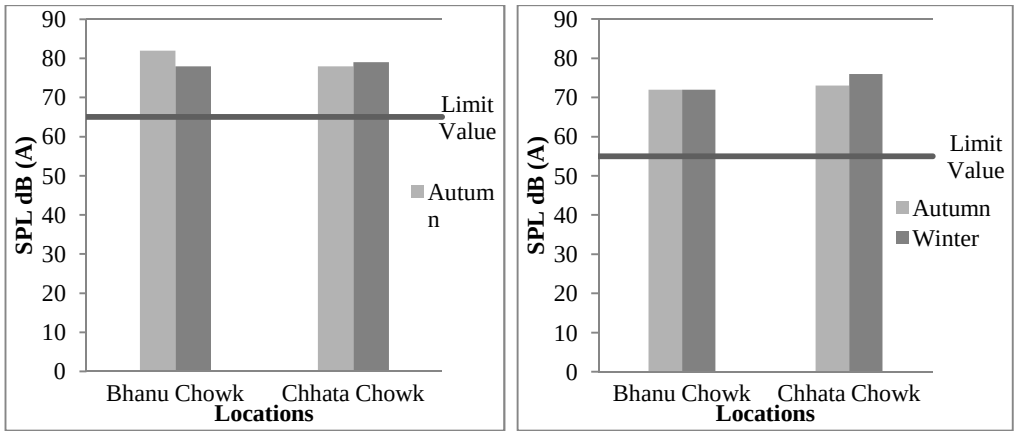

Figure 2. Equivalent sound pressure level in the commercial area of Dharan Sub-metropolitan City (a) L_d and (b) L_n

Similarly, L_d and L_n for Inaruwa were 75 to 77 and 73 to 75 dB(A) in autumn and 66 to 70 and 63 to 68 dB(A) in winter, respectively where only L_d value for winter lies within the standard in Inaruwa Bazar site but other spots facing more noise pollution (Fig. 3a, 3b).

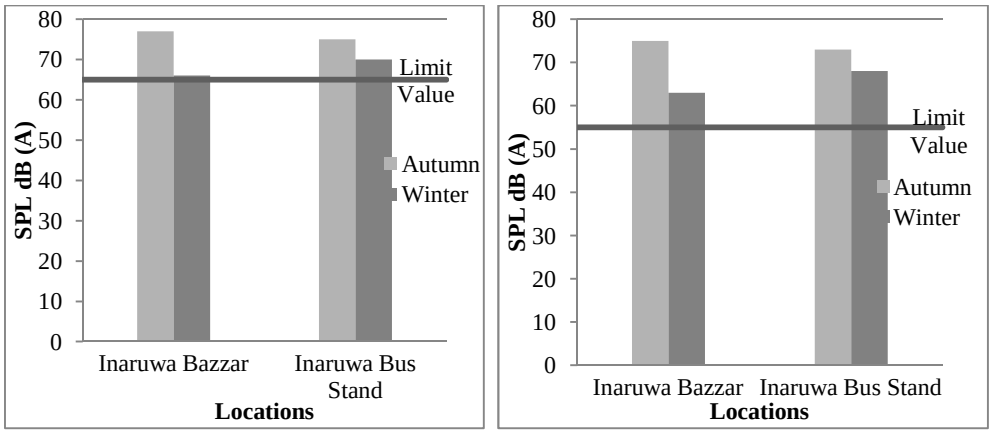

Figure 3. Equivalent sound pressure level in the commercial area of Inaruwa Municipality (a) L_d and (b) L_n

By the comparison with the noise pollution level of Koteshwor, commercial areas of Kathmandu Metropolitan City which has L_d and L_n were 81 and 78 dB(A), respectively (Kafle & Maharjan, 2013), Lucknow city 74.8 to 84.2 and 68.2 to 74.9 dB(A) (Kisku *et al*., 2006) and Jharsguda district, Orissa 73 to 83 and 62 to 65 dB(A) (Debta *et al*., 2015) were comparable with the other cities but it is quite different from Delhi where Ld and Ln were 72 to 74 dB(A) and 70 to 73 dB(A), respectively (Garg *et al*., 2017).

In the silence zones of both cities the equivalent sound pressure level L_d and L_n were 65 to 73 and 60 to 70 dB(A) in autumn and 64 to 71 and 58 to 68 dB(A) in winter for Dharan. Similarly, L_d and L_n for Inaruwa were 59 and 57 dB(A) in autumn and 55 and 53 dB(A) in winter, respectively (Figs. 4a, 4b) which exceeds the limit value (L_d and L_n 50 and 40 dB(A), respectively) (MOSTE, 2012) in both seasons which was found quite similar in comparison with its status in Delhi where L_d and L_n were 51 to 69 dB(A) and 48 to 60 dB(A), respectively (Garg *et al*., 2017) and higher than Jharsguda District, Orissa 44 and 37 dB(A) (Debta *et al*., 2015).

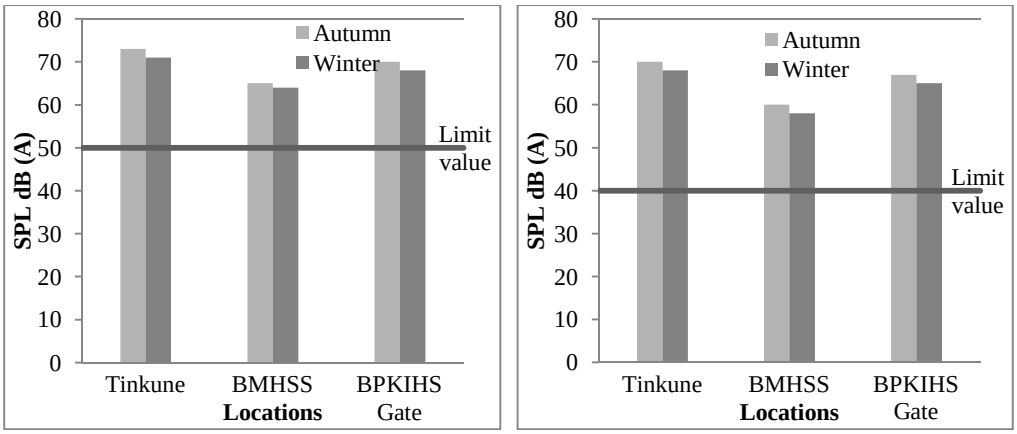

Figure 4. Equivalent sound pressure level in the silence zone of Dharan City (a) L_d and (b) L_n

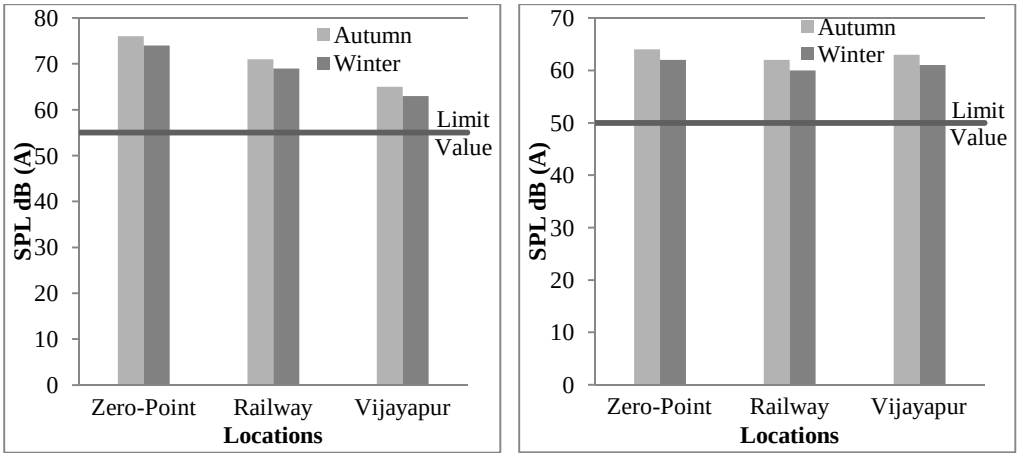

Figure 5. Equivalent sound pressure level in the residential area of Dharan Sub metropolitan City (a) L_d and (b) L_n

The residential areas of both cities were facing more noise pollution than prescribed standard (L_d and L_n were 50 and 40 dB(A), respectively) (MOSTE, 2012) in both seasons. The equivalent sound pressure level L_d and L_n were 65 to 76 and 62 to 64 dB(A) in autumn and 63 to 74 and 60 to 62 dB(A) in winter for Dharan. Similarly, L_d and L_n for Inaruwa were 67 and 60 dB(A) in autumn and 65 and 58 dB(A) in winter, respectively (Figs. 5a,5b, 6a, 6b). It is quite higher than the Indian cities as L_d and L_n were 55 to 69 dB(A) and 48 to 61 dB(A) for Delhi (Garg *et al*., 2017) and L_d and L_n were 63.84 and 54.34 dB(A) for Jharsguda District, Orissa (Debta *et al*., 2015), respectively.

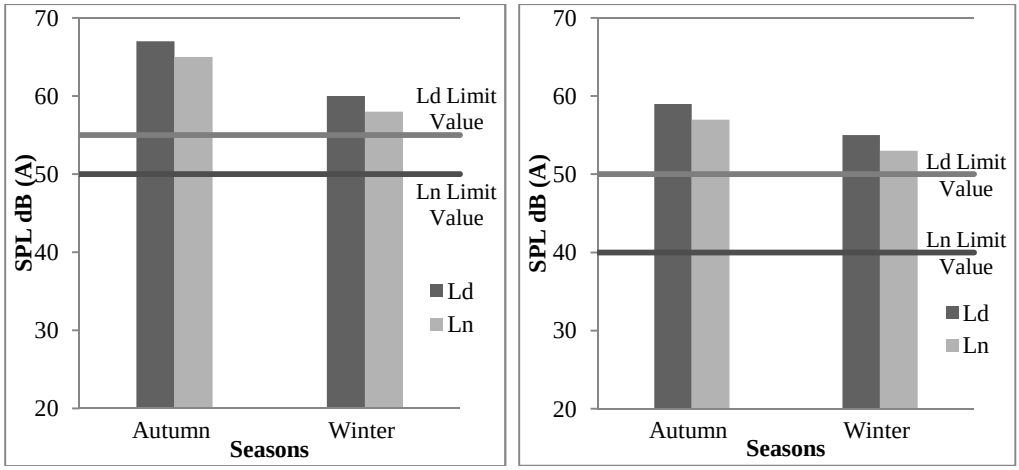

Figure 6. Average day time sound pressure level (L_d) and Average night time sound pressure level (L_n) (a) Residential area and (b) Silence zone of Inaruwa Municipality

Conclusion

Environmental noise pollution in both of the cities was mainly due to road traffic activities which had been found above the limit value in most of the monitoring sites. It is being compulsive to prepare and imply the action plan on management of environmental noise pollution with particular emphasis on road traffic noise abatement measures.

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