

## Association between Noise Levels, Particulate Matter Concentrations and Traffic Intensities in a Near-Highway Urban Area

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**Abstract :** Both traffic-generated particles and noise have been associated with the development of cardiovascular diseases, especially in near-highway environments. Although noise and particulate matters (PM) have different mechanisms of dispersion, sharing the same emission source in urban areas (road traffics) can result in a similar degree of variability in their levels. This study investigated the temporal variation of and correlation between noise levels, PM concentrations and traffic intensities near a major highway in Tehran, Iran. Tehran particulate concentration is highly influenced by road traffic. Additionally, Tehran ultrafine particles (UFP,  $PM < 0.1 \mu m$ ) are mostly emitted from combustion processes of motor vehicles. This gives a high possibility of a strong association between traffic-related noise and UFP in near-highway environments of this megacity. Hourly average of equivalent continuous sound pressure level (Leq), total number concentration of UFPs, mass concentration of  $PM_{2.5}$  and  $PM_{10}$ , as well as traffic count and speed were simultaneously measured over a period of three days in winter. Additionally, meteorological data including temperature, relative humidity, wind speed and direction were collected in a weather station, located 3 km from the monitoring site. Noise levels showed relatively low temporal variability in near-highway environments compared to PM concentrations. Hourly average of Leq ranged from 63.8 to 69.9 dB(A) (mean  $\sim 68$  dB(A)), while hourly concentration of particles varied from 30,800 to 108,800  $cm^{-3}$  for UFP (mean  $\sim 64,500$   $cm^{-3}$ ), 41 to 75  $\mu g m^{-3}$  for  $PM_{2.5}$  (mean  $\sim 53$   $\mu g m^{-3}$ ), and 62 to 112  $\mu g m^{-3}$  for  $PM_{10}$  (mean  $\sim 88$   $\mu g m^{-3}$ ). The Pearson correlation coefficient revealed strong relationship between noise and UFP ( $r \sim 0.61$ ) overall. Under downwind conditions, UFP number concentration showed the strongest association with noise level ( $r \sim 0.63$ ). The coefficient decreased to a lesser degree under upwind conditions ( $r \sim 0.24$ ) due to the significant role of wind and humidity in UFP dynamics. Furthermore,  $PM_{2.5}$  and  $PM_{10}$  correlated moderately with noise ( $r \sim 0.52$  and  $0.44$  respectively). In general, traffic counts were more strongly associated with noise and PM compared to traffic speeds. It was concluded that noise level combined with meteorological data can be used as a proxy to estimate PM concentrations (specifically UFP number concentration) in near-highway environments of Tehran. However, it is important to measure joint variability of noise and particles to study their health effects in epidemiological studies.

**Keywords :** noise, particulate matter,  $PM_{10}$ ,  $PM_{2.5}$ , ultrafine particle

**Conference Title :** ICAST 2018 : International Conference on Aerosol Science and Technology

**Conference Location :** Lisbon, Portugal

**Conference Dates :** April 16-17, 2018