

Health risk assessment of ambient air benzene among primary school children in urban and rural areas in Johor, Malaysia

ABSTRACT

It is a fact that children are vulnerable, and are at risk from benzene, a volatile, carcinogenic organic compound. The aim of our study is to determine the levels of ambient air benzene and examine the non-carcinogenic and carcinogenic risks involved. Methods: A cross-sectional study was conducted in two urban and two rural primary schools in Johor, Malaysia. Benzene concentrations were measured using BUCK Libra L-4 pumps and analyzed in the gas chromatography-mass spectrometry (GC-MS). Data were collected from 334 10-12 year old children, to calculate the exposure levels based on their body weights and heights. The hazard quotient (HQ) served to evaluate the non-carcinogenic risks, whereas the lifetime cancer risk (LCR) was determined with the aid of the United States Environmental Protection Agency (USEPA). Results and Discussion: Benzene concentrations were higher in rural than urban areas, surpassing the European Union (EU) standard of 5 $\mu\text{g}/\text{m}^3$. It was also established that the highest average levels recorded were $6.89 \pm 6.68 \mu\text{g}/\text{m}^3$. The HQ values, nonetheless, had indicated no immediate non-carcinogenic risk, while LCR estimates were found to be within a tolerable range across all sites. Findings showed that although the immediate risk from benzene exposure is low, long-term exposure still poses a significant cancer risk to children; even low levels of chronic exposure can heighten the likelihood of children to develop cancers. Conclusion: This study has produced a revelation that there are elevated benzene levels in rural areas in Johor. Despite the low, immediate non-carcinogenic risks, further investigation on the potential for long-term cancer risks is warranted. These risks can be addressed by conducting stricter air quality monitoring, enhancing vehicle emission standards, and introducing educational programs that can raise awareness about benzene exposure.