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Investigating Traffic-Related Diesel Particulate Matter Exposure on the Basal Gene and Protein Expressions in Normal and Asthma-Derived Epithelial Lung Cells

Abstract *

Over 11 million U.S. residents live in close proximity to major highways and are subjected to significant exposures of traffic-related particulate matter. Fine-sized diesel particulate matter (DPM) deposits on respiratory airway cells and promote inflammatory cytokine release. Our method included a two-phased approach: determining the basal level gene and protein expression of cells and measuring the cellular cytokine expression after DPM exposure. A comparative cytotoxicity analysis was performed on normal and asthma-derived cells derived from the lung. Microarrays and ELISA assays were utilized to assess gene and protein expression. Cell morphology was documented through several microscopy techniques, i.e. bright field and fluorescence. Results demonstrated evidence of increased IL-6 and IL-10 intraplasmic expression as well as presence of DPM in vacuoles. Morphologic alterations were found in the nuclei and cell membrane. Asthmatic cell lines exposed to DPM (in dose range of 0.001-100 mg/mL) displayed the most pronounced expressions of inflammatory genes and proteins relative to normal cell lines exposed to the same particles at the same doses. This research contributes to a deeper understanding of the toxicological relationships between human lung epithelial cells diseased state and exposure to diesel particulate matter. Individuals living near roadways may be at risk for detrimental airway malformation and exacerbated respiratory illnesses, such as asthma. This study, along with further research, has the potential to shape transportation, housing, and public health policies for those living in areas of high traffic and elevated levels of particulate matter exposure.

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