1.088 Toxicity and anti-oxidative response induced by carbon black particles in a co-culture system.

Early Career Scientist

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Abstract:

Carbon black (CB) is among the most highly produced and utilized nanoparticles. However, their increased usage has led to health and environmental concerns. A human alveolar-capillary co-culture system using Small Airway Epithelial Cell (SAEC) and Human Umbilical Vein Endothelial Cell (HUVEC), was used to investigate the cytotoxic effects of CB in neighbouring endothelial cells that were not exposed to CB. Prior to the start of the study, characterization of carbon black was performed using transmission electron microscopy (TEM) and dynamic light scattering (DLS). Subsequently, SAEC cells were cultured with various doses of 0µg/ml, 10 µg/ml, 25 µg/ml, 50µg/ml and 75 µg/ml of CB for 24 h before trypan blue cytotoxicity assay was carried out. Next, colony forming assay, reactive oxygen species (ROS) assay and profiling of the antioxidant (CAT, SOD1, SOD2, PRDX1-3, 5-6), metallothionein (MT1A, 1E, 1F, 1X, 2A, 3, 4) gene expression in HUVECs by RT-PCR, after co-culture with CB-treated SAECs were investigated. TEM images confirmed the uptake of CB into the SAECs,as shown by the presence of many black particles, in the form of agglomerates, lying free in both the cytoplasm and vacuoles. SAECs directly treated with CB exhibited a concentration dependent decrease in cell viability. On the other hand, HUVEC cells co-cultured with CB pre-treated SAECs did not exhibit any decrease the cell or reproductive viability. There was no increased ROS in the co-cultured HUVEC cells, indicating an absence of early oxidative stress. This observation could be due to the cyto-protective effect by metallothionein (an antioxidant) as evidenced by the increased expression of metallothionein genes in HUVEC cells. Taken together, the data from this study suggests that HUVEC cells are able to mount an antioxidant response to mitigate the cytotoxic effects of CB particles, when co-cultured with SAECs pretreated with CB particles.