Title *

Investigation of the toxicity of ingested copper oxide nanomaterials (CuO NM) to the intestine *in vitro*.

Abstract *

Nanomaterial (NM) exposure to the Gastrointestinal (GI) tract could occur via direct oral ingestion, mucocillary escalator clearance (following inhalation) and hand to mouth contact. Transport of NMs across the intestinal barrier into the circulation could lead to systemic effects. The aim of this study was to investigate the toxicity of copper oxide nanomaterials (CuO NM) to the intestine *in vitro*, using human Caco-2 intestinal cells. Undifferentiated or differentiated Caco-2 cells were exposed to CuO NM (10 nm) or $CuSO_4$ at concentrations ranging from 1.95 to 250 µg/ml, and cell viability assessed 24 h post exposure using the alamar blue assay. The benchmark dose (BMD 20) of CuO NM was 14.2 µg/ml and this was used for the selection of concentrations for further experiments. CuO NM and $CuSO_4$ caused a concentration dependent decrease in cell viability. IL-8 production (ELISA) by CuO NMs and $CuSO_4$ was 2 fold higher in undifferentiated Caco-2 cells compared to differentiated cells. A concentration dependent increase in ROS production (DCFH-DA assay) was observed in differentiated and undifferentiated cells. In differentiated cells, CuO NMs caused shortening of microvilli imaged using SEM, decreased TEER and tight junction dysfunction (ZO-1 staining). Our findings suggest that intestinal barrier integrity was disrupted which increased the translocation of Cu across the enterocytes. Therefore, differentiated Caco-2 cells are a powerful model to assess the impacts of ingested NMs on the GI tract and were less sensitive than undifferentiated cells to the toxicity of CuO NMs.

Permission to publish *

☑ Check this box to give us permission to publish your abstract on a flash drive/USB Stick for distribution to all delegates if it is accepted for presentation

Affiliations and Authors *

Author Information
Victor C. Ude (Presenting)

Affiliations
Nano Safety Research Group, School of Engineering and Physical Sciences, Institute of Biological Chemistry, Biophysics and Bioengineering, Heriot-Watt University, Edinburgh, United Kingdom

Author Information
Vicki Stone

Affiliations
Nano Safety Research Group, School of Engineering and Physical Sciences, Institute of Biological Chemistry, Biophysics and Bioengineering, Heriot-Watt University, Edinburgh, United Kingdom

Author Information
Helinor J. Johnston

Affiliations

Nano Safety Research Group, School of Engineering and Physical Sciences, Institute of Biological Chemistry, Biophysics and Bioengineering, Heriot-Watt University, Edinburgh, United Kingdom