

Nano-scale Dangers: Unravelling the Impact of Nanoplastics on Human Trophoblast Invasion

Abstract

Utilizing HTR-8/SVneo cells for *in vitro* modeling of human trophoblast invasion, we examined how different concentrations of 40 nm and 200 nm carboxylated polystyrene particles affect early-pregnancy trophoblast phenotype and function. We focused on migration and invasion, as critical processes in placental development. Our findings revealed disruptions in extravillous trophoblast mesenchymal phenotype and invasive behavior, following acute exposure to a higher concentration of the smaller sized particles. Specifically, differential uptake of the particles by trophoblast cells was observed, as well as cytotoxicity and concentration-dependent DNA damage after 72 h of exposure. In addition, a 24 h exposure to 100 $\mu\text{g/ml}$ of 40 nm particles correlated with downregulated protein expression of $\alpha 5$ and $\alpha 1$ integrin subunits, N-cadherin, matrix metalloproteinase-2 and macrophage migration inhibitory factor, alongside upregulated protein expression of the epithelial marker E-cadherin. These changes likely contributed to the diminished migration of HTR-8/SVneo cells and the invasive potential of HTR-8/SVneo spheroids. Understanding these interactions is paramount for assessing the broader implications of nanoplastics on reproductive outcomes and maternal-fetal well-being and informing public health measures.