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# Inflammatory and senescence-related effects of polyethylene microspheres on dermal cells

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## Abstract

**Background:** Microplastics (MPs) have been raising environmental and human health concerns [1]. Polyethylene (PE) is a synthetic organic polymer and is one of the main constituents of plastics [2]. PE MPs are widely used in cosmetics and personal care products due to their cost-effectiveness, versatility and durability [3]. However, their effect on skin cells remains unclear. Exposure of the dermis to these particles may induce several cellular and molecular changes, contributing to skin ageing and disease. **Objective:** Investigate the potential cytotoxic impact of PE MPs in normal human dermal fibroblasts (NHDFs) and murine macrophages (RAW 264.7), focusing on cell viability and induction of inflammatory and senescence responses. **Methods:** RAW 264.7 and NHDF cells were incubated with different concentrations of the MPs (25-500µg/mL) during two different time-points (24 and 48 hours). Cellular metabolic activity was measured in both cell lines using the resazurin assay. In macrophages, nitric oxide (NO) production was quantified using the Griess assay, interleukin-1 beta (IL-1β) secretion was measured in the supernatants by ELISA and the expression of pro-IL-1β and inducible nitric oxide synthase (iNOS) was analysed by Western blot (WB). In fibroblasts, the mRNA levels of collagen were measured by RT-PCR analysis and the morphology of these skin cells was analysed by microscopy. The senescence markers H2Ax and Lamin B1 were monitored by immunocytochemistry and the activity of the lysosomal enzyme senescence-associated β-galactosidase was quantified by a cytochemical assay. **Results:** Preliminary findings indicate that exposure to PE MPs compromises the cellular metabolism in both cell models, with a significant decrease in macrophages and an increase in fibroblast cells. Upon incubation with the MPs, increased NO production and a slight decrease in the expression of pro-IL-1β were detected in RAW 264.7 macrophages, while no changes in iNOS content were observed. In addition, the concentration of secreted IL-1β was higher. In cultured skin fibroblasts, alterations in cell morphology, as well as in the levels of senescence markers, were triggered by exposure to PE MPs. **Conclusions:** Our data suggest that PE MPs can trigger an inflammatory response and can affect the morphology and function of fibroblasts in the dermis, contributing to their senescence. Further research is needed to clarify their role in promoting skin ageing.

**Keywords:** microplastics; skin exposure; cellular ageing

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