Beneficial effect of differently-coated Selenium Nanoparticles in 3D cell culture models mimicking the respiratory tract and intestinal epithelium

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1. Introduction

Selenium (Se) is an essential trace element that plays a crucial role in various physiological processes, including enhanced immunity[1] (Avery and Hoffmann, 2018) and antioxidant defense[2]. Ingested as well as inhaled Se nanoparticles (SeNP) can be absorbed by epithelial and resident immune cells and being incorporated into selenoproteins that scavenge reactive oxygen species (ROS) and protect against oxidative stress-induced damage. Moreover, Se has been shown to modulate the release of inflammatory cytokines, and Se deficiency has been associated with impaired intestinal barrier function and increased susceptibility to intestinal infections and inflammation. Therefore, Se serves as a valuable micronutrient in protecting against oxidative stress and inflammation. Understanding the mechanisms of Se metabolism and its effects on intestinal and lung physiology is crucial for developing therapeutic strategies to combat gastrointestinal and respiratory disorders. However, the direct administration of Se as an antioxidant is not advised due to its narrow therapeutic window[3].

2. Objective

The objective of this study was to evaluate the toxicity as well as the antioxidant and anti-inflammatory capacity of SeNPs in 3D cell culture models. The respiratory tract can be resembled by an alveolar *in vitro* test system called ALIsens®[4] built on a microporous membrane of hanging inserts by seeding human alveolar type II epithelial cells (A549) and endothelial cells (EA.hy926), as well as macrophage-like (Mφ-THP1) and dendritic-like cells (DC-THP1). The physiologically relevant architecture of the system favors the development of a tissue-like microenvironment and facilitates exposures at the air-liquid-interface (ALI). The *in vitro* intestinal epithelium is based on a tri-culture model consisting of human intestinal epithelial cells (Caco-2) and mucus-secreting HT29-MTX cells, as well as hematopoietic cells (Raji B) able to promote Caco-2 conversion in specialized microfold cells (M-cell)[5,6].

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3. Conclusions

The treatment shows that the SeNPs are well tolerated in both cell culture systems without inducing neither a strong basal cytokine release nor increasing oxidative stress measured by ROS formation.

4. References

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