

# PROTECTIVE PROPERTIES OF PLANT-DERIVED NANOVESICLES AGAINST VIRAL INFLAMMATION BY MODULATING MITOCHONDRIAL RESPIRATION

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Based on data provided by the World Health Organisation, lower respiratory tract infections were the 5th most common cause of death in 2021 [1]. Research highlights the importance of mitochondrial respiration as a critical factor in the cellular immune response to viral inflammation [2]. Plant-derived nanovesicles (PDNV) have a unique structure – a double phospholipid layer - which protects bioactive substances inside the vesicle and improves their targeted delivery to affected cells [3].

This topic is relatively new, and therefore the aim of this study was to analyse the effect of PDNV on mitochondrial respiration during viral inflammation.

Methods: PDNV isolation by polymeric precipitation method; human bronchial epithelial cells (HBEC-3KT) cultivation; Seahorse XF Cell Mito Stress test; cell viability analysis with fluorescent microscopy using Hoechst 33342 dye and propidium iodide; Bradford method.

Cell viability analysis results revealed that none of the analysed Poly (I:C) concentrations (0.01, 0.025, 0.05, 0.075, 0.1, 0.25, 0.5, 0.75 and 1 µg/ml) had a significant effect on cell viability. A concentration of 1 µg/ml Poly (I:C) was used for further experiments. It was determined that PNDV statistically significantly reduced the number of dead cells exposed to Poly (I:C) compared to a group affected by Poly (I:C) alone. A cellular mitochondrial respiration test showed that PNDV restored both maximum and baseline respiration in cells exposed to Poly (I:C) and PNDV, compared to a group exposed only to Poly (I:C)

Plant-derived nanovesicles have the potential to improve mitochondrial respiration during viral inflammation induced by Poly (I:C). These results indicate that PDNVs possess virus-fighting properties. Further research is needed to explore their potential applications in treating virus-induced lower respiratory infections.

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[1] World Health Organization: WHO, "The top 10 causes of death," Aug. 07, 2024. <https://www.who.int/news-room/fact-sheets/detail/the-top-10-causes-of-death>

[2] X. Li et al., "Viral infection modulates mitochondrial function," *International Journal of Molecular Sciences*, vol. 22, no. 8, p. 4260, Apr. 2021, doi: 10.3390/ijms22084260.

[3] M. Chai et al., "Leveraging plant-derived nanovesicles for advanced nucleic acid-based gene therapy," *Theranostics*, vol. 15, no. 1, pp. 324–339, Dec. 2024, doi: 10.7150/thno.104507.