Magrophage-derived hybrid lipid vesicles loaded with cyanocobalamin for anti-inflammatory therapy enhancement

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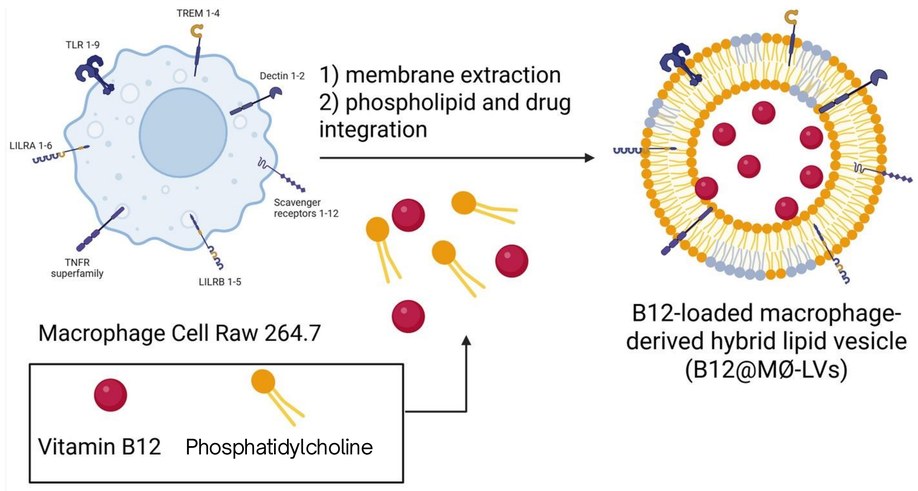
Introduction

Biomimetic technology combines the innate bioactive features of cells with the therapeutic potential of synthetic nanoparticles. Here, hybrid lipid vesicles combining synthetic phospholipids with RAW 264.7 membranes (MMØ) were used to preserve the macrophage (MØ) functions and enable cyanocobalamin (B12) drug delivery.



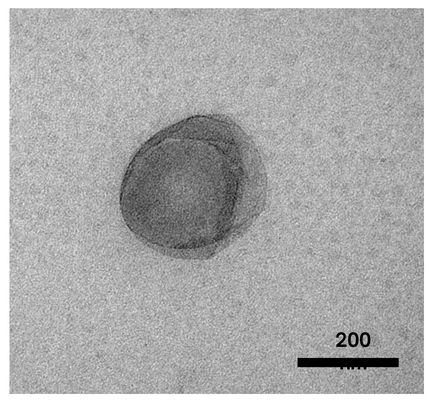


Figure 1: Electronic microscope images of B12@MØ-LVs

B12@MØ-LVs Characterization

MMØ were isolated from 10^8 RAW 264.7 cells in hypotonic buffer using three freeze–thaw cycles and differential centrifugation. Cyanocobalamin-loaded macrophage hybrid vesicles (B12@-MØ-LVs) were prepared by microfluidics using different ratios between protein from isolated MMØ and phosphatidylcholine.

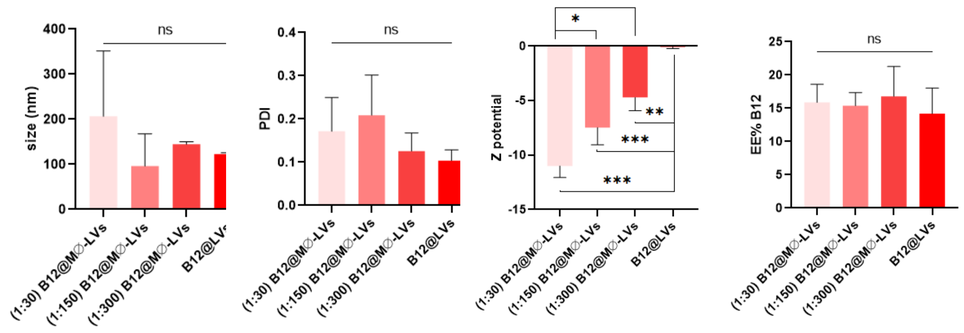
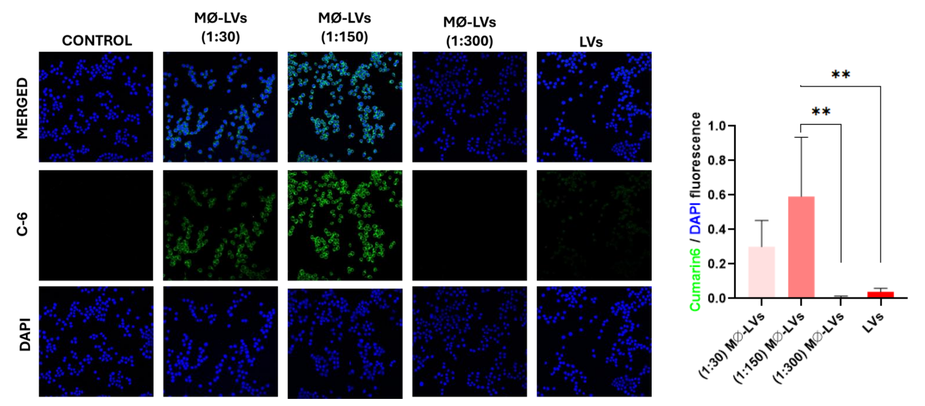


Figure 2: B12@MØ-LVs characterization results: Size, PDI and Z-potential and B12-Entrapement Efficacy (%). Ratios were described as protein from the isolated MMØ (mg) : Phosphatidylcholine (mg).

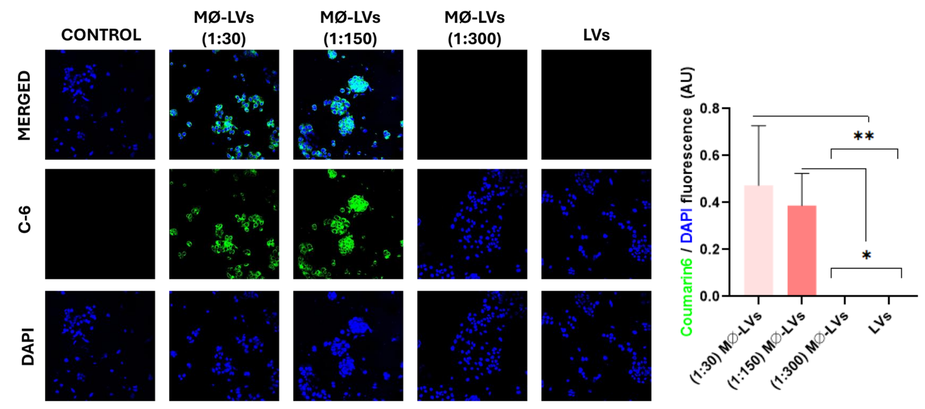
MØ-LVs improves cell uptake

Figure 3: In vitro cellular uptake experiments performed on different mouse skin cell lines namely, macrophage Raw 264.7, keratinocytes (PDV) and L929 Fibroblasts. Different ratios between MMØ and phosphatildylcholine were evaluated. Cell uptake expressed as c-6 fluorescence (NP) / DAPI (cell).

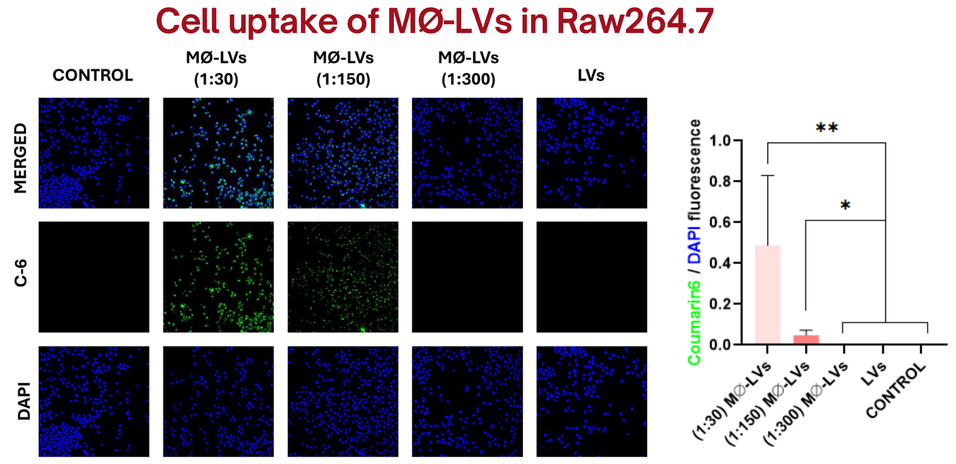
Cell uptake of MØ-LVs in Raw264.7



Cell uptake of MØ-LVs in PDV cells

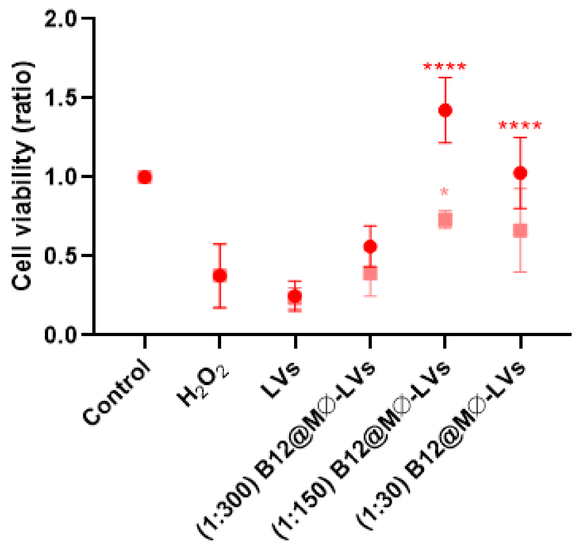


Cell uptake of MØ-LVs in Raw264.7



MØ-LVs protects cells against oxidative stress

Protective activity against oxidative stress



Protective activity of B_{12}-loaded MØ-LVs was evaluated in vitro, by measuring cell viability of Human keratinocytes (HaCaT) after 6 h exposure to H_2O_2, 1200 uM

Figure 4: MØ-LVs protective activity against H_2O_2 stress. in red, MØ-LVs at 10% w/v and in pink MØ-LVs at 5% w/v. * and **** indicates $p < 0.05$ respect to H2O2

Key Findings

We developed a new **biomimetic hybrid nanocarrier**. The characterization demonstrated that B12@MØ-LVs had superior properties to perform as a nanocarrier compared with conventional liposomes. The in vitro studies showcased that the hybrid formulation **promoted cell uptake** and demonstrated drug performance as a **Reactive Oxygen Species scavenger**.

Funded by

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