Elucidating the antioxidant action mechanism of a phytotherapeutic released from polymeric nanoparticles by diamond magnetometry

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Previous studies have shown that the intraperitoneal administration of enriched triterpene extract (OBE100) obtained from Eucalyptus tereticornis reduced metabolic alterations in a diet-induced obese (DIO) mouse model. We developed a phytotherapeutic prototype of OBE100 encapsulated into polymeric nanocarriers (PNs) to transport triterpene-rich fractions orally and intravenously, improving their solubility and bioavailability. Encapsulating therapeutic principles into functional nanocarriers allowed their site, dose, and controlled release.

Oral PNs were formulated with polylactic-co-glycolic acid (PLGA) polymer, and intravenous PNs with PLGA-b-PEG-maleimide conjugated with the P3 peptide (CKGGRAKDC). Both PNs were self-assembled by the solvent evaporation method, physicochemically characterized by HPLC, DLS, DSC, and TEM, and administered orally and intravenously in the in-vivo DIO mouse model. Metabolic biomarkers were assessed, and body distribution was evaluated ex vivo. Resultant oral PNs had 165.0 nm average size, -35.1 zeta potential (ζ), 0.18 dispersity (Đ), 92.0 % encapsulation efficiency (EE), and 6.4 % loading capacity (LC). Functionalized particles were slightly higher with a size of 278.0 nm, + 3,1 ζ, 0.16 Đ, and had slightly lower EE and LC of 80.0 and 4.0 %, respectively, yet highly metabolically efficient. The in-vivo assay demonstrated a decrease in the mouse weight and glucose measured in the blood and changes in metabolic biomarkers related to obesity and T2DM.

We know the extract has anti-inflammatory activity, however, the antioxidant action mechanism of OBE100 released from PNs is unknown. Thus, we aim to evaluate the free radical loading using fluorescence nanodiamonds (FNDs) by nanoscale magnetometry in fresh tissue slices of an aging mouse model to get an insight into the OBE100 action mechanism for the first time. Furthermore, these PNs open the path for developing new drugs nanoformulations based on natural products.