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Lipoaspirate-derived biogenic nanoparticles: characterization and anti-inflammatory effect

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Extracellular vesicles (EVs) released from adipose-derived stem cells (ADSCs) have therapeutic effects in inflammatory diseases. However, production of EVs from ADSCs is costly, inefficient, and time consuming. The anti-inflammatory properties of adipose tissue-derived EVs and other biogenic nanoparticles (BiNPs) have not been explored. In this study, BiNPs were obtained directly from lipoaspirate (Lipo), an easily accessible and abundant source of biological material. Compared to ADSC-EVs, Lipo-NPs take less time to process (hours compared to months) and cost less to produce (clinical-grade cell culture facilities are not required). The physicochemical characteristics and the anti-inflammatory properties of Lipo-NPs were evaluated and compared to those of patient-matched ADSC-EVs. Moreover, guanabenz (GBZ) loading in Lipo-NPs was evaluated for enhanced anti-inflammatory effects. Apolipoprotein E (Apo E) and glycerolipids were enriched in Lipo-NPs compared to ADSC-EVs. Additionally, the uptake of Lipo-NPs in hepatocytes and macrophages was substantially higher. Lipo-NPs and ADSC-EVs had comparable protective and anti-inflammatory effects. Specifically, Lipo-NPs reduced toll-like receptor 4 (TLR4)-induced secretion of inflammatory cytokines in macrophages. GBZ-loaded Lipo-NPs further suppressed inflammatory pathways, suggesting that this combination therapy could have promising applications for inflammatory diseases.