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Anti-inflammatory and Mitochondrial-protective Effect of Olive Pomace on LPS-stimulated RAW264.7 Macrophages

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Abstract

Chronic low-grade inflammation is a well-established driver of obesity-related metabolic disorders, underscoring the need for effective dietary interventions (1,2). Olive pomace (Orujo), a major by-product of olive oil production, is rich in bioactive compounds with possible anti-inflammatory properties, making it a promising candidate for such strategies (3). Therefore, the present study aimed to evaluate the anti-inflammatory activity of olive pomace (variety Orujo) on LPS-stimulated RAW264.7 macrophages. Olive pomace extract was characterized in terms of phytochemical composition and antioxidant capacity. In order to rule out potential cytotoxic effects, cell viability was assessed in RAW264.7 macrophages using concentrations ranging from 25 to 2000 µg/mL. The preventive effect of the extracts on extracellular NO generation in LPS-treated RAW264.7 cells was measured using the Griess assay. In addition, analysis of the main inflammatory markers through PCR were performed for a better understanding of the mechanism by which the bioactive compounds exerted their effect. Finally, mitochondrial respiration was evaluated using an extracellular flux analyzer to assess mitochondrial function through oxygen consumption rate (OCR) measurements. The results confirmed that olive pomace is a rich source of natural antioxidants. Olive pomace extract exhibited concentration-dependent effects on RAW264.7 cell viability. Cell viability remained above 90% up to 250 µg/mL and progressively decreased at higher concentrations, reaching approximately 20% at 2000 µg/mL. Furthermore, the extract significantly inhibited the production of extracellular NO. At the same time, the mRNA expression levels of tumor necrosis factor (TNF)-α, interleukin (IL)-6, TLR-4, CD40, and STAT-3 were reduced by approximately 1.67-, 1.24-, 1.33-, 1.53-, and 1.06-fold, respectively, compared with LPS-treated cells. Mitochondrial respiration analysis revealed that LPS impaired maximal respiratory capacity, whereas olive pomace treatment enhanced mitochondrial function and partially reversed the effects of LPS. These findings suggest that olive pomace attenuates the inflammatory response induced by LPS in RAW264.7 macrophages. Therefore, olive pomace may represent a promising source of bioactive compounds for the prevention of inflammation-related disorders.

Keywords: Olive byproducts, anti-inflammatory activity, mitochondrial function

References

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