Combating Inflammatory Disease: Anti-inflammatory Effect of Nisin (Bacteriocin) on Lipopolysaccharide-stimulated THP-1 Cell

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Chronic inflammation is a significant health concern, damaging tissues and cells, leading to serious diseases like cancer, heart disease, and diabetes. Many anti-inflammatory treatments, such as steroids and Non-Steroidal Anti-Inflammatory Drugs (NSAIDs), cause side effects, including gastrointestinal issues and immune suppression. The goal is to identify a natural candidate for managing these diseases with minimal side effects. Recently, numerous immunomodulatory studies with bacteriocins like nisin have been conducted. Nisin, derived from Lactococcus lactis, is used as a food preservative with FDA approval and has shown potential as an anti-inflammatory compound. The THP-1 human monocytic cell line is widely used in inflammation research. These cells differentiate into macrophages and can polarize into either the M1 (pro-inflammatory) or M2 (anti-inflammatory) state depending on stimuli. In this study, THP-1 cells were first differentiated into M0 macrophages using phorbol 12-myristate 13-acetate (PMA) for 48 hours, then stimulated with LPS for 3 hours to induce M1 polarization. Cells were then treated with Nisin (25 µg/mL, 50 µg/mL) for 24 hours. TNF-a expression, an M1 marker, was analyzed via immunofluorescence (IF), and cell image intensity was quantified using ImageJ software. Corrected Total Cell Fluorescence (CTCF) values were then calculated. The PMA-only group had an average CTCF value of 1456.69, the PMA + LPS group was 19,918.28, while the Nisin-treated groups showed significantly reduced fluorescence (1524.11 and 1438.40, respectively). Additionally, elongated and stretched morphological changes were observed in the Nisin-treated group. These results suggest that Nisin could serve as a natural alternative to synthetic anti-inflammatory drugs.

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