

Verification of the anti-inflammatory effects of *Saccharomyces cerevisiae* CK78 on HaCaT cells and identification of its functional components

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Abstract

This study aimed to evaluate the anti-inflammatory effects of various strains of *Saccharomyces cerevisiae* on HaCaT cells. Two yeast samples, *S. cerevisiae* CK34, CK78, and two commercial powders (Yeast powder HA, Yeast powder HG), were tested for their ability to suppress inflammation. No anti-inflammatory activity was observed in Yeast powder HA and HG, while *S. cerevisiae* CK34 and CK78 exhibited significant effects. All four samples were subsequently subjected to fractionation using a cation-exchange resin, and the anti-inflammatory properties of each resulting fraction were assessed. Among these, Fraction 5 (Fr.5) from *S. cerevisiae* CK78, Yeast powder HA, and Yeast powder HG demonstrated notable anti-inflammatory activity. LC/MS, LC/MS/MS, and heat map analysis of each yeast's Fr.5, combined with cell-based assays, identified inosine as one of the bioactive components responsible for the observed effect in *S. cerevisiae* CK78.

Keywords : *Saccharomyces cerevisiae*, anti-inflammatory effect, IL-1 β , HaCaT cell, inosine

I Introduction

The skin is the largest organ of the human body and is of extremely high interest in anti-aging research, as it reflects the defense mechanism against the external environment and an individual's aging process¹⁾. Approximately 20% of natural aging is due to intrinsic aging, while the remaining 80% is due to photoaging²⁾. Photoaging is attributed to the production of reactive oxygen species (ROS) in skin tissues caused by exposure to ultraviolet (UV) radiation present in sunlight³⁾. UV rays are classified into three types: UVA (315-400 nm), UVB (280-315 nm), and UVC (100-280 nm). We are constantly exposed to UVA and UVB radiation, as they are not absorbed by the ozone layer and therefore reach the Earth's surface. UVB irradiation induces ROS production in the epidermis⁴⁾. Although ROS is an essential element of life activity, its highly reactive nature leads to oxidative stress, in which excessive ROS damage cells and tissues. Oxidative stress plays a major role in skin aging by aggravating inflammatory skin conditions

and promoting both acute and chronic reactions, including sunburn, pigmentation, and wrinkle formation, among others⁵⁾. Therefore, to prevent photoaging, it is essential to eliminate ROS and suppress oxidative stress in order to reduce skin irritation. Studies on the suppression of inflammation, an anti-inflammatory effect, are being actively conducted in the field of anti-aging. Interleukin-1 beta (IL-1 β) is a pro-inflammatory cytokine that functions upstream in the UVB-induced inflammatory response of the skin⁵⁾. Therefore, inhibiting the expression of IL-1 β is expected to suppress inflammation.

Yeast is widely utilized in food, health supplements, and related applications due to its richness in proteins, B vitamins, and nucleic acids. While immunomodulatory effects have been reported for β -glucan, a key component of the yeast cell wall⁶⁾, it is generally considered insoluble and unlikely to reach the skin when ingested. Consequently, we focused on evaluating the anti-inflammatory effects of water-soluble components contained in yeast by assessing the expression level of IL-1 β in skin cells. In this study, the expression level of IL-1 β was