Phycocyanin from Microalgae (Spirulina or Blue-Green Algae) and Its Application in Skin Wound Healing: A Systematic Review

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ABSTRACT

Introduction: Phycocyanin (PC), a light-harvesting protein complex derived from micro-algae such as *Spirulina platensis*, has been recognized for its therapeutic properties, including antioxidant, anti-inflammatory, and wound-healing capabilities. This systematic review summarized available knowledge on extracting PC from spirulina and its potential in skin wound healing.

Search Strategy: Following the PRISMA guidelines, a systematic search was conducted in databases including PubMed, Scopus, Web of Science, and Embase using the keywords "phycocyanin" and "wound healing" or "wound repair" or "biomedical applications" or "tissue regeneration"] in the title, abstract, and keywords. The search was limited to studies published in English from 2004 to 2023.

Results: A total of 59 studies were included. The review encompassed in vitro, in vivo, and clinical studies exploring PC's effects on skin wound healing. PC, particularly C-phycocyanin (C-PC) from Spirulina, was found to promote fibroblast proliferation and urokinase-type plasminogen activator (uPA) migration, inducing the G1 phase of the cell cycle and increasing the expression of cyclin-dependent kinases (cdK1 and cdK2). In vivo studies in mice demonstrated that C-PC treatment resulted in an 80% closure of wounds by the end of the first week, compared to 50% closure in control groups. Additionally, C-PC was shown to regulate uPA gene expression via a cAMP-mediated mechanism dependent on the PKA pathway.

Conclusion and Discussion: Evidence synthesized in this review underscores the potential of PC, particularly C-PC from Spirulina, as an active component in medicinal products for wound treatment. Its ability to enhance cell proliferation and migration suggests its utility in healing external and internal wounds, such as ulcers. However, further research is needed to optimize its therapeutic use and establish standardized protocols for PC extraction and application in wound care.

Keywords: Phycocyanin, Spirulina, Wound healing

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