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Heat-Killed Lactobacilli Preparations Promote Healing in the Experimental Cutaneous Wounds

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Abstract: Probiotics are defined as microorganisms with beneficial health effects when consumed by humans, being applied mainly to improve allergic or intestinal diseases. Due to the increasing resistance of pathogens to antibiotics, the abuse of antibiotics becomes inefficient in the skin and in systemic infections, and probiotics may also provide the protective effect for repairing the healing of infected cutaneous wounds. Here we selected two Lactobacillus strains, *L. plantarum* GMNL-6 and *L. paracasei* GMNL-653, in heat-killed format to examine the beneficial effect in skin wound repair through the selection by promoting collagen synthesis in Hs68 fibroblast cells. The coverage of gels containing heat-killed GMNL-6 or GMNL-653 on the mouse tail with experimental wounds displayed healing promoting effects with promoting of metalloproteinase-1 expression at the early phase and reduced excessive fibrosis accumulation and deposition in the later tail-skin recovery stage. More importantly, lipoteichoic acid, the major component of Lactobacillus cell wall, from GMNL-6/GMNL-653 could achieve the anti-fibrogenic benefit similar to the heat-killed bacteria cells in the TGF-β stimulated Hs68 fibroblast cell model. Our study offers a new therapeutic potential of the heat-killed format of Lactobacillus as an alternative approach to treating skin healing disorders.

Keywords: heat-killed probiotics; Lactobacillus; *L. plantarum*; *L. paracasei*; skin wound healing; lipoteichoic acid

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1. Introduction

Studies that focus on the biological functional integration between microbiota and the human body have implied that the microbiome may have a principal impact on multiple physiological connections, including protection against injury-induced infections and modulation in the body. The importance of commensal microorganisms in maintaining host health has been recognized early and focused on intestinal microbiota research. The application of a wider and deeper potential to the microbiota is a burning issue for healthcare. As with the role of local and systemic probiotic effects, approaches that manipulate its composition to improve host disorders have become increasingly important. An earlier study indicated that probiotics altered the healing capacity of mucous wounds [1] and were reported to have a potentially beneficial effect on inflammatory cutaneous conditions [2]. Moreover, probiotics are an alternative medication and are often considered to promote health care [3]. *Lactobacillus* is a common probiotic species, and its health benefits for human disease improvement have been widely reported [4–6].