Silk fibroin nanofiber-phytoconstituent composites: Promising biomaterials for wound healing applications

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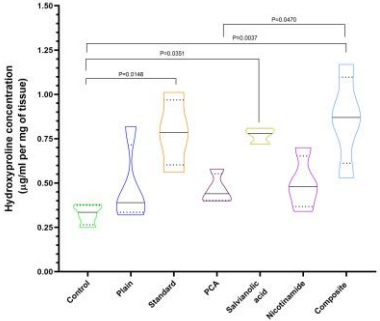
Introduction. Despite advances in skin tissue engineering over the past 30 years, delayed wound healing and scarring remain challenges. Many of the wound healing treatments available today have drawbacks, including inadequate bioactivity, poor mechanical properties, and inadequate drug delivery. There is a need for novel wound healing materials that can effectively disperse drugs to encourage healing and provide structural support.

Aims. The present study aims to investigate silk fibroin (SF) nanofiber and phytoconsituent composite for wound healing application.

Methods. The procedure encompasses a multi-phase strategy for the creation of drug-infused silk nanofibers designed for specific stages of wound healing with its characterisation, and in vivo evaluation.



Results. Drug-loaded silk fibroin nanofibers (50–200 nm) were successfully fabricated, showing first-order drug release kinetics and uniform drug distribution (FTIR). The nanofibers exhibited good mechanical strength (5.69 MPa), significant antimicrobial activity, and no dermal irritation. In vivo rat studies demonstrated enhanced wound healing and increased hydroxyproline content with the composite patches.

Discussion/conclusion. Our results indicated that phytoconstituent-embedded SF nanofibers have a significant positive effect on wound healing rate. The drug compounds utilized in the study possess varying properties, each contributing to the rate of different phases of wound healing process.