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ORIGINAL ARTICLE

Assessment of anti-arthritic activity of lipid matrix encased berberine in rheumatic animal model

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ABSTRACT

The purpose of this study was to evaluate the drug delivery and therapeutic potential of berberine (Br) loaded nanoformulation in rheumatoid arthritis (RA)-induced animal model. The Br-loaded NLCs (nanostructured lipid carriers) were prepared employing melt-emulsification process, and optimised through Box–Behnken design. The prepared NLCs were assessed for in-vitro and in-vivo evaluations. The optimised NLCs exhibited a mean diameter of 180.2 ± 0.31 nm with 88.32 ± 2.43% entrapment efficiency. An enhanced anti-arthritic activity with reduced arthritic scores to 0.66 ± 0.51, reduction in ankle diameter to 5.80 ± 0.27 mm, decline in paw withdrawal timing, and improvements in walking behaviour were observed in the Br-NLCs treated group. The radiographic images revealed a reduction in bone and cartilage deformation. The Br-NLCs showed promising results in the management of RA disease, can be developed as an efficient delivery system at commercial levels, and may be explored for clinical application after suitable experiments in the future.

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1. Introduction

Rheumatoid arthritis (RA) mostly acts on the joints and is an autoimmune disease. It gives rise to severe inflammation, disability, and deformity, all of which can have life-threatening effects and significantly shorten lifespans (Bullock *et al.* 2018). Swollen, red, and painful joints are the most prominent clinical indications of this condition, which affects roughly 1% of the adult population (Sultana and Rasool 2015). Genetics, autoimmunity, and environmental variables may have a pathogenic role in the condition, although sufficient evidence and mechanisms are not available for the same (Conforti *et al.* 2021). RA has a complex history, in which the gender, genetics, phenotype, age of the person, and concomitant diseases all play a very crucial role (Guo *et al.* 2018). At this point, we don't know what causes RA, but synovial inflammation, which is a bad thing, may be the result of a complex interaction between genetics and the environment (Kumar *et al.* 2017). Multiple studies show that macrophages activated inflammatory B cells and T cells that invade the synovium of the joint causing the joint and cartilage to break down, although the precise purpose of RA remains unknown. In RA inflammatory B cells and T cells produce cytokines (pro-inflammatory) and their mediators that are the reason for inflammatory injuries and significant tissue damage. Additionally, T cells set off the autoimmune response and result in chronic synovitis, which damages joints (Wang *et al.* 2017).

Various synthetic drugs, herbal remedies, and biological therapies are now available as RA treatments. Potential delivery methods for RA management are based on conventional treatment but they still carry significant threats of toxic and therapeutic intolerance consequences brought due by higher dosage. Patients do require cutting-edge treatments with few adverse effects. Nanoparticles are the modern delivery system of drugs that can be used to target pharmaceuticals to a specific location in cells and tissues. They also have a higher bioavailability, improved pharmacokinetics profile, and a rise in the loading of drug molecules which allows an effective and safe way of delivering

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