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Pharmacological Evaluation of Curcumin for its Anti-Inflammatory and Antioxidant Effects Using In-Vitro and In-Vivo Models in Rats

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Introduction & Background: Inflammation and oxidative stress are two critical biological processes implicated in the pathogenesis of several chronic diseases including cancer, cardiovascular disorders, neurodegenerative diseases, and metabolic syndromes. Inflammation is a complex, protective response triggered by harmful stimuli such as pathogens, damaged cells, or irritants. While it is essential for tissue repair and host defense, persistent or uncontrolled inflammation can lead to tissue damage and chronic disease conditions.

Oxidative stress arises from an imbalance between the production of reactive oxygen species (ROS) and the body's antioxidant defense mechanisms. ROS such as superoxide radicals, hydroxyl radicals, and hydrogen peroxide can initiate lipid peroxidation, DNA damage, and protein modification, ultimately leading to cell injury and death. The link between oxidative stress and inflammation is well established, as oxidative stress not only results from inflammation but also further aggravates inflammatory pathways.

Current pharmacological interventions for inflammation and oxidative stress include non-steroidal anti-inflammatory drugs (NSAIDs), corticosteroids, and synthetic antioxidants. However, these drugs are often associated with undesirable side effects, particularly with long-term use. As a result, there is increasing interest in identifying naturally occurring compounds with dual anti-inflammatory and antioxidant properties, which are both effective and safe.

Chronic inflammation and oxidative stress are central to the pathogenesis of various diseases, including arthritis, neurodegenerative disorders, and cardiovascular complications. Curcumin, the principal curcuminoid derived from *Curcuma longa* (turmeric), has been traditionally acclaimed for its anti-inflammatory and antioxidant properties. However, scientific validation through controlled experimental models remains essential for its therapeutic application.

Objective: To evaluate the anti-inflammatory and antioxidant efficacy of curcumin using established in-vitro and in-vivo models, and to compare its performance with standard drugs.

Keywords: Curcumin, Anti-inflammatory, Antioxidant, DPPH, Paw Edema, MDA, SOD, CAT, In-vitro, In-vivo, Wistar Rats

Conclusion: Curcumin exhibits strong anti-inflammatory and antioxidant properties, demonstrating significant potential as a natural therapeutic agent for managing inflammation and oxidative stress-related disorders. Its effectiveness supports further exploration in drug development and formulation studies for safe and efficient pharmacological applications.

Result: Curcumin showed significant dose-dependent antioxidant activity in vitro and effectively reduced paw edema and granuloma formation in vivo. Biochemical and histopathological analyses indicated enhanced antioxidant enzyme levels, reduced lipid peroxidation, and minimal inflammatory cell infiltration in treated rats.

Biography 1: **Ms. Voonna Ruchitha**, a postgraduate student from the Department of Pharmacology, completed her M.Pharm thesis titled “Pharmacological Evaluation of Curcumin for Its Anti-inflammatory and Antioxidant Effects Using In-vitro and In-vivo Models in Rats.” The study highlighted significant findings in natural product pharmacology under the guidance of Dr. A.V.S. Kasheera Bhavani, reflecting her focus on research excellence and student development.

Biography 2: **Dr. A.V.S. Kasheera Bhavani,** Associate Professor of Pharmaceutics at Sri Venkateswara College of Pharmacy, has over six years of experience in teaching, research, and student mentorship. Her expertise includes drug delivery systems, formulation development, and pharmaceutical technology, with a strong commitment to academic excellence and research-driven learning.

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