Artemisinin-Mediated Modulation of Acid-Sensing Ion Channel 3 in Experimental Fibromyalgia: Combined In Vivo and Computational Investigation

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Abstract:

Fibromyalgia represents a complex chronic pain syndrome marked by diffuse musculoskeletal discomfort and enhanced nociceptive responses. Acid-sensing ion channel 3 (ASIC3) plays a crucial role in fibromyalgia pathophysiology, making it an attractive therapeutic target. Artemisinin, a bioactive compound extracted from Artemisia annua, has demonstrated analgesic properties in various pain models.

This investigation examined artemisinin's regulatory effects on ASIC3 function within an experimental fibromyalgia model through integrated in vivo experimentation and computational molecular analysis. The experimental protocol involved inducing fibromyalgia-like conditions in laboratory rats using validated methodologies. Comprehensive behavioral evaluations confirmed the successful establishment of fibromyalgia phenotypes. Following confirmation, artemisinin treatment was administered to affected animals, with subsequent assessment of nociceptive responses and pain thresholds.

Experimental findings revealed that artemisinin treatment produced substantial reductions in pain hypersensitivity among fibromyalgia-affected rats. Complementary computational studies employed molecular docking approaches to characterize artemisinin-ASIC3 binding interactions at the atomic level. Docking analyses indicated that artemisinin demonstrates favorable binding affinity to discrete ASIC3 domains, potentially modifying channel functionality. Furthermore, predictive modeling suggested artemisinin treatment correlates with reduced ASIC3 expression levels, indicating a plausible mechanistic pathway underlying its analgesic properties.

The combined experimental and computational evidence indicates that artemisinin functions as an ASIC3 modulator, resulting in diminished pain sensitivity within the fibromyalgia model system. This multi-faceted approach provides mechanistic insights into the molecular foundations of artemisinin's therapeutic effects. Additional investigations are needed to fully characterize the underlying