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Review [Diabetol Metab Syndr.](#) 2025 Aug 5;17(1):314. doi: 10.1186/s13098-025-01884-5.

Curcumin as a promising therapeutic agent for diabetic neuropathy: from molecular mechanisms to functional recovery

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Abstract

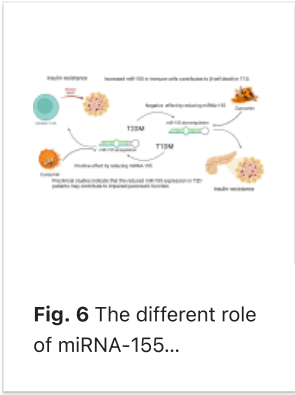
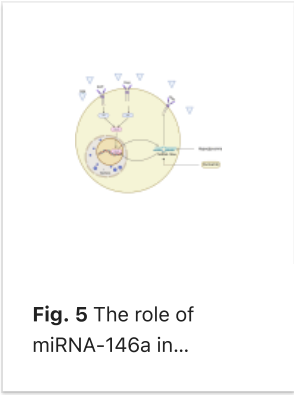
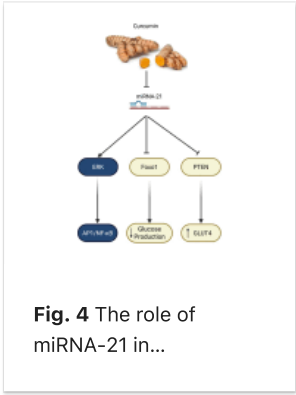
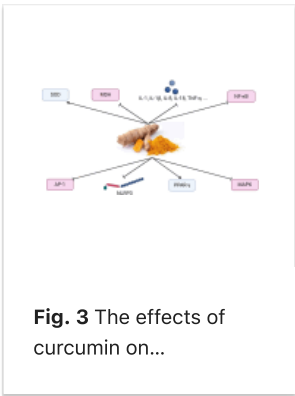
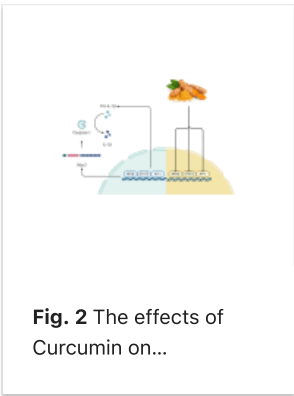
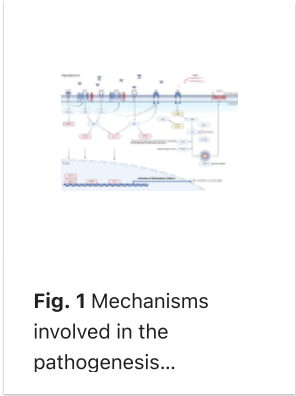
Diabetes mellitus is an endocrine disorder characterized by prolonged hyperglycemia. It results from either insulin deficiency (type 1 diabetes mellitus, T1DM) or insulin resistance (type 2 diabetes mellitus, T2DM). This condition has emerged as a significant health concern in recent years. Hyperglycemia induces the overproduction of reactive oxygen species (ROS), which can modulate multiple pathways, including AGEs-RAGE, PKC stimulation, NF-κB and PI3K/AKT. These pathways contribute to diabetes-related complications such as inflammation, oxidative stress, insulin resistance, and reduced glucose uptake. The interplay of these metabolic disturbances can lead to demyelination and peripheral nerve damage, resulting in diabetic neuropathy. This is a challenging complication of diabetes for which there are limited effective treatments. Despite its low bioavailability, curcumin, a natural component extracted from turmeric, despite its low bioavailability, affects and modulates several intracellular pathways underlying neuropathic damage. Curcumin is considered a potential treatment for diabetic neuropathy (DN) because it measurably reduces markers of oxidative stress and inflammatory cytokines, while significantly alleviating neuropathic pain and improving nerve function. MicroRNAs (miRNAs or miR), which are small non-coding RNAs consisting of 19-25 nucleotides, are stable in circulation and can regulate multiple target genes. This makes them promising biomarkers for both diagnostic and therapeutic applications. Curcumin has been shown to regulate the dysregulation of relevant miRNAs associated with neuropathy by suppressing the inflammatory miR-21 while enhancing the expression of the anti-inflammatory miR-146a. Current formulations of curcumin face bioavailability challenges; however, advancements in delivery systems and structural modifications, such as nanoformulations, have significantly improved its bioavailability. These improvements overcome previous pharmacokinetic limitations and enhance the therapeutic effects of curcumin. With continued research, curcumin could ultimately become a cornerstone in managing diabetic complications and improving the quality of life for affected patients.

Keywords: Curcumin; Diabetic neuropathy; miR-146a; miR-155; miR-21.

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