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Natural Products in Diabetes Mellitus

Edited by: Ana Angélica Feregrino-Pérez

Diabetes mellitus (DM) is a chronic metabolic disorder characterized by sustained hyperglycemia, which promotes excessive generation of reactive oxygen species and subsequent oxidative damage. This oxidative environment plays a critical role in the initiation and progression of microvascular and macrovascular complications that significantly contribute to DM-associated morbidity and mortality. The global prevalence of DM continues to increase imposing substantial economic and healthcare burdens. Although lifestyle interventions constitute the primary strategies for DM prevention, natural products are widely used as complementary therapeutic options. These natural products contain structurally diverse bioactive compounds with demonstrated or potential antidiabetic effects. Their mechanisms of action include inhibition of carbohydrate-hydrolyzing enzymes (α -amylase and α -glucosidase), modulation of insulin secretion and sensitivity, regulation of signaling pathways involved in glucose homeostasis, and enhancement of endogenous antioxidant defense systems. Additionally, many natural compounds exert pleiotropic biological activities that may synergistically attenuate metabolic dysfunction and reduce the risk of diabetic complications. However, despite their extensive traditional use, rigorous scientific evidence regarding efficacy, toxicity, pharmacokinetics, and optimal dosing remains limited. Therefore, systematic investigation of isolated compounds, crude extracts, and complex natural matrices is essential for developing safe, mechanism-informed therapeutic or adjuvant interventions for DM.



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