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RESEARCH ARTICLE

Phytochemical Profiling and Renoprotective Effects of Methanolic Extract of *Trigonella foenum-graecum* in Diabetic Nephropathy: An Experimental Study on Rats

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Abstract:

Introduction:

The accumulation of advanced glycation end products (AGEs) and persistent hyperglycemia play a crucial role in the development of diabetic nephropathy. Fenugreek seed extract (FSE), known for its high flavonoid content, has the potential to mitigate oxidative stress in cells and tissues. This study aimed to evaluate whether FSE could prevent kidney damage in diabetic rats by reducing AGE formation in the renal glomerulus.

Methods:

The phytochemical constituents of fenugreek seed extract were analyzed, and its antioxidant activity was evaluated using the DPPH assay. A total of 36 albino Wistar rats were used to assess diabetic nephropathy. Normal and diabetic rats were administered FSE orally at low (100 mg/kg), medium (200 mg/kg), and high doses (400 mg/kg) for eight weeks. Renal function markers, adiponectin levels, pro-inflammatory markers, oxidative stress markers, and blood glucose levels were measured.

Results:

FSE treatment significantly reduced STZ-induced increases in urine output, urinary albumin excretion, and the albumin-to-creatinine ratio. It also alleviated renal damage caused by STZ. Rats treated with FSE exhibited lower levels of aspartate aminotransferase (AST), alanine aminotransferase (ALT), serum creatinine, blood urea nitrogen (BUN), and malondialdehyde (MDA) in kidney tissue compared to untreated diabetic rats. Notably, serum MDA levels were significantly decreased in the FSE-treated group. Additionally, serum and renal antioxidant capacity were significantly higher in FSE-treated rats than in untreated diabetic rats.

Discussion:

FSE treatment effectively mitigated STZ-induced renal dysfunction, oxidative stress, and biochemical alterations, as evidenced by improved renal markers, reduced oxidative damage, and enhanced antioxidant capacity. These findings suggest FSE's potential protective role against diabetic nephropathy.

Conclusion:

This study has demonstrated, for the first time, that FSE at 200 mg/kg not only ameliorated diabetic nephropathy by enhancing renal antioxidant defenses and reducing inflammation, but also exhibited potential as a novel phytotherapeutic intervention. These findings contribute new evidence supporting the role of plant-based antioxidants in diabetic kidney disease management and highlight FSE as a promising candidate for future clinical investigations.

Keywords: Fenugreek, Diabetes, Nephropathy, TNF- α , Interleukins, Oxidative stress, *Trigonella foenum-graecum*.

Article History

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1. INTRODUCTION

Diabetic nephropathy (DN) is a major cause of end-stage renal disease (ESRD), contributing to 30–40% of cases

worldwide. Recent estimates indicate that 20–40% of diabetic patients develop DN, with higher prevalence in low- and middle-income countries. According to the International