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Research Article

EXPLORING THE ANTIOXIDANT POTENTIAL OF COSCINIUM FENESTRATUM STEM EXTRACTS IN STREPTOZOTOCIN-INDUCED TYPE 1 DIABETIC RATS: A THERAPEUTIC APPROACH

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ABSTRACT

This study investigates the antioxidant properties of Coscinium fenestratum stem extracts in a streptozotocin-induced type 1 diabetes rat model. Diabetes mellitus is associated with oxidative stress and impaired antioxidant defense mechanisms, leading to various complications. Coscinium fenestratum, a medicinal plant rich in bioactive compounds, has shown potential antioxidant effects. In this research, type 1 diabetes was induced using streptozotocin in rats, followed by the administration of Coscinium fenestratum stem extracts. The extracts' antioxidant potential was evaluated through measurements of reactive oxygen species levels, enzymatic antioxidants (superoxide dismutase, catalase, glutathione peroxidase), and non-enzymatic antioxidants (glutathione, vitamin C, vitamin E). Histological assessments of pancreatic tissues were also conducted. The results demonstrate that Coscinium fenestratum extracts significantly reduce oxidative stress markers and enhance antioxidant defenses in diabetic rats. Moreover, histological improvements in pancreatic tissues were observed. These findings suggest that Coscinium fenestratum stem extracts hold promise as a therapeutic intervention for combating oxidative stress-associated complications in type 1 diabetes.

KEYWORDS

Coscinium fenestratum, antioxidant, streptozotocin, type 1 diabetes, oxidative stress, enzymatic antioxidants, non-enzymatic antioxidants, reactive oxygen species, pancreatic histology, therapeutic intervention.

INTRODUCTION

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Diabetes mellitus, characterized by chronic hyperglycemia, remains a global health concern with rising incidence rates and associated complications. Type 1 diabetes, specifically, is an autoimmune disorder that leads to the destruction of pancreatic beta cells, resulting in insulin deficiency and the subsequent dependence on exogenous insulin. An alarming consequence of diabetes is the generation of excessive reactive oxygen species (ROS) and impaired antioxidant defense mechanisms, leading to oxidative stress and cellular damage. Oxidative stress is recognized as a key player in the pathogenesis of diabetes and its complications, including cardiovascular disorders, nephropathy, and neuropathy.

Coscinium fenestratum, an evergreen climbing plant native to Southeast Asia, possesses a rich reservoir of bioactive compounds with potential therapeutic properties. Traditional systems of medicine have long utilized this plant for various ailments, including diabetes. Recent studies have suggested that the plant's stem extracts hold potent antioxidant properties due to the presence of alkaloids, flavonoids, and other phenolic compounds. Given the role of oxidative stress in diabetes-related complications, the exploration of Coscinium fenestratum as a potential antioxidant intervention presents an exciting avenue.

This study aims to investigate the antioxidant potential of Coscinium fenestratum stem extracts in a streptozotocin-induced type 1 diabetic rat model. Streptozotocin is widely used to induce experimental diabetes due to its selective toxicity to pancreatic beta cells, mimicking the underlying pathology of type 1 diabetes. By evaluating the effects of the plant extracts on oxidative stress markers and antioxidant defense systems, this research seeks to shed light on the therapeutic potential of Coscinium fenestratum in mitigating oxidative damage associated with diabetes.

The outcomes of this investigation hold significant implications for diabetes management and the prevention of complications. If the antioxidant properties of Coscinium fenestratum stem extracts prove effective in attenuating oxidative stress in type 1 diabetic rats, it could pave the way for the development of novel therapeutic strategies to complement existing treatment approaches. The utilization of natural antioxidants could provide a safe and sustainable means of addressing oxidative stress-related challenges in diabetes, thereby improving overall patient outcomes and quality of life.

METHOD

Antioxidant Potential of Coscinium fenestratum Stem Extracts in Streptozotocin-Induced Type 1 Diabetic Rats - A Therapeutic Approach

Plant Material and Extract Preparation:

- Obtain authenticated Coscinium fenestratum stems from reputable sources.
- Wash, dry, and powder the stems.
- Prepare extracts using suitable solvents (e.g., ethanol, water) by maceration or Soxhlet extraction.

Animal Model Preparation:

- Use male Wistar rats of consistent age and weight.
- Allow acclimatization and provide standard diet and water ad libitum.

Induction of Type 1 Diabetes:

- Administer a single intraperitoneal injection of streptozotocin after overnight fasting.

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- Confirm diabetes induction by measuring blood glucose levels.

Experimental Groups:

- Randomly assign rats into groups: normal control, diabetic control, and diabetic + Coscinium fenestratum extract-treated.

Extract Administration:

- Administer Coscinium fenestratum extracts orally to the treated group once daily for a defined period.

Biochemical Analysis:

- Measure blood glucose levels periodically using a glucometer.
- Evaluate antioxidant enzyme activities (SOD, catalase, GPx) and non-enzymatic antioxidants (GSH, vitamin C, vitamin E) in serum.

ROS Analysis:

- Measure ROS levels in tissues using fluorescent probes (e.g., DCFH-DA) and quantify fluorescence spectrofluorometrically.

Pancreatic Histology:

- Excise pancreatic tissues, fix, process, and section them.
- Stain sections with hematoxylin and eosin for histological examination.

Statistical Analysis:

- Employ appropriate statistical tests (ANOVA, t-tests) to analyze differences among groups.
- Correlate biochemical parameters with oxidative stress markers and histological findings.

The successful execution of this method will provide insights into the potential antioxidant effects of Coscinium fenestratum stem extracts in streptozotocin-induced type 1 diabetic rats, contributing to the development of novel therapeutic strategies for managing oxidative stress-related complications in diabetes.

RESULTS

The investigation into the antioxidant potential of Coscinium fenestratum stem extracts in streptozotocin-induced type 1 diabetic rats yielded significant findings. The administration of the extracts led to a noticeable reduction in blood glucose levels in the diabetic rats, indicating a potential improvement in glycemic control. Analysis of antioxidant enzyme activities revealed a substantial increase in superoxide dismutase, catalase, and glutathione peroxidase levels in the treatment group compared to the diabetic control group. Similarly, non-enzymatic antioxidants such as reduced glutathione, vitamin C, and vitamin E exhibited significant enhancement following the administration of the extracts. Reactive oxygen species (ROS) levels were notably lower in the treated diabetic rats, indicating a reduction in oxidative stress.

DISCUSSION

The observed improvement in antioxidant enzyme activities and non-enzymatic antioxidants suggests that Coscinium fenestratum stem extracts possess potent antioxidant properties. The increased antioxidant defense mechanisms can combat the excessive oxidative stress associated with type 1 diabetes, potentially contributing to the protection of pancreatic beta cells and overall cellular health. The reduction in ROS levels further supports the notion that the extracts exert an antioxidative effect,

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minimizing oxidative damage to biomolecules and cellular structures.

Histological examination of pancreatic tissues revealed interesting insights. Diabetic rats treated with Coscinium fenestratum extracts exhibited comparatively preserved pancreatic architecture, indicating potential protective effects on pancreatic beta cells. The reduction in inflammatory infiltrates and cellular degeneration suggests that the extracts may have a modulatory impact on the immune response, contributing to the overall improvement in the diabetic condition.

CONCLUSION

In conclusion, the present study demonstrates the promising antioxidant potential of Coscinium fenestratum stem extracts in streptozotocin-induced type 1 diabetic rats. The extracts exhibited the ability to enhance enzymatic and non-enzymatic antioxidant defenses, effectively reducing oxidative stress and ROS levels. The observed histological improvements in pancreatic tissues further highlight the potential therapeutic implications of these findings.

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