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Pharmacological Evaluation of Ethyl Acetate and Petroleum Ether Flower Extract of Eichhornia Crassipes

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ABSTRACT:

The present study investigated the phytochemical constituents and pharmacological effects of "Eichhornia crassipes" (water hyacinth) flower extracts, focusing on antioxidant and antidiabetic activities. Phytochemical screening revealed the presence of alkaloids, flavonoids, tannins, and other bioactive compounds, especially in the ethanolic extract. Acute toxicity tests showed the ethanolic extract was safe up to a dose of 2000 mg/kg in animal models. The DPPH radical scavenging assay and alpha-amylase inhibition studies demonstrated significant antioxidant and antidiabetic activity, respectively. Further, the "in vivo" antidiabetic potential of the extract was confirmed using STZ-induced diabetic rats, where a marked reduction in blood glucose and improvement in body weight was observed. The findings suggest that "Eichhornia crassipes" has therapeutic potential in diabetes management.

1. Introduction

Diabetes mellitus is a prevalent metabolic disorder characterized by chronic hyperglycemia due to insulin deficiency or resistance. The increasing demand for alternative therapies to manage diabetes has propelled research into plant-based treatments known for their bioactive phytochemicals, which may enhance glucose metabolism and mitigate oxidative stress. "Eichhornia crassipes" (water hyacinth), an aquatic plant, has gained attention for its bioactive compounds, including alkaloids, flavonoids, and terpenoids. This study aims to evaluate the antidiabetic and antioxidant potential of "Eichhornia crassipes" flower extracts and to identify the phytochemicals responsible for these activities.

2. Materials and Methods

2.1 Plant Material Collection and Extraction

Fresh flowers of "Eichhornia crassipes" were collected, cleaned, dried, and finely ground. The powdered material was subjected to solvent extraction using petroleum ether, chloroform, ethyl acetate, ethanol, and aqueous solutions. The extraction process involved continuous hot percolation for petroleum ether, chloroform, ethyl acetate, and ethanol, whereas cold maceration was applied for the aqueous extract. The percentage yield for each extract was calculated based on the initial dry weight.

2.2 Phytochemical Screening

Each extract was screened for phytochemical constituents, including alkaloids, sterols, carbohydrates, phenolic compounds, tannins, proteins, terpenoids, and flavonoids, using standard qualitative methods.

2.3 Acute Toxicity Study

Acute toxicity of the ethanolic extract was evaluated in Wistar rats according to OECD-423 guidelines. Rats were administered escalating doses of the extract (10, 50, 300, and 2000 mg/kg), and mortality was observed. The LD50 and ED50 values were determined based on this study.

2.4 DPPH Radical Scavenging Assay

The antioxidant activity of the ethanolic extract was assessed using the DPPH radical scavenging method. Extracts and ascorbic acid (control) were prepared at varying concentrations, and the degree of discoloration was measured. Inhibition of DPPH radicals was calculated as a percentage, and results were expressed as mean ± SD for three replicates.

2.5 Alpha-Amylase Inhibition Assay

Alpha-amylase inhibitory activity was measured to evaluate the antidiabetic potential of the ethanolic extract. The inhibition percentage of alpha-amylase was calculated at various concentrations (0.2-1.0 mg/ml). Metformin was used as a positive control for comparison.

2.6 STZ-Induced Diabetic Model

Diabetes was induced in Wistar rats by intraperitoneal injection of streptozotocin (STZ). Rats were grouped as follows: normal control, diabetic control, and diabetic groups treated with "Eichhornia crassipes" ethanolic extract (25 mg/kg and 50 mg/kg) and metformin (10 mg/kg). Body weight and blood glucose levels were recorded weekly. Oral glucose tolerance tests (OGTT) were conducted at intervals to evaluate glucose uptake.

3. Results

3.1 Phytochemical Analysis

Phytochemical screening confirmed the presence of alkaloids, sterols, flavonoids, phenolic compounds, and tannins, with ethanolic and ethyl acetate extracts showing a rich composition of bioactive compounds. The highest percentage yield was obtained with ethanol (6.02%), followed by aqueous extracts (5.45%).

3.2 Acute Toxicity Study

The ethanolic extract demonstrated no signs of toxicity at a dose of 2000 mg/kg, indicating a high safety margin. Based on these findings, an effective dose (ED50) of 200 mg/kg was selected for subsequent studies.

3.3 Antioxidant Activity (DPPH Radical Scavenging Assay)

In the DPPH assay, the ethanolic extract showed dose-dependent antioxidant activity, with a maximum inhibition of 86.3% at 25 µg/ml, comparable to ascorbic acid (99.7% inhibition). The presence of flavonoids and tannins likely contributed to the extract's free radical scavenging activity.

3.4 Alpha-Amylase Inhibition Assay

The ethanolic extract exhibited significant alpha-amylase inhibition, with an inhibition rate of 96.3% at 1.0 mg/ml concentration, supporting its antidiabetic activity. The results indicate that compounds in the ethanolic extract, such as alkaloids and flavonoids, may contribute to enzyme inhibition, effectively controlling glucose release.

3.5 STZ-Induced Diabetes Study

Diabetic rats treated with the ethanolic extract (25 mg/kg and 50 mg/kg) exhibited significant reductions in blood glucose and improvements in body weight over 28 days. Rats treated with the 50 mg/kg dose had blood glucose levels of 93 mg/dL, similar to the metformin group (90 mg/dL), highlighting the extract's hypoglycemic effect. Body weight in the treated groups increased, suggesting mitigation of diabetes-induced wasting. OGTT results showed reduced blood glucose at 60, 90, and 120 minutes post-glucose administration, indicating enhanced glucose tolerance.

4. Discussion

The present study demonstrates the antioxidant and antidiabetic potential of "Eichhornia crassipes"flower extracts. The phytochemical profile, especially of the ethanolic extract, shows an abundance of flavonoids, tannins, and alkaloids, which are known for their antidiabetic and antioxidant effects. The ethanolic extract's strong alpha-amylase inhibition suggests its efficacy in modulating carbohydrate metabolism, a key factor in diabetes management. The significant improvement in body weight and glucose regulation in STZ-induced diabetic rats supports its therapeutic potential, suggesting possible mechanisms such as enhanced insulin sensitivity or pancreatic protection.

5. Conclusion

The ethanolic extract of "Eichhornia crassipes" flowers shows promising antioxidant and antidiabetic activities, indicating its potential as a natural therapeutic for diabetes management. The presence of bioactive compounds like flavonoids and alkaloids underscores the extract's pharmacological efficacy, paving the way for further studies to isolate specific compounds responsible for these effects.

References

1. Ghosh, D., Mishra, M.K., & Chandra, G. (2012). "Phytochemical screening and antioxidant activities of Eichhornia crassipes." Journal of Pharmacy Research, 5(6), 3097-3102.
2. Kar, A., & Choudhary, B.K. (2011). "Bioactive constituents and antidiabetic activity of medicinal plants." Journal of Diabetes & Metabolism, 2(8), 136-144.
3. Patel, D.K., Prasad, S.K., Kumar, R., & Hemalatha, S. (2012). "An overview on antidiabetic medicinal plants having insulin mimetic property." Asian Pacific Journal of Tropical Biomedicine, 2(4), 320-330.
4. Bhagat, A.P., & Kasak, P.K. (2014). "Evaluation of hypoglycemic potential of Eichhornia crassipes in streptozotocin-induced diabetic rats." International Journal of Pharmaceutical Sciences Review and Research, 26(2), 94-99.
5. Saha, P., Mazumdar, U.K., & Haldar, P.K. (2013). "Phytochemical screening and study of antioxidant and antidiabetic activity of Eichhornia crassipes." Indian Journal of Pharmaceutical Sciences, 75(4), 448-452.
6. Mulla, W.A., Kuchekar, S.B., Thorat, V.S., Chopade, A.R., & Kuchekar, B.S. (2010). "Antioxidant, antidiabetic, and antihyperlipidemic activity of ethanolic extract of leaves of Annona squamosa L. in alloxan-induced diabetic rats." Indian Journal of Pharmaceutical Education and Research, 44(3), 288-296.
7. Siddiqui, S., & Verma, A. (2016). "Antioxidant and antidiabetic activity of Moringa oleifera leaves in streptozotocin-induced diabetic rats." Journal of Ayurveda and Integrative Medicine, 7(4), 194-200.
8. Jain, S.K., & Saraf, S. (2010). "Phytochemical screening and evaluation of in vitro antioxidant activity of leaf and stem extracts of Eichhornia crassipes." Journal of Pharmaceutical Sciences and Research, 2(9), 502-505.
9. Alberti, K.G.M.M., & Zimmet, P.Z. (1998). "Definition, diagnosis and classification of diabetes mellitus and its complications." Diabetic Medicine, 15(7), 539-553.
10. OECD. (2001). "Guideline for Testing of Chemicals: Acute Oral Toxicity – Acute Toxic Class Method." OECD Guideline 423.