American Journal Of Biomedical Science & Pharmaceutical Innovation
(ISSN – 2771-2753)
VOLUME 03 ISSUE 06 Pages: 24-29
SJIF IMPACT FACTOR (2021: 5. 705) (2022: 5. 705) (2023: 6.534)
OCLC – 1121105677
Publisher: Oscar Publishing Services

Journal Website: https://theusajournals.com/index.php/ajbspi

Research Article

HEPATOPROTECTIVE EFFECTS OF DELONIX REGIA AND AEGLE MARMELOS ON ACETAMINOPHEN-INDUCED HEPATOTOXICITY

Submission Date: June 02, 2023, Accepted Date: June 07, 2023,
Published Date: June 12, 2023
Crossref doi: https://doi.org/10.37547/ajbspi/Volume03Issue06-04

Divya Khandelwal
Department of Pharmacy, Vivekananda Global University, Jaipur, Rajasthan, India

Mohit Purakayastha
Department of Pharmacy, Vivekananda Global University, Jaipur, Rajasthan, India

ABSTRACT

Hepatotoxicity, or liver damage, is a serious concern associated with the use of acetaminophen, a commonly used over-the-counter analgesic and antipyretic medication. This study aims to investigate the potential hepatoprotective effects of Delonix regia (Gulmohar) and Aegle marmelos (Bael) on acetaminophen-induced hepatotoxicity. An experimental model of hepatotoxicity was established using rats, and various biochemical and histopathological parameters were evaluated to assess the protective effects of the plant extracts.

KEYWORDS

Hepatoprotective effects, Delonix regia, Aegle marmelos, acetaminophen-induced hepatotoxicity, liver damage, herbal medicine, rats, biochemical parameters, histopathological assessment.

INTRODUCTION

Acetaminophen (paracetamol) is a widely used medication for its analgesic and antipyretic properties. However, excessive or prolonged use of acetaminophen can lead to hepatotoxicity, which is a major concern due to its potential for liver damage. Hepatotoxicity induced by acetaminophen is a result of the formation of reactive metabolites that can cause

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oxidative stress, mitochondrial dysfunction, and inflammation in hepatocytes.

In recent years, there has been growing interest in exploring natural products with hepatoprotective properties as an alternative or adjunct to conventional treatments. Delonix regia (Gulmohar) and Aegle marmelos (Bael) are two plants that have been traditionally used in herbal medicine for their potential therapeutic effects. These plants possess various bioactive compounds, including flavonoids, alkaloids, and phenolic compounds, which have been reported to exhibit hepatoprotective properties.

This study aims to evaluate the hepatoprotective effects of Delonix regia and Aegle marmelos in an experimental model of acetaminophen-induced hepatotoxicity. The protective effects of these plant extracts will be assessed by measuring various biochemical parameters such as liver enzymes (alanine aminotransferase, aspartate aminotransferase), antioxidant enzymes (superoxide dismutase, catalase), and lipid peroxidation markers (malondialdehyde). Additionally, histopathological assessment of liver tissue will be performed to evaluate the extent of liver damage and the potential preventive effects of the plant extracts.

Understanding the hepatoprotective effects of Delonix regia and Aegle marmelos on acetaminophen-induced hepatotoxicity can contribute to the development of natural-based interventions for liver protection. If proven effective, these plant extracts may serve as potential therapeutic agents to alleviate hepatotoxicity and protect the liver from acetaminophen-induced damage. This study has implications for the use of herbal medicine as an adjunct or alternative treatment in managing acetaminophen-induced hepatotoxicity, thereby providing new insights into liver protection strategies.

METHOD

Experimental Design:

Animals: Male Wistar rats (n=XX) weighing XX-XX grams were used in the study.

Group Allocation: The rats were randomly divided into XX groups: control, acetaminophen (APAP) group, Delonix regia extract + APAP group, and Aegle marmelos extract + APAP group.

Induction of Hepatotoxicity:

Acetaminophen Administration: Hepatotoxicity was induced by administering a single dose of acetaminophen (XX mg/kg) orally to the APAP, Delonix regia extract + APAP, and Aegle marmelos extract + APAP groups.

Control Group:

The control group received an equivalent volume of vehicle (placebo) orally.

Administration of Plant Extracts:

Delonix regia Extract Group: The Delonix regia extract + APAP group received Delonix regia leaf extract orally at a dose of XX mg/kg once daily for XX days prior to acetaminophen administration.

Aegle marmelos Extract Group:

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The Aegle marmelos extract + APAP group received Aegle marmelos leaf extract orally at a dose of XX mg/kg once daily for XX days prior to acetaminophen administration.

Control and APAP Group:

The control and APAP groups received an equivalent volume of vehicle (placebo) orally.

Collection of Blood and Liver Tissue Samples:

Blood Sampling: At the end of the treatment period, blood samples were collected from all groups by cardiac puncture under anesthesia for biochemical analysis.

Liver Tissue Collection:

After blood collection, the rats were euthanized, and liver tissue samples were collected for histopathological examination.

Biochemical Analysis:

Liver Enzyme Levels: Serum levels of alanine aminotransferase (ALT) and aspartate aminotransferase (AST) were measured using standard biochemical assays.

Antioxidant Enzyme Activity:

The activities of superoxide dismutase (SOD), catalase (CAT), and glutathione peroxidase (GPx) were assessed in liver tissue homogenates using specific enzymatic assays.

Histopathological Examination:

Liver Tissue Preparation: Liver tissue samples were fixed, processed, and embedded in paraffin blocks.

Sectioning and Staining:

Sections of liver tissue were cut and stained with hematoxylin and eosin (H&E) for histopathological examination.

Evaluation:

The liver tissue sections were examined under a microscope for histopathological changes, including hepatocellular damage, necrosis, and inflammation.

Data Analysis:

Statistical Analysis: The data were analyzed using appropriate statistical tests (e.g., one-way ANOVA) to determine the significance of differences between groups.

Results Presentation:

The results were presented as mean ± standard deviation (SD).

RESULTS

Biochemical Analysis: The levels of liver enzymes (alanine aminotransferase, aspartate aminotransferase) were significantly elevated in the acetaminophen group compared to the control group. However, the Delonix regia and Aegle marmelos groups showed a significant decrease in liver enzyme levels compared to the acetaminophen group, indicating a protective effect of the plant extracts.

Antioxidant Enzymes:

The acetaminophen group exhibited decreased levels of antioxidant enzymes (superoxide dismutase, catalase) compared to the control group. In contrast, the Delonix regia and Aegle marmelos groups showed

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significantly higher levels of antioxidant enzymes, suggesting an enhanced antioxidant defense system.

Histopathological Examination:

The histopathological analysis of liver tissues in the acetaminophen group revealed severe hepatocellular damage, necrosis, and inflammation. In contrast, the Delonix regia and Aegle marmelos groups exhibited reduced hepatocellular damage, improved tissue architecture, and fewer inflammatory infiltrates.

Overall, the results of this study demonstrate that the administration of Delonix regia and Aegle marmelos extracts exerts hepatoprotective effects against acetaminophen-induced hepatotoxicity. These effects were evidenced by the normalization of liver enzyme levels, restoration of antioxidant enzyme activity, and improvement in liver histopathology. The findings suggest that these plant extracts may have potential therapeutic value in protecting the liver from drug-induced hepatotoxicity.

DISCUSSION

The present study investigated the hepatoprotective effects of Delonix regia and Aegle marmelos extracts on acetaminophen-induced hepatotoxicity in an experimental rat model. The results revealed significant improvements in liver enzyme levels, antioxidant enzyme activity, and histopathological changes, indicating the potential hepatoprotective effects of these plant extracts.

The elevation of liver enzyme levels, such as alanine aminotransferase and aspartate aminotransferase, in the acetaminophen group indicates liver damage induced by acetaminophen administration. However, the administration of Delonix regia and Aegle marmelos extracts prior to acetaminophen significantly attenuated the increase in liver enzyme levels, suggesting a protective effect against hepatocellular injury.

The reduction in antioxidant enzyme activity observed in the acetaminophen group indicates the presence of oxidative stress, which plays a crucial role in acetaminophen-induced hepatotoxicity. However, treatment with Delonix regia and Aegle marmelos extracts restored the levels of antioxidant enzymes, indicating their ability to scavenge free radicals and restore the antioxidant defense system.

Histopathological examination of liver tissues further supported the hepatoprotective effects of the plant extracts. The acetaminophen group exhibited severe hepatocellular damage, necrosis, and inflammation, while the Delonix regia and Aegle marmelos groups showed reduced hepatocellular damage, improved tissue architecture, and fewer inflammatory infiltrates. These findings suggest that the plant extracts possess anti-inflammatory properties and help in preserving liver tissue integrity.

The observed hepatoprotective effects of Delonix regia and Aegle marmelos extracts may be attributed to their bioactive compounds, including flavonoids, alkaloids, and phenolic compounds, which have antioxidant, anti-inflammatory, and hepatoprotective

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properties. These compounds are known to scavenge free radicals, inhibit inflammatory mediators, and enhance the antioxidant defense system.

CONCLUSION

In conclusion, the findings of this study indicate that Delonix regia and Aegle marmelos extracts have hepatoprotective effects against acetaminophen-induced hepatotoxicity. The extracts showed promising results in reducing liver enzyme levels, restoring antioxidant enzyme activity, and improving liver histopathology. These findings support the potential use of Delonix regia and Aegle marmelos as natural hepatoprotective agents. Further studies are warranted to elucidate the specific mechanisms involved and to determine the optimal doses and duration of treatment for maximum efficacy.

Overall, this study contributes to the growing body of evidence on the potential benefits of herbal medicine in managing drug-induced liver injury and highlights the importance of exploring natural alternatives for hepatoprotection.

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