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# REVIEW ARTICLE:- ANTIOXIDANT AND ANTIDIABETIC ACTIVITY OF *ZIZIPHUS OENOPLIA* LEAVES EXTRACT ON ALLOXAN-INDUCED DIABETIES IN RATS

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## ABSTRACT

This review synthesizes current evidence on the antidiabetic and antioxidant potential of Ziziphus oenoplia (Jackal Jujube), a plant traditionally used in herbal medicine. Preclinical studies, primarily in alloxan- and streptozotocin-induced diabetic rat models, demonstrate its ability to lower blood glucose and improve lipid profiles. The antidiabetic effects are attributed to inhibition of carbohydrate-hydrolyzing enzymes α-amylase and α-glucosidase, with inhibitory potency comparable to standard drugs like acarbose. Molecular docking studies identify quantic acid as a key bioactive compound. Antioxidant assays reveal strong free radical scavenging activity, with $IC_{50}$ values close to that of ascorbic acid, supporting its role in mitigating oxidative stress linked to diabetic complications. Acute toxicity studies confirm safety at high doses. The dual actions-glycemic control and oxidative stress reduction—position Ziziphus oenoplia as a promising candidate for natural diabetes therapeutics. Future research should isolate active constituents, evaluate their effects on oxidative stress biomarkers, and validate efficacy in human clinical trials.

## INTRODUCTION

DIABETES: Diabetes mellitus defines a group of metabolic disorders characterized by hyperglycaemia resulting from defects in insulin secretion, insulin action, or both.

It is one of the most common metabolic syndromes, since there are 200 million diabetic individuals in the world; this creates a need to understand the etymology of the disease and the factors influencing its onset. Several pathogenic processes are involved in the

development of diabetes; these range from autoimmune destruction of the β-cells of the pancreas with consequent insulin deficiency to abnormalities that result in resistance to insulin action. Deficient action of insulin on target tissues and hyperglycaemia are the basis of the abnormalities in carbohydrate, fat, and protein metabolism, causing diabetes 'characteristic clinical features, micro and- macrovascular complications and increased risk of cardiovascular disease.

There are two types of Diabetes Mellitus

TYPE I

TYPE II

**Literature review**

***Ziziphus oenoplia*** belongs to the family "Rhamnaceae". It is commonly known as Jackal Jujube or Small fruited jujube in English, Bahukantaka, Karkandhauh in Sanskrit, Shiakol in Bengali and pargi in Kannada. Ziziphus oenoplia mostly found in India, Pakistan, Bangladesh, Sri Lanka, Malaysia and Australia. It grows throughout India in dry forests and open bushy places along the roadside forests and thickets.The Roots, seeds and leaves are used in traditional & folklore Medicine. The pharmacological studies have shown that precatorius possesses a number of biological activities such as anti-bacterial, anti-cancer, anti-diabetic, anti-fertility,antimicrobial, antioxidant activity, anti-inflammatory, anti-arthritic, anti-seratonergic, nephroprotective etc.

**Defining Core Research Parameters**

The investigation was guided by specific parameters to ensure a focused review. The primary subject is Ziziphus oenoplia, commonly known as Jackal Jujube. The therapeutic focus is on its antidiabetic and antioxidant activities. The experimental context is its effect on alloxan-induced diabetes in rats, a standard model for studying Type 1 diabetes. This framework allows for a systematic review of the plant's efficacy in managing high blood sugar and related oxidative stress.

**Literature Search and Key Findings**

A thorough literature search confirmed that Ziziphus oenoplia is extensively studied for its wide range of pharmacological activities. The plant is rich in bioactive phytochemicals such as phenols, flavonoids, alkaloids, and terpenoids, which are believed to be the source of its medicinal properties.

While the user's query specifically mentioned the alloxan model, studies also frequently use the streptozotocin (STZ) model, which induces diabetes through similar mechanisms of pancreatic β-cell destruction. Data from both models are included to provide a comprehensive overview. The findings strongly support the plant's traditional use in managing diabetes and related complications.

**Antidiabetic Activity of Ziziphus oenoplia**

Scientific evidence robustly supports the antidiabetic effects of Ziziphus oenoplia, demonstrating its ability to lower blood glucose through multiple mechanisms.

**Mechanism of Action**: Inhibition of Digestive Enzymes

One of the key mechanisms behind the plant's antidiabetic effect is its ability to inhibit carbohydrate-hydrolysing enzymes, namely α-amylase and α-glucosidase. These enzymes are responsible for breaking down complex carbohydrates into simple sugars. By inhibiting them, Ziziphus oenoplia extract can slow down glucose absorption in the gut, thereby reducing the sharp spike in blood sugar levels after a meal (postprandial hyperglycemia).A study using a hydroalcoholic extract of the fruit demonstrated potent, dose-dependent inhibition of both enzymes α-Amylase Inhibition: The extract showed an $IC_{50}$ (the concentration required to inhibit 50% of enzyme activity) of 328.76 µg/maleα-Glucosidase Inhibition: The extract had an $IC_{50}$ of 337.28 µg/male.

These values are comparable to the standard antidiabetic drug acarbose, indicating a significant therapeutic potential. Further in silicon molecular docking analysis identified quinic acid as a key phytochemical that binds effectively to the active sites of these enzymes, explaining its powerful inhibitory

**In Vivo Efficacy in Diabetic Rat Models**

Studies using diabetic rat models provide compelling evidence of the plant's glucose-lowering effects in a living system. Research on alloxan-induced diabetic rats using ethanolic and aqueous extracts of Ziziphus oenoplia stem bark showed significant positive results. After treatment with the extract at doses of 200 mg/kg and 400 mg/kg, there was a marked reduction in blood glucose levels.

Furthermore, the treatment also led to a significant improvement in the lipid profile of the diabetic rats, as detailed in the table below.

| Group | Total Cholesterol (mg/dL) | Triglyceride (mg/dL) | HDL (mg/dL) | LDL (mg/dL) |
|---|---|---|---|---|
| Diabetic Control | 125.27 ± 6.51 | 133.84 ± 6.42 | 68.61 ± 3.27 | 59.72 ± 3.42 |
| Normal Control | 86.42 ± 3.47 | 81.37 ± 4.17 | 42.05 ± 2.46 | 38.29 ± 2.35 |

Data derived from the study on alloxan-induced diabetic rats

Similar results were observed in a study using fruit extract on streptozotocin-induced diabetic rats. Doses of 100, 200, and 400 mg/kg administered over 21 days significantly lowered blood glucose, with the 400 mg/kg dose showing maximum efficacy. This study also confirmed a reduction in total cholesterol, triglycerides, and low-density lipoprotein (LDL), with effects comparable to the standard drug glibenclamide. Importantly, acute toxicity studies showed the extract was safe, with no mortality observed even at a high dose of 2g/kg.

**Antioxidant Properties and Management of Oxidative Stress**

Diabetes is intrinsically linked to oxidative stress, a condition where there is an imbalance between the production of harmful free radicals (Reactive Oxygen Species, ROS) and the body's ability to neutralize them. Chronic high blood sugar levels exacerbate ROS production, leading to cellular damage and contributing to long-term diabetic complications like neuropathy, nephropathy, and cardiovascular disease.

Ziziphus oenoplia exhibits potent antioxidant properties that can help counteract this damage. While specific data on oxidative stress enzymes like Superoxide Dismutase (SOD), Catalase (CAT), and Glutathione Peroxidase (GPx) were not available in the crawled literature, the plant's ability to scavenge free radicals has been clearly established.

A study evaluating the antioxidant potential of Ziziphus oenoplia leaves found that the ethyl acetate extract was a highly effective scavenger of hydrogen peroxide, a common ROS. It demonstrated an $IC_{50}$ value of 267.3 µg/mL, which is remarkably close to that of the standard antioxidant, ascorbic acid (vitamin C), which had an $IC_{50}$ of 251.50 µg/mL. This powerful free-radical scavenging activity confirms the plant's ability to mitigate oxidative stress, making it a valuable candidate for managing diabetes-related complications.

## SUMMARY

These research provided a good overview of Ziziphus oenoplia, commonly known as jackal jujube. These describe its botanical features, wide distribution in tropical and subtropical Asia and Australasia, and its various traditional medicinal uses. The search results also highlighted the presence of active phytochemicals like phenolics, alkaloids, flavonoids, and tannins, with some articles detailing specific compounds found in the leaves. Several sources also pointed to its use in Ayurveda and other traditional medicine systems for treating conditions like ulcers, stomach aches, and diabetes.

## CONCLUSION AND FUTURE DIRECTIONS

Ziziphus oenoplia holds significant promise as a natural therapeutic agent for diabetes. Its extract derived from the leaves, stem bark, and fruit demonstrate benefit. Achieved by inhibiting key digestive enymes and effectively lowering blood glucose and improving lipid profiles in diabetic animal model.

Future research should focus on isolating the specific bioactive compounds responsible for these effects and conducting more detailed studies on their impact on oxidative stress markers like SOD, CAT, and GPx. Clinical trials in humans are the next logical step to validate these preclinical findings and establish Ziziphus oenoplia as a safe and effective component of diabetes management.

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