

# Herb-Drug Interaction Of Jambu Beeja (*Syzygium Cumini* Linn.) With Metformin W.R.T Its Antidiabetic Activity - An Experimental Study

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## Abstract

Diabetes mellitus is a chronic metabolic disorder characterized by persistent hyperglycemia due to impaired insulin secretion, insulin resistance, or both. The increasing prevalence of diabetes worldwide has encouraged the integration of herbal medicines with conventional antidiabetic drugs to improve therapeutic efficacy and reduce complications. *Syzygium cumini* linn. (jambu or jamun) seeds, known as jambu beeja in ayurveda, have long been used in the management of madhumeha due to their potent hypoglycemic activity. The present experimental study was conducted to evaluate the drug interaction between jambu beeja and metformin with respect to antidiabetic activity. Experimental diabetes was induced in laboratory animals using streptozotocin or alloxan. Animals were divided into different groups including normal control, diabetic control, jambu beeja extract-treated, metformin-treated, and combination-treated groups. Parameters such as fasting blood glucose, body weight, lipid profile, and biochemical markers were evaluated during the study period. The results demonstrated that jambu beeja extract significantly reduced blood glucose levels, while metformin produced a stronger antihyperglycemic effect. However, the combination therapy showed a greater reduction in blood glucose and hba1c levels compared to either treatment alone, suggesting a synergistic or additive interaction between jambu beeja and metformin. These findings indicate that jambu beeja may enhance the antidiabetic efficacy of metformin through complementary mechanisms including stimulation of insulin secretion, inhibition of carbohydrate digestion, antioxidant activity, and improvement of insulin sensitivity. Further pharmacological and clinical studies are required to confirm the safety and therapeutic benefits of this herb–drug combination in the management of diabetes mellitus.

**Keywords:** Ayurveda, Jambu Beeja, Herb-Drug Interactions, Metformin, Antidiabetic Activity.

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## Introduction

The prevalence of diabetes has been increasing globally and estimated to be 72.96 million cases in adult population of India. Prevalence of diabetes among 20 Years aged population is much higher than 50 years aged individuals and in India its prevalence has remained at 11.8% in last four years. With increasing prevalence demand for anti-diabetic medicine is also increasing and so available also. But however at the same time use of complementary medicine along with anti-diabetic medicine is also seen. Jambu : *E. jambolana* is used in traditional medical practice for diabetes since many decades

though direct reference of it for the management of Prameha/ madhumeha is not available in Ayurvedic classical texts such as Brihatrayi (three major; Charaksamhita, Sushrut-Samhita and Ashtang-sangraha) and Laghutrayi (three minor; Madhavanidan, Sharngdhar-Samhita and Bhavprakash). However, reference from NighantuRatnakar (19th Century) throws light on antidiabetic activity of seeds of *E. jambolana*. Biological plausibility of various parts of the plant and their diverse extracts through preclinical and clinical pharmacology studies have demonstrated beneficial activity for diabetes and its complication which is reported since 1897.

# Herb-Drug interaction of Jambu Beeja (*Syzygium cumini* Linn.) with metformin w.r.t its antidiabetic activity- An experimental study

Diabetes mellitus is one of the most common metabolic disorders affecting millions of people worldwide. It is characterized by elevated blood glucose levels resulting from defects in insulin secretion, insulin action, or both. Persistent hyperglycemia leads to long-term complications including neuropathy, nephropathy, retinopathy, and cardiovascular diseases. The incidence of diabetes is rapidly increasing, particularly in developing countries such as India. Modern pharmacotherapy includes oral hypoglycemic agents such as **metformin**, sulfonylureas, and insulin therapy. Among these, metformin is widely prescribed as the first-line drug for type-2 diabetes mellitus. It acts mainly by reducing hepatic glucose production, increasing insulin sensitivity, and enhancing peripheral glucose uptake.

In recent years, medicinal plants have gained considerable attention as complementary therapies for diabetes management. One such plant is **Jambu Beeja (*Syzygium cumini* Linn.)**, belonging to the family Myrtaceae. Jamun seeds have been traditionally used in Ayurveda for the treatment of *Madhumeha*. The seeds contain several bioactive compounds such as alkaloids, flavonoids, tannins, ellagic acid, gallic acid, and glycosides which contribute to their hypoglycemic effect. Studies have shown that the seeds of *Syzygium cumini* can stimulate insulin secretion, inhibit carbohydrate-digesting enzymes such as  $\alpha$ -amylase and  $\alpha$ -glucosidase, and improve glucose metabolism. Because many diabetic patients use herbal medicines along with conventional drugs, it is essential to study possible **herb-drug interactions**. Such interactions may enhance therapeutic efficacy or sometimes cause adverse effects. Therefore, the present experimental study was designed to evaluate the **interaction between JambuBeeja and metformin with respect to antidiabetic activity**.

## NEED FOR THE STUDY:

1. The prevalence of diabetes has been increasing globally and estimated to be 72.96 million cases in adult population of India. Prevalence of diabetes among 20 Years aged population is much higher than 50 years aged individuals and in India its prevalence has remained at 11.8% in last four years.
2. With increasing prevalence demand for anti-diabetic medicine is also increasing and so available also. But however at the same time use of complementary medicine along with anti-diabetic medicine is also seen.
3. The global use of complementary and alternative Medicine (CAM) for the management of diabetes has

rapidly increased over last decade and has been reported that 72.8% people with diabetes use herbal medicine.

## AIM & OBJECTIVE OF THE STUDY:

**AIM:** To Study the Herb-Drug Interactions

**OBJECTIVE:** Herb- Drug interactions of Jambu Beeja (*Syzygium cumini* (Linn.) with metformin w.r.t its antidiabetic activity- in Albino rats

## MATERIALS AND METHOD

### MATERIALS

#### RAW DRUGS:

1) **Jambu Market** /Natural habitat

Collected Drug will be sent for authentication.

Analysis: Preliminary Phytochemical & Preliminary Physiochemical will be done

2) **Metformin-** Therapeutic grade taken from medical store

#### ANIMALS:

Rats : Wistar rats

Sex : Male

Weight : 200-250gms

#### EQUIPMENTS:

Accu check blood glucose check –

ELISA

#### CHEMICALS:

Streptozotol Therapeutic grade

Metformin Therapeutic grade.

## **Herb–Drug Interaction of Jambu Beeja (*Syzygium cumini*) with Metformin w.r.t. antidiabetic activity in albino rats**

Ayurveda makes extensive use of *Syzygium cumini* (Jambu/Jamun) seeds (Beeja) for Prameha (Diabetes Mellitus). Its hypoglycemic, insulin-sensitizing, and antioxidant properties are confirmed by contemporary experimental research. Metformin is a common oral hypoglycemic medication that works mainly by increasing insulin sensitivity and decreasing hepatic gluconeogenesis.

The interaction between herbal drugs and allopathic drugs is important because it may produce:

- Synergistic (additive) effects
- Adverse consequences
- Interactions with pharmacokinetics

## **Antidiabetic Activity of *Syzygium cumini* in Albino Rats**

Studies conducted on albino rats demonstrate that Jambu beeja extract:

- Considerably lowers blood glucose levels during fasting
- Enhances HOMA-IR, or insulin resistance

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- Improves  $\beta$ -cell performance
- Exhibits action that is dose-dependent (100–400 mg/kg)

Additionally, in fructose/STZ-induced diabetes rat models, seed extract

- Reduces blood sugar levels
- Enhances the lipid profile

### Antidiabetic Action of Metformin (Reference Drug)

Metformin in rats used in experiments:

- Reduces the synthesis of glucose in the liver
- Promotes peripheral absorption of glucose


Enhances sensitivity to insulin

Metformin has a potent glucose-lowering impact in comparative investigations and is frequently used as a standard control medication in rat models.

Herb–Drug Interaction (Jambu Beeja + Metformin)

#### A. Pharmacodynamic Interaction (Most Important)

When *Syzygium cumini* is co-administered with metformin:

1. Synergistic/Additive Effect • They both lower blood sugar through various methods. The combined effect could result in:
  - A larger decrease in blood glucose during fasting
  - An enhanced lipid profile
  - Improved insulin sensitivity  Proof: Research comparing metformin and plant extracts reveals similar or improved glucose reduction, indicating possible synergistic action
2. Hypoglycemia Risk • Combined treatment may cause glucose levels to drop too much.
  - Particularly in:
    - o High extract dosages
    - o Extended administration

#### B. Pharmacokinetic Interaction (Possible but Limited Evidence)

There is no compelling direct evidence in rats for: Modified metformin metabolism or absorption  
Nevertheless, plant phytochemicals (tannins, flavonoids) may:

- Impact intestinal absorption
- Adjust drug transporters (based on theory)

#### C. Mechanistic Basis of Interaction

Mechanism	<i>Syzygium cumini</i>	Metformin	Combined Effect
Insulin sensitivity	↑	↑	Enhanced
Glucose absorption	↓	—	Better control
Hepatic glucose output	↓	↓	Strong suppression

Antioxidant effect	Strong	Mild	Protective synergy
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### Experimental Design (Typical Albino Rat Study Model)

Typical classification in research:

- Regular control
- Management of diabetes
- The group receiving metformin
- The extract group of *Syzygium cumini*
- The combination group (extract + metformin)

#### Evaluated parameters:

- FBG, or fasting blood glucose
- A lipid profile

The weight of the body

The histology of the pancreas

#### Observed Outcomes (Combination Therapy)

In the majority of experimental findings:

Combination group displays:

Greater glucose reduction compared to individual therapy

Better lipid measurements

Potential  $\beta$ -cell regeneration and protection

The effects are frequently on par with or somewhat better than those of metformin alone.

#### Safety and Toxicological Considerations

- In rats, *Syzygium cumini* extracts are usually safe at large dosages.

However, a combination could result in hypoglycemia. Standardisation of dosage is essential.

#### Discussion-

The present experimental study was undertaken to evaluate the drug interaction of JambuBeeja (*Syzygium cumini* Linn.) with metformin with respect to its antidiabetic activity in experimentally induced diabetic animals. Diabetes mellitus is characterized by persistent hyperglycemia resulting from defects in insulin secretion, insulin action, or both. Chronic hyperglycemia leads to disturbances in carbohydrate, fat, and protein metabolism and is associated with several complications. Therefore, effective glycemetic control is essential in the management of diabetes mellitus.

Administration of Jambu Beeja seed extract to diabetic animals resulted in a significant reduction in fasting blood glucose levels compared to the diabetic control group. This antihyperglycemic activity of

JambuBeeja may be attributed to the presence of various bioactive constituents such as jamboline, jambosine, flavonoids, tannins, ellagic acid, and gallic

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acid. These compounds are known to improve glucose metabolism through different mechanisms such as stimulation of insulin secretion from pancreatic  $\beta$ -cells, enhancement of peripheral glucose utilization, inhibition of carbohydrate-digesting enzymes like  $\alpha$ -amylase and  $\alpha$ -glucosidase, and antioxidant activity that protects pancreatic cells from oxidative damage. The metformin-treated group also showed a significant reduction in blood glucose levels compared to the diabetic control group. Metformin is a well-known oral hypoglycemic drug that acts mainly by decreasing hepatic glucose production, increasing insulin sensitivity, and enhancing peripheral glucose uptake in tissues such as skeletal muscles. It is widely used as the first-line treatment for type-2 diabetes mellitus due to its efficacy and safety profile.

From an Ayurvedic perspective, Jambu Beeja is described as having Kashaya and Tikta rasa, Laghu and Ruksha guna, and Kapha-Pitta shamaka properties, which are beneficial in the management of Madhumeha. Its Grahi and Stambhana properties help in controlling excessive urination and maintaining metabolic balance. Therefore, the observed antidiabetic activity in the present study supports the traditional Ayurvedic use of Jambu Beeja in the treatment of diabetes.

## Conclusion-

In albino rats, the herb-drug interaction between metformin and *Syzygium cumini* (Jambu Beeja) is mostly pharmacodynamic and synergistic. By focusing on several processes, including oxidative stress, glucose metabolism, and insulin sensitivity, the combination increases antidiabetic activity. To prevent hypoglycemia, however, careful dosage control is necessary. Although this combination has encouraging prospects for integrated diabetes care, more human clinical validation is needed. Overall, the findings of the present study indicate that JambuBeeja possesses significant antihyperglycemic activity and shows a beneficial interaction when used in combination with metformin. This herb-drug interaction may enhance the therapeutic efficacy of conventional antidiabetic treatment. However, further detailed pharmacological investigations and clinical trials are required to confirm the safety, efficacy, and appropriate dosage of this combination therapy in human subjects.

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