IJCRT.ORG ISSN : 2320-2882

INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

A Comprehensive Study Of The Antidiabetic Effects Of *Withania Coagulans*

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Abstract:

Diabetes mellitus is a common and serious long-term world-wide metabolic disorder. Chemist and pharmacist have introduced treatments, but they have side effects. Researchers are looking into herbal medicines as possible alternative treatments that might not have as many side effects. Withania coagulans Dunal, also known as Rishyagandha in Ayurveda, has been used for a long time to treat Prameha, which is the traditional name for diabetes. A growing collection of preclinical and limited clinical evidence substantiates its hypoglycemic, antihyperlipidemic, antioxidant, anti-inflammatory, and organ-protective attributes. This review summarizes the data, looks at possible mechanisms, talks about safety and standardization issues, and points out gaps and chances for future research.

Key words: Diabetes, Paneer Phool, Withania coaguans, Albino Mice

Introduction:

Diabetes mellitus (DM) is a persistent condition characterized by hyperglycaemia due to impairments in insulin secretion, insulin action, or both, frequently accompanied by macrovascular and microvascular complications. Conventional therapies, including insulin, sulfonylureas, metformin, and other pharmaceuticals, are efficacious but may induce adverse effects (such as hypoglycaemia, weight gain, and gastrointestinal disturbances) and incur significant costs, especially in resource-limited environments.

In ancient time majorly Ayurvedic and unani system used different herbs and shurbs to treat metabolic disorders. Withania coagulans Dunal (Solanaceae family), commonly referred to as Rishyagandha, Paneer dodi, or Paneer phool, has been reported for its anti-diabetic properties. Ancient Ayurvedic texts refer to its use in Prameha, a clinical syndrome characterized by excessive urination, cloudy urine, and metabolic irregularities akin to diabetes (B. N. Upadhyay & Gupta, 2011). In recent

decades, pharmacological studies have endeavoured to validate these claims. This review aims to provide a comprehensive analysis of the current facts, mechanisms of action, and obstacles in the translation of W. coagulans as a clinically efficacious antidiabetic agent.

Review of literature:

A. Botanical Profile and Historical Use:

N. Upadhyay & Gupta, 2011 reports that Withania coagulans is a perennial shrub that grows in India, Afghanistan, and Pakistan. People usually pick the leaves and fruits and use them in extracts, powders, or decoctions. Public often use the plant in traditional medicine to treat urinary diseases, kidney problems, inflammation, ulcers, and metabolic disorders like Prameha.

B. Phytochemical study of W. coagulans:

Ihsan-ul-Haq et al., 2013 Reported 37 chemicals in Withania coagulans that belong to different classes, such as withanolides, flavonoids, alkaloids, saponins, phenolics, and glycosides (Maurya, 2010). In a particular study, researchers isolated three novel steroidal lactones (withacoagulin G, H, and I) alongside six established derivatives.

Sang-Ngern et al., 2025 reported Biologically Active Withanolides inhibited the production of nitric oxide and the activation of NF-κB. Withanolides that fight inflammation could make the plant more effective in treating metabolic and inflammatory diseases.

C. Anti-diabetic and hypoglycemic effects .

Jaiswal et al. (2009) reported the efficacy of Withania coagulans fruit extract in the treatment of diabetes in rats. The extract was seen to reduce blood glucose levels by 39.2% four hours post-diabetes induction and by 39.9% two hours thereafter during an oral glucose tolerance test (OGTT). In a 30-day longitudinal study, rats with severe diabetes exhibited a notable reduction in fasting glucose and postprandial glucose levels.

Yan, 2022 reported extract demonstrated efficacy in the Nicotinamide/STZ model, with a dosage of 250 mg/kg proving to be the most beneficial. In a study by Datta et al., 2013 the hydroalcoholic extract of desiccated Withania coagulans was evaluated against glipizide in STZ-induced diabetic rats, demonstrating a reduction in elevated blood glucose levels during a four-week period.

Bage et al., 2023 demonstrated anti-hyperlipidemic efficacy by decreasing total cholesterol, triglycerides, and the atherogenic index in STZ-induced diabetic rats.

Ojha et al., 2014 exhibited renal protection via antioxidant and anti- inflammatory mechanisms, mitigating hyperglycemia, regulating glutathione levels, preventing lipid peroxidation, and lowering kidney hypertrophy.

Arslan et al., 2025 discovered that the extract significantly influenced GLP-1 levels and combo therapy in STZ-induced diabetic mice.

D. Suggested Working Mechanism

Shukla et al. (2012) found that extracts of W. coagulans inhibit carbohydrate- digesting enzymes, slowing glucose absorption and reducing post-meal glucose levels. Tests on glucose uptake showed that methanolic fruit extract increased glucose transport across yeast cell membranes in bioassays, suggesting peripheral absorption. Ihsan-ul-Haq et al. (2013) found that Withanolides from W. coagulans, including withacoagulin, reduced systemic inflammation linked to insulin resistance by inhibiting nitric oxide generation and NF κB activation in macrophage mice.

Wickramasinghe et al.'s 2021 histopathological study, combined with extract + glipizide, showed improved pancreatic islet architecture, indicating regenerative effects on cells and anti-diabetic and antihyperlipidemic activity.

According to Shukla et al. (2012), treatment with Withania coagulans increases the activity of glycolytic enzymes (glucokinase, phosphofructokinase) and inhibits the gluconeogenic enzyme glucose-6-phosphatase, promoting glucose utilization over synthesis.

Shukla et al., 2012 found that treated rats store more glycogen in the liver and muscle than diabetic controls, indicating glucose redirection from hyperglycemia to storage.

Ojha et al., 2014 demonstrated Chronic hyperglycemia harms β-cells, vascular endothelium, and renal tissue through ROS production. Wickramasinghe et al. (2021) showed Withania coagulans increases glutathione, superoxide dismutase, and catalase, lowers lipid peroxidation, and reduces oxidative stress. This prevents free radical damage to the kidneys and pancreas.

Miller et al., 2020 showed the anti-inflammatory impact is crucial since inflammation causes insulin resistance and other diabetes issues. Withania coagulans reduces proinflammatory cytokines (IL-1β, IL-6, TNF-α) in the kidneys and other tissues, while its withanolides block NF-κB and nitric oxide pathways.

Kumar & Singh (2010) suggested reducing total cholesterol and triglycerides while increasing atherogenic index for cardiac health. Anti-hyperlipidemic W. Coagulans reduces diabetes-related cardiovascular disease. effectiveness against hyperlipidemia.

Saxena (2010) found that glipizide improves lipid profiles and pancreatic histology better when used together. Along with regulating blood sugar, Withania coagulans reduces diabetic nephropathy by lowering inflammatory mediators, renal tissue oxidative stress, and renal hypertrophy, according to Ojha et al. (2014). The multi-modal approach that targets blood sugar, antioxidants, and inflammation may protect organs.

Conclusion and Discussion:

Review of the contemporary literature suggests Withania coagulans shows a lot of potential as a plant-based treatment for diabetes. Numerous animal studies show that it has strong effects on lowering blood sugar, lowering cholesterol, protecting the kidneys, and fighting inflammation through a number of different ways, such as changing how insulin is released, controlling enzymes, increasing

glucose uptake, and reducing oxidative and inflammatory damage. Initial human studies indicate promising efficacy, albeit with limitations in design and scope. Nonetheless, significant obstacles persist before W. coagulans can be dependably utilized in clinical environments. These encompass the standardization of extracts,

pharmacokinetics, dosage translation, long-term safety assessments, stringent human trials, and mechanistic investigations in human cell systems.

Withania coagulans needs to be studied more and more for better result.

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