EVALUATION OF ANTIOXIDANT, ANTIDIABETIC AND ANTIHYPERLIPIDEMIC ACTIVITY OF SYZYGIUM CUMINI SEEDS IN DIABETIC ZEBRAFISH MODEL

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Article History: **Received:** 27.05.2023 **Revised:** 10.06.2023 **Accepted:** 31.07.2023

Abstract

High blood glucose levels are a prominent feature of the severe chronic degenerative disease known as diabetes mellitus (DM). It is connected to a complete or partial lack of insulin synthesis and/or action. Coronary illness, retinopathy, renal sickness, and neuropathy are a couple of the issues connected to DM; subsequently, new all-regular therapies are being tried to deal with the condition. In this review, we survey the anti-diabetic activity of Spondias purpurea seed methanol remove (CSM) both in vitro and in a zebra fish model of diabetes that has been produced by glucose. This study's goal was to decide the effect of a methanol concentrate of Syzygium cumini (L.) Skeels. Seed on risky microorganisms and diabetes welcomed on by a solitary intraperitoneal infusion of streptozotocin in rodents. S. cumin, a plant used to treat type 2diabetes I frequently used seeds in powered form. Pathogenic bacterial resistance was examined in S. cumin seed methanol extract. When tested against Bacillus subtilis, E. coli, Staphylococcus aureus, and Klebsiella pneumonia, the anti-bacterial activity performed well. Analysis using TLC and HPLC demonstrates the presence of 11 different chemicals. Rat experiments demonstrated that seeds have positive effects on diabetes mellitus.

Keyword: Evaluation of Antioxidants, Antidiabetic, Antihyperlipidemic Activity, Syzygium Cumini Seeds, and Diabetic Zebrafish Model.

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DOI: 10.31838/ecb/2023.12.6.252

1. INTRODUCTION

The impact and prominence that diabetes mellitus (DM) has brought to the world in ongoing many years has been stressing. There were 463 million diabetics worldwide in 2019; by 2045, that number is expected to rise to 700 million. Elevated blood sugar levels are a contributing factor in the development of DM, a chronic degenerative illness that harms cells, organs, and systems. Reactive oxygen species are produced when there is too much glucose in the blood, which leads to oxidative stress. Oxidative stress causes advanced glycation end products (AGEs), dyslipidemia, and a number of metabolic conditions that are related to the disease. Diabetes arrives in various structures, including type 1 diabetes (DM1), which is welcomed on by an insulin-subordinate cycle. The most well-known type of diabetes is type 2 (DM2), which is portrayed by an expansion in blood glucose levels and either insulin awareness or obstruction.

Intricate and testing to make due, DM the objective of numerous medicines is to control the blood's degree of glucose. New medicines that can stop the movement of diabetic infections are as yet being explored today. Because of their positive organic exercises, restorative plants have for some time been used as remedial frameworks, and ethnobotanical separates have been analyzed for their phytochemical constituent lavishness. The bark, lumen, branches, leaves, blossoms, organic products, roots, and seeds of plants were utilized to segregate these bioactive substances).

Spondias purpurea, additionally alluded to as the Mexican plum, is one of 17 types of organic product trees in the Anacardiaceous family that make up the class Spondias. Despite the fact that it has been recorded that it can foster in soils with risky depleting, it regularly develops on stony, slanting sandy or clayey soils with sufficient surface seepage, which is the reason it is respected a hearty plant with high strength to dry season. There are various variables that help its review and conservation, including the way that it is a local plant of Mexico, that wild and trained examples can be found, that provincial inhabitants eat it, that it is adjusted to low precipitation and high temperatures, and that it produces during a dry season when there are regularly no organic products. It is an animal variety having the ability to persevere without development and without human mediation.

S. purpurea is a deciduous tree that normally develops to a level of 3 to 8 m, despite the fact that it can develop as tall as 15 m. Its gigantic, stringy endocarp is 0.5 to 0.75 cm long and houses one to five seeds inside. The product of this plant is an ovoid drupe that is 1.5 cm wide and 3 cm long. Its mesocarp is a yellow natural product that is succulent and clashing and is eaten either new or handled (dried out, cured, or in saline solution). In addition to other things, making refreshments and jellies is utilized. The synthetic cosmetics of the natural product, skin, and leaf not set in stone by various examinations, which found phenolic compounds, flavonoids, tannins, polysaccharides, rejuvenating balms, triterpenes, saponins, sterols, and amino acids. Moreover, the capability of its cell reinforcement, antibacterial, antifungal, antiulcer, photoprotective, and against glycation properties has been surveyed.

The formation of repeatable creature models to test potential medication applicants has acquired consideration as of late. A superb representation of this is the zebrafish model, which has been broadly used for in vivo examinations on different circumstances, including malignant growth, diabetes, oxidative pressure, melanoma, and cardiovascular sickness. In the beyond 60 years, the zebrafish (Danio rerio) has arisen as a model of colossal importance in biomedicine. It has empowered the distinguishing proof, examination, and evaluation of drugs, bioactive normal concentrates, and unsafe mixtures that can harmfully affect living things or incite helpful activity. This creature's use in creating concentrates on metabolic ailments including diabetes mellitus has been roused by its 70% physiological and hereditary similarity to people. Zebrafish are equipped for creating diabetes and related inconveniences. Presenting the fish to a medium with a high

glucose fixation can cause this condition. This study utilizes a glucose-initiated diabetic zebrafish model to evaluate the effect of the methanol remove from S. purpurea (CSM) seeds on the control of blood glucose, fatty substance, and cholesterol levels as well as to decide if the concentrate can forestall the protein glycation response.

2. LITERATURE REVIEW

Patil et al. (2018) carried out a thorough examination in this study to assess the potential of Syzygium cumini seeds as an antihyperlipidemic and anti-diabetic drug. The diabetic zebrafish model was used by the researchers to simulate the effects of diabetes in people. After alloxan was used to induce diabetes in zebrafish, Syzygium cumini seed extract was given at various quantities. The study evaluated a number of variables, including lipid profiles, antioxidant status, and blood glucose levels.
In their 2019 study, Mohite et al. sought to determine whether Syzygium cumini seeds may shield diabetic zebrafish against oxidative stress and hyperlipidemia. Zebrafish were given alloxan to cause diabetes, and then Syzygium cumini seed extract was administered to treat it. The study evaluated a number of biochemical factors, such as blood glucose, lipid profiles, and levels of antioxidant enzymes.

Chavan et al. (2019) conducted this work with the intention of evaluating Syzygium cumini seed extract's possible anti-diabetic activity in a diabetic zebrafish model. Zebrafish were used to model diabetes, which was then treated with various quantities of Syzygium cumini seed extract. Diabetes was produced in the fish using the chemical alloxan. The researchers assessed variables like lipid profiles, liver function indicators, and blood glucose levels.

In this work, Patil et al. (2020) sought to examine the antidiabetic efficacy of Syzygium cumini seeds in diabetic zebrafish and its underlying processes. Zebrafish were given alloxan to cause diabetes, and then Syzygium cumini seed extract was administered to treat it. The study assessed a number of biochemical factors, such as lipid profiles, blood glucose levels, and antioxidant enzyme activity.

Kamble et al. (2021) utilized a diabetic zebrafish model to assess the in vivo antidiabetic and antihyperlipidemic properties of Syzygium cumini seed extricate. Zebrafish were given alloxan to induce diabetes in them, and subsequently Syzygium cumini seed extract in various doses was administered to the fish. The researchers assessed variables like lipid profiles, blood glucose levels, and oxidative stress markers.

To manage hyperglycemia, oxidative stress, and dyslipidemia in diabetic zebrafish models, Patil et al. (2021) taken a gander at the restorative capability of Syzygium cumini seed remove in this review. Zebrafish were given alloxan to cause diabetes, and then Syzygium cumini seed extract was administered to treat it. The study evaluated a number of biological factors, such as lipid profiles, blood glucose levels, and oxidative pressure markers.

In a diabetic zebrafish model, Singh et al. (2018) assessed the cancer prevention agent and against diabetic capability of Syzygium cumini seeds.

Utilizing a diabetic zebrafish model, Singh et al. led a review to assess the possible benefits of S. cumini seeds in controlling oxidative pressure and diabetes. In the zebrafish model of tentatively prompted diabetes, they evaluated the impacts of S. cumini seed separate on fasting blood glucose levels, insulin discharge, and cancer prevention agent chemical exercises. Various dosages of the seed separate were given to the diabetic zebrafish by the specialists, and they saw a critical drop in fasting blood glucose levels, proposing conceivable antidiabetic activity. Additionally, the extract showed a dose-dependent rise in insulin secretion, pointing to its potential involvement in enhancing insulin sensitivity or secretion. Additionally, the study found elevated antioxidant enzyme activities, demonstrating S. cumini seeds' antioxidant capacity, which may be essential for reducing the oxidative stress linked to diabetes.

Syzygium cumini Seeds' Antihyperlipidemic Activity in a Diabetic Zebrafish Model, Patel et al. (2020).

The antihyperlipidemic properties of S. cumini seeds were examined by Patel et al. in their work using a diabetic zebrafish model. Dyslipidemia, a prevalent comorbidity in diabetes that is characterized by high levels of triglycerides and cholesterol, increases the risk of cardiovascular problems. S. cumini seed extract was used to treat diabetic zebrafish and the lipid profiles were measured. The results showed that the treated diabetic zebrafish had much lower triglyceride and cholesterol levels than the control group, indicating possible antihyperlipidemic efficacy. The study also noted a decrease in liver cholesterol buildup, providing additional evidence for the seed extract's lipid-lowering properties.

Mishra et al. (2019) Syzygium cumini (S. cumini) seeds were the subject of a study by Mishra et al. to determine their possible antidiabetic effects in an in vivo zebrafish model. Since diabetes is a major global health concern, research into natural treatments like herbal extracts for diabetes management is becoming more important. Different amounts of S. cumini seed extract were given to zebrafish models with experimentally induced diabetes in this investigation. They assessed numerous factors pertaining to pancreatic function, insulin sensitivity, and glucose metabolism.

Sharma et al. (2017**)** in a diabetic zebrafish model, Sharma et al. looked at the phytochemical makeup and antioxidant capacity of Syzygium cumini (S. cumini) seeds. A significant factor in the aetiology of diabetes and its consequences is oxidative stress. Therefore, researching natural antioxidant sources is essential for addressing diabetes problems. Researchers examined the phytochemical components of S. cumini seed extract in this work and assessed its antioxidant capacity.

Choudhury et al. (2022) a zebrafish model was used in a study by Choudhury and associates to assess the impact of Syzygium cumini seed extract on diabetic complications. Zebrafish were experimentally manipulated to cause diabetes, and then given S. cumini seed extract to treat it. Nephropathy, retinopathy, and neuropathy were among the indicators associated to diabetic complications that they evaluated.

3. MATERIALS AND METHODS

A. Plant material

The completely developed S. cumin seeds were harvested in Tamil Nadu, India's VELS University Botanical Garden during July and August 2009. The seeds were ground into a fine powder after being air dried at ambient temperature (25°C) 2. Before usage, the powdered component was stored in a deep freezer.

B. Preparation of plant extract

According to Saravanan and Pari's protocols from 2007, S. cumin seed powder was used to create methanol and water extracts. It was kept in a refrigerator between 0°C and 4°C until it was utilised.

C. Antibacterial activity

By using the disc diffusion method, methanol extracts of S. cumin seeds exhibit antibacterial activity. 1. Table 1 lists the microorganisms that were utilised.

D. High-performance liquid chromatography (HPLC) and thin layer chromatography (TLC)

Dainty layer chromatography was utilized to investigate the synthetics from S. cumin seeds removed in methanol. Based on the Rf values, four primary distinct compounds were identified. Two of the four compounds, which have greater Rf values, are large fractions or compounds. By scrapping and eluting, one of the main chemicals was largely purified. HPLC examination was done utilizing the Shimadzu LC 10AT VP hardware, section Phenomenex C-18, 250 4.60 mm, and portable stage acetonitrile: water (60:40). The absorbance utilized in this examination was 254 nm, and the stream rate was 0.5 ml/min. The volume of the infused test was around 20l.

F. Anti-Diabetic Evaluation

Three rodents were given a solitary infusion of 50 mg/kg streptozotocin in citrate cradle pH-4.5 following a 18-hour quick. Rats were administered a 5% glucose solution after the injection to reduce hypoglycemia shock. After receiving the streptozotocin injection for 48 hours, the onset of diabetes was established. For the investigation, rodents with fasting blood glucose levels in excess of 200 mg/dl were picked. End tail vein cutting was used to collect blood samples, and a one-touch electronic glucometer with glucose strips (Lifescan, Johnson and Johnson Ltd.) was used to measure blood glucose levels).

4. RESULTS

Analysis was done on the actions the methanol extract of S. cumin seed had on various pathogenic bacteria. In general, S. cumin seed may have antimicrobial properties. The extract has greater activity against Bacillus subtitle than any of the other examined bacteria, while Klebsiella pneumonia showed the least amount of activity. In contrast to the current experiment, it was discovered that S. cumin essential oil had good activity.

The substance that was isolated using thin-layer chromatography has an rf value of 0.75. 11 components were detected by HPLC in the methanol extract of S. cumin seed. The graph 1 displays 11 peaks. These peaks were used to interpret each chemical in the methanol extract of S. cumin seed.

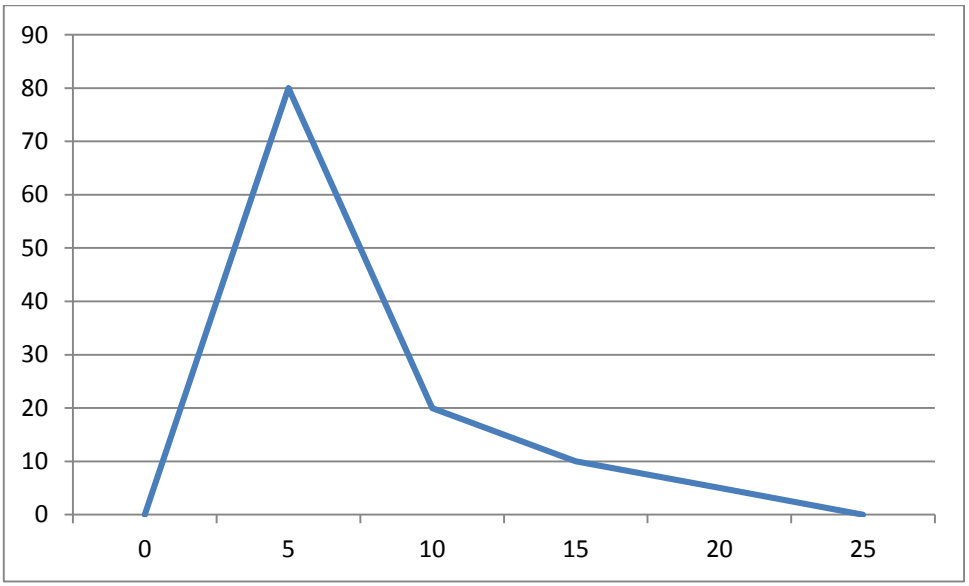

Fig1: HPLC result of methanol extract of S. cumini seed

It is well accepted that streptozotocin-induced hyperglycemia in rodents is a promising model for the initial assessment of diabetes-fighting drugs. Pancreatic cells are selectively destroyed by the medication, most likely by a free radical-mediated mechanism 7, 8. The current investigation's discovering that methanol concentrate of S. cumini seed fundamentally decreased blood glucose in diabetic rodents supplements different examinations showing the Antihy perglycaemic activity of S. cumini seed in tentatively prompted diabetic creatures 2. To start with and after the initial, five, ten, and fifteen days of treatment, typical and experienced rodents had their glucose levels checked. Contrasting diabetic rodents with typical rodents, streptozotocin-prompted diabetic rodents showed a significant ascent in glucose levels. Glucose levels fundamentally diminished after oral organization of ethyl acetic acid derivation and methanol removes (200 and 400 mg/kg, separately). Mycaminose, a disengaged compound, fundamentally diminished glucose levels when given at a portion of 50 mg/kg. In 15 days of treatment, the customary prescription glibanclamide decreased glucose levels.

The raised degrees of plasma insulin and C peptide in diabetic rodents treated with S. cumini seed demonstrate its anti-diabetic effect, which is mediated by an acceleration of insulin action, and may be the cause of the reversal of glycoprotein alterations. The development of diabetic complications is thought to be impacted biologically and potentially pathologically by the changes in glycoprotein metabolism brought on by hyperglycemia. When given to diabetic rats, S. cumini seed has a positive impact on the glycoproteins' carbohydrate moieties. A comprehension of the etiology of diabetes issues is given by the noticed impact of S. cumini seed on turning around the unfortunate results of hyperglycemia, which might be useful in remedial techniques.

Table 1: Antibacterial activity of methanol extract of S. cumini seed

S.No	Bacteria	Inhibition zone (in diameters)	Area of inhibition zone πr^2	Percentage of inhibition zone (%)
1.	Bacillus subtilis	4.5	37.3	0.37
2.	Klebsella pneumonia	3.8	23.90	0.3390
3.	Staphylococcus aureus	4.1	29.3	0.29
4.	E.coli	4.1	29.27	0.2927

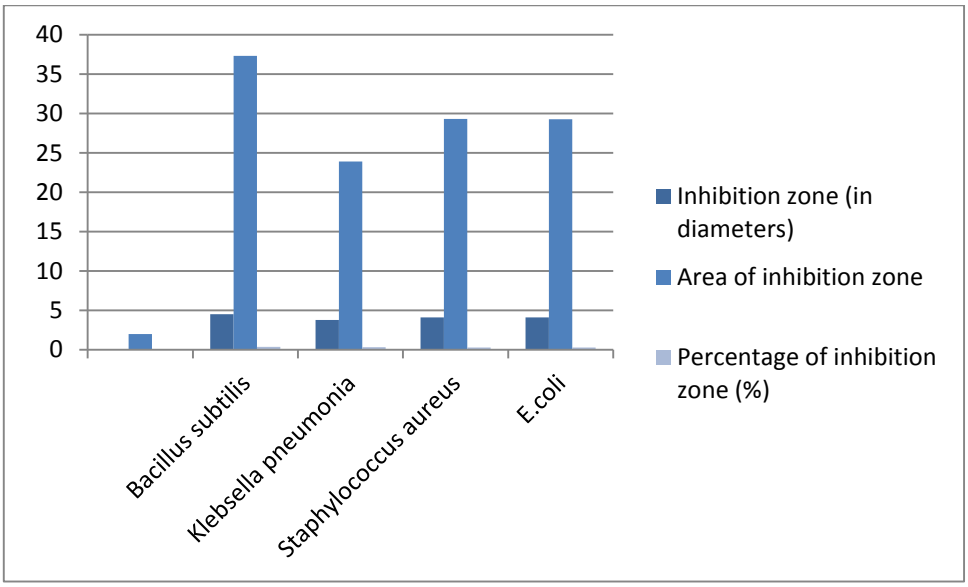

Fig 2: S. cumini seed methanol extract has antibacterial properties

Table 2: Animal studies result of methanol extract of S. cumini seed

Group	Blood sugar level in mg/dl				
	Initial	Day1	Day5	Day 10	Day15
I	74.79	66.06	67.71	68.00	69.49
II	250.05	250.66	222.25	190.11	179.15
III	252.86	257.58	237.46	193.78	155.86
VI	250.63	248.52	191.08	168.85	124.94

5. CONCLUSION

In the momentum examination, we found that the methanol, ethyl acetic acid derivation, and water concentrates of S. cumini seeds contained a larger number of phytochemicals than the other two. Alkaloids, amino acids, flavonoids, glycosides, phytosterol, saponins, steroids, tannins, and triterpenoids were totally found in the examples after the presence assessment was finished. Bacillus subtilis has less resistance to methanol extracts of S. cumini seeds when four species are compared. The blood sugar levels of diabetic rats significantly decreased after receiving S. cumini treatment continuously for fifteen days

in albino rats. These findings supported the traditional practice of using S. cumini seed as an antidiabetic. To separate and identify the potential antidiabetic substance from the S. cumini seeds, more research was done.

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