Characterization of Antioxidant Properties in Syzygium Cumini (LINN)

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Abstract

In India, the fruit classified as Syzycium cumini (Myrtaceae) is generally referred to as jamun. Several metabolic illnesses are thought to be caused by free radicals, which has prompted researchers to look into the antioxidant capabilities of plants as a potential treatment for these conditions. In this study, phytochemical analysis, antioxidant activity, in-vitro antihyperglycemic activity, and the identification of functional groups were performed on extracts of the pulp of the Syzygium cumini plant. To quantify antioxidant activity, we used a diphenyl picrylhydrazyl (DPPH) and an ABTS scavenging test. The phenolics in fruits have antioxidant capabilities due to their redox characteristics, which allow them to serve as a reducing agent.

Keywords: *Syzygium cumini; Antioxidant activity, DPPH, Jamun seeds.*

1. INTRODUCTION

Some phenolic chemicals found in plant-based meals may be responsible for their health benefits. In recent years, scientists have paid a lot of attention to phytochemicals and the ways they might improve human health. Particularly interesting is the quest for anti-inflammatory, hypoglycemic, and cancer-fighting compounds in various plant foods such vegetables, fruits, teas, spices, and medicinal herbs. Several of these chemicals have been credited with antioxidant and free radical scavenging properties. S's antioxidant action is hardly studied. Despite recent studies revealing the chemical make-up and antioxidant potential of S. cumini leaves, they are still not widely used. Fleshy, dark, and sweet, cuminis. The S. leaf. The antioxidant activity and total phenolic content of cumini were studied. To separate tannins from S. Recent studies have looked at the chemical composition and antioxidant activity of cumini fruit, and they showed highly powerful DPPH radical scavenging activity and ferric reducing/antioxidant capabilities. Nutritionists have found that the fruit of S. cumini is high in carbs, minerals, and vitamins, and particularly high in the sugar's glucose and fructose. minerals like manganese, zinc, iron, calcium, sodium, and potassium may be found in abundance in the fruit.

2. LITERATURE REVIEW

Rauza Sukma Rita et.al (2021) To begin, let us establish that lead is among the most harmful heavy metals found naturally. Lead exposure may occur by ingesting contaminated water, using batteries, painting with lead-based paint, or being exposed to industrial contaminants. One of the numerous health issues linked to lead exposure is oxidative stress, which may be triggered by prolonged contact to the metal. Lead causes oxidative damage, which may be mitigated using exogenous antioxidants. The high levels of antioxidants in Syzygium cumini leaf reduce lead's damaging effects on cells. The rodents were randomly divided into three groups: the control, the positive control, and the treatment. Malondialdehyde and catalase activity were evaluated from blood samples taken at experiment's conclusion. The serum malondialdehyde levels were lowered and the catalase activity was raised due to the Syzygium cumini leaf extract. Lead exposure causes oxidative stress, however the leaves of Syzygium cumini may alleviate this condition.

Namrata Dwivedi et.al (2020) Black plum, also known as Syzygium Cumini, or "jamun," is a medicinal plant revered in many different belief systems. Diabetes mellitus may be well managed with this. Compounds such as anthocyanins, glucoside, ursolic acid, beta sitosterol, ellagic acid, isoquercetin, kaemferol, and myrecetin are plentiful in the plant. The seeds are said to contain the alkaloid jambosine and the glycoside jambolin or antimellin, both of which block the diastatic conversion of starch into sugar. To back up jamun's antidiabetic claims, this work attempts to detail the research done on ant hyperglycemic activity, free radical scavenging activity, and Fourier transform infrared spectroscopy of dried extract of Syzygium cumini Linn.

Nureen Zahra et.al (2019) we investigated the phytochemical characteristics, such as antioxidant activity, of Eugenia jambolana plant extracts derived from its leaf, stem, and seed. Quantitative phytochemical analysis was done using biochemical tests, and antioxidant activity of extracts was assessed using DPPH radical scavenging assays. Our qualitative and quantitative results show that ethanol is an effective solvent system with a greater concentration of bioactive chemicals than water. When comparing the antioxidant activity of water and ethanolic extracts of the same parts, we found that the former were 68% effective in neutralizing free radicals, whereas the latter were just 5% and 1.25% effective. Ascorbic acid, which neutralizes 97% of free radical species, was used as the gold standard. The antioxidant activity and phtyo-chemical content of ethanol extracts were particularly striking.

Ranu Biswas et.al (2018) The goal is to reduce the prevalence of diabetes, which is presently estimated to impact 10% of the world's population. The purpose of this study was to measure the total phenolic and flavonoid content of Syzygium cumini seed powder, conduct a phytochemical profile of the plant, and evaluate its antioxidant activity and hypoglycemic potential in alloxan-induced diabetic rats. Ayurvedic Pharmacopoeia of India-recommended procedures were used to assess the seed powder's pharmacognostical and physicochemical properties (API). Strength of antioxidants was measured by their capacity to scavenge 1, 1-diphenyl-2-picrylhydrazyl (DPPH) radicals in vitro. Syzygium cumini seed ethanolic extract was administered at 200mg/kg and 400mg/kg body weight (bw) daily to rats for three weeks after they had been induced to develop diabetes by the drug alloxan. All physicochemical characteristics were found to be within acceptable limits set by the API. Phytochemical study of the extract revealed the presence of polyphenols, flavonoids, glycosides, alkaloids, tannins, and saponins. High levels of phenolic compounds and inhibition are present in the extract. The extract decreased fasting blood sugar by 46.67-52.67%, which is almost as much as the gold standard medication glibenclamide. In addition, extract administration reduced the bw of diabetic rats by 18.20-20.41%, while the usual medicine raised bw by 22.95%. In conclusion, phenolic chemicals abound in Syzygium cumini seed extract. These results demonstrated that the extract reduced FBS and had a potent radical (DPPH) scavenging effect in alloxan-induced diabetic mice.

Ganesh Chandra Jagetia (2017) In recent years, the use of plants as medicines has increased because of their low or nonexistent toxicity when given in the amounts commonly necessary to treat different ailments, however plants have been used as medicine for millennia. Jamun (Syzygium cumini), a tree in the family Myrtaceae, has been attributed to many therapeutic characteristics in the Ayurvedic medical tradition, and this article provides an in-depth discussion of its phytochemical and pharmacological activity. Jamun's medicinal properties have been likened to those of a range of other fruits, including those that are sweet, sour, astringent, acrid, refrigerant, carminative, diuretic, and digestive. Through both scientific research and clinical application in traditional medicinal systems, jamun has been demonstrated to be beneficial in the treatment of leucorrhoea, gastrointestinal disorders, fever, diabetes, piles, stomachache, wounds, and dental, digestive, and skin problems. Jamun has components with a wide range of health benefits, including those for the digestive system, the liver, the heart, and even protection from radiation. Finally, Jamun contains several different phytochemicals, including anthraquinones, alkaloids, catechins, flavonoids, glycosides, steroids, phenols, tannins, saponins, and cardiac glycosides. Jamun's versatility may be due to its ability to scavenge free radicals, increase antioxidant status in cells by increasing levels of glutathione, glutathione peroxidase, catalase, and/or superoxide dismutase, and reduce lipid peroxidation. In addition, it suppresses the transcription of peroxisome proliferator-activated receptor, Nuclear factor kappa B, cyclooxygenase, inducible nitric oxide synthase, tumour necrosis factor alpha, and other proinflammatory cytokines while up-regulating the transcription of nuclear factor erythroid 2-related factor 2, which is involved in regulating the antioxidant status of the cells.

3. ESTIMATION OF TOTAL ANTIOXIDANT ACTIVITY

The Oyaizu, M. technique was used to determine how effective the extracts were in reducing iron (III) (1986). Antioxidants would cause Fe3+ to be reduced to Fe2+ in the reducing power test by giving an electron.

The production of Perl's Prussian blue at 700nm may then be used to track the concentration of Fe2+ complex.

In general, a higher absorbance at 700 nm suggests better reducing power. Ascorbic acid was employed as a standard at concentrations ranging from 10100 g/ml. An increase in reducing power is shown by a rise in the absorbance of the reaction mixture.

4. SYZYCIUM CUMINI

Syzygium, with its around 1,200 species, is the most diverse genus in the Myrtaceae family. Because there are still many unique species to be found and numerous validly described species waiting to be transferred to Syzygium, it was determined that Syzygium should be ranked as the sixteenth biggest flowering plant genus, out of 57. This paleotropical genus is distributed in southern and southeastern Asia, southern China, Australia, Malesia, and New Caledonia. These creatures may be found in East Africa, Madagascar, the Mascarenes, the islands of the South Western Pacific, Taiwan, and southern Japan. Its evolutionary foundations can be found in the Melanesian-Australian area, although the diversity hotspot is in Malesia.

Distribution and Habitat:

Syzygium cumini originated in India or the East Indies. The Thai, the Filipino, and the Malagasy all have it in their wilds. Many other tropical and subtropical places, such as the West Indies, East and West Africa, and the states of Florida, California, Algeria, and Israel, have also successfully integrated the plant into their local ecosystems.

Traditional and Medicinal uses:

Traditional medicines made from the Syzygium cumini plant often include the whole plant, from seed to fruit to leaves to flowers to bark. Charaka made decoctions out of the seeds, leaves, and fruits, and utilized the bark as an astringent, to treat diarrhea. In cases of obesity, vaginal discharges, and monthly abnormalities, as well as cold infusions for cases of intrinsic bleeding, Sushruta recommended eating the fruit. Chronic diarrhea, dysentery, and menorrhagia are treated with dosages of the juice extracted from the bark (56-112 ml). Gargling or rinsing with a decoction of the bark might help with sore gums, stomatitis, and a loose throat. Anti-itch creams containing bark have also been utilised. Bark is used for tanning, dying, and coloring leather and fishnets. According to Ayurveda, the tree's bark may be used to treat a number of different ailments, including sore throat, bronchitis, asthma, thirst, biliousness, dysentery, blood impurities, and ulcers. Diarrhea accompanied with blood is treated with a mixture of goat milk, honey, and the juice of Jambu, Amra, and Amalaka plants. To cure diabetes, drink some leaf juice. Every morning, the milk and juice combination is consumed. Stomach aches may be alleviated by drinking fresh leaf juice. The syrup extracted from the ripe fruit's juice is a delicious drink. A syrup or vinegar produced from the mature fruit may be used to expand the spleen and as an efficient astringent in cases of persistent diarrhoea. Stomach ulcers, low stomach acid, and diabetes are treated with a hot water extract of dried fruits. Alloxan-induced diabetic mice showed decreased blood sugar levels when given an ethanolic extract of Syzygium cumini seeds. 28 Powdered seed was given with card to treat diarrhea, dysentery, spleen enlargement, and infections because to its antibacterial properties and mango kernels.

Pharmacological activities

Antidiarrheal, antioxidant, gastroprotective, antiallergic, astringent, analgesic, anti-inflammatory, anti-plaque, and antibacterial properties are only some of the pharmacological functions of Syzygium cumini.

Antioxidant activity: Free radical scavenging experiments have showed that several components of Jamun exhibit antioxidant potential. Jamun leaf and seed extracts have a dose-dependent ability to quench the free radical production of nitric oxide (NO). Jamun fruit skin aqueous extract has also been demonstrated to exhibit free radical scavenging properties against hydroxyl (OH), superoxide (O2 •), and diphenyl phosphate (DPPH).

Antibacterial and antifungal activity:

Antimicrobial activity of essential oils isolated from Jamun leaves has been shown against many different bacterial species, including Basillus sphaericus, Staphylococcus aureus, Escherichia coli, Pseudomonas aeruginosa, and Samonella typhimurium. The hydroalcoholic extract of Jamun leaves was shown to be effective against 26 different types of bacteria and yeasts, including Candida krusei, Enterococcus faecalis, E. coli, Kocuria rhizophila, Neisseria gonorrhoeae, Pseudomonas aeruginosa, and Shigella flexneri. Extracts of Jamun fruit in diethyl ether, methanol, and water were able to inhibit the development of Bacillus cereus, Staphylococcus epidermidis, Micrococcus luteus, and Salmonella typhi. Against Vibrio cholerae serogroups Ogawa and Inaba, an ethanol extract of Jamun leaf was shown to be effective.

Anti-inflammatory activity: Acute and chronic inflammation may both be reduced by jamun's anti-inflammatory properties. Carrageenan (acute) and kaolin carrageenan-induced paw edoema in rats were attenuated, and there was some indication that chloroform seed extract might inhibit protein exudates, dye leakage in peritoneal inflammation, and leukocyte migration. An anti-inflammatory effect was also seen in human neutrophils when the aqueous seed extract was used.

Rat models of acute inflammation using carrageenan, kaolin carrageenan, and formaldehyde showed that the ethanol extract of Jamun stem bark reduced swelling and pain. In carrageenan-induced rat paw edema, the seed extracts methanol and ethyl acetate showed an anti-inflammatory effect. Inflammation may be reduced with the use of jamun leaf methanol extracts, as shown in studies involving carrageenan-, histamine-, and serotonin-induced rat paw edoema, and cotton pellet-induced rat granuloma. Several studies have shown that jamun leaf reduces inflammation; one research found that its essential oils reduced eosinophil migration in rats.

5. METHODS

In-vitro Antioxidant Activity

Assay for reducing power of photosystem Using a calibration curve of standards, namely Quercetin and Gallic acid, the total flavonoid and phenolic content was calculated and reported as mg/g QE and mg/g GAE. The ability to quench free radicals was evaluated using the DPPH scavenging test.

ABTS assay The ABTS method, with a few tweaks, was used. This test measures a substance's capacity to scavenge the radical cation ABTS+, which is generated when ethylbenzthiazoline-6-sulfonic acid (ABTS) is hydrolyzed. When reduced by an antiradical chemical, ABTS loses its distinctive absorbance at 734 nm, which is typical of its radical state. Hydrogen-donating antioxidants are evaluated by their ability to dampen the long-wave (734 nm) absorption spectra of a solution-colored blue-green by ABTS radicals.

6. DATA ANALYSIS

In- vitro Antioxidant Activities

Syzygium cumini methanolic extract has an IC50 value of 4.390.011g/ ml for its ability to scavenge DPPH radical. The screening of medicinal plants for anti-oxidant activity often involves measuring the ability of DPPH to scavenge free radicals. The process, however, is rather clear: one electron is supplied by an antioxidant chemical, which causes DPPH to lose its color.

A prominent process is the removal of DPPH's color after an anti-oxidant molecule has contributed one electron. Syzygium cumini methanolic extract's ability to quench DPPH radicals varied with sample and standard (Ascorbic acid's IC50 value is 4.390.011mg/ml), and was concentration-dependent. Table 1. Antioxidant and phenolic content have been linked to claimed concentration-dependent action in certain research. ORGIN pro was used to determine the antioxidant capacities of the plants. Table 2 and Figure 1 displayed the findings of the in-vitro antioxidant activity.

Table 1: FTIR data of Syzygium cumini pulp and Catechol

S.N	Peak value	Functional Group	Bond
1	1619	Aromatic	C=C strech
2	1629	Aromatic	C=C strech
3	2358	Phosphine	P-H stretch
4	1629	Amines	C-N Strech
5	1078	Alekens	C-H-strech
6	1635	Cynognic	C-N strech
7	817	Alkenes	C-H strech

Table 2: IC_{50} value of in vitro assay

S.N	Method	IC_{50} values (µg/ml)*
1	*DPPH*	4.39±0.01
2.	ABTS Assay	25.76±0.01
3.	Alpha Glucosidase assay	32.896±0.005
4.	Alpha amylase assay	257.493±0.002
5.	Beta glucosidase	228.493±0.005

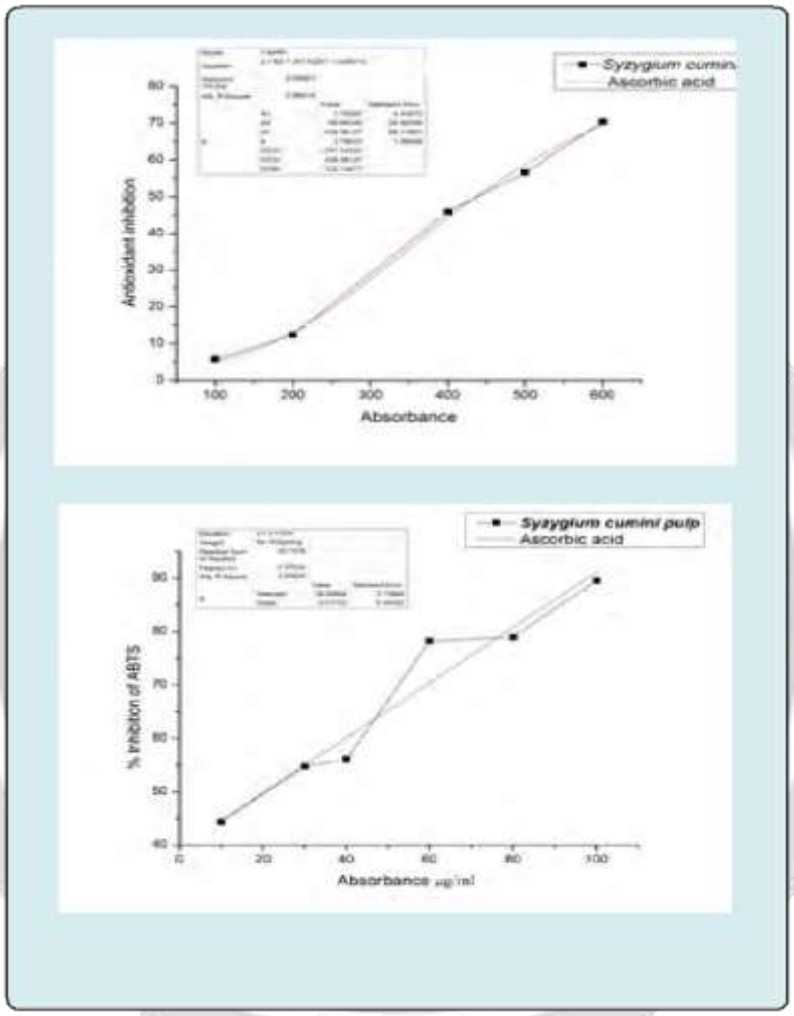

Figure 1: Syzygium cumini pulp in DPPH & ABTS radical scavenging assay equation

7. QUANTITATIVE ANALYSIS OF EXTRACTS

Antioxidant Activity (% DPPH inhibition)

The DPPH radical scavenging test was used to calculate the overall antioxidant activity of the ethanolic extracts. The DPPH test indicated that the antioxidant capacity of the Soxhlet, Microwave, and ultrasonicated extracts were, in order, 84.731.4, 94.031.6, and 95.830.50%. The ultrasonicated extract had the greatest DPPH inhibition (a measure of free radical scavenging ability) of any of the three methods tested. Margaret et al. (2015) assessed the antioxidant potency of several Syzygium cumini components, finding that a higher phenolic content is often associated with a higher level of activity (Linn.). They found that the total phenolic and flavonoid concentrations of the plant extracts were frequently responsible for the antioxidant activities observed. A connection between total phenolic content and antioxidant strength is seen in Figure 2. The data show that among the three extracts, UJE has the greatest Total phenolic content and the highest % DPPH inhibition. The overall phenol content of SJE is lower than that of the other varieties, making it the least antioxidant-active of

the bunch. For an extract to have a high percentage of DPPH inhibition, it must have a high total phenolic content, since phenolic chemicals are known to have antioxidant function (Table 3).

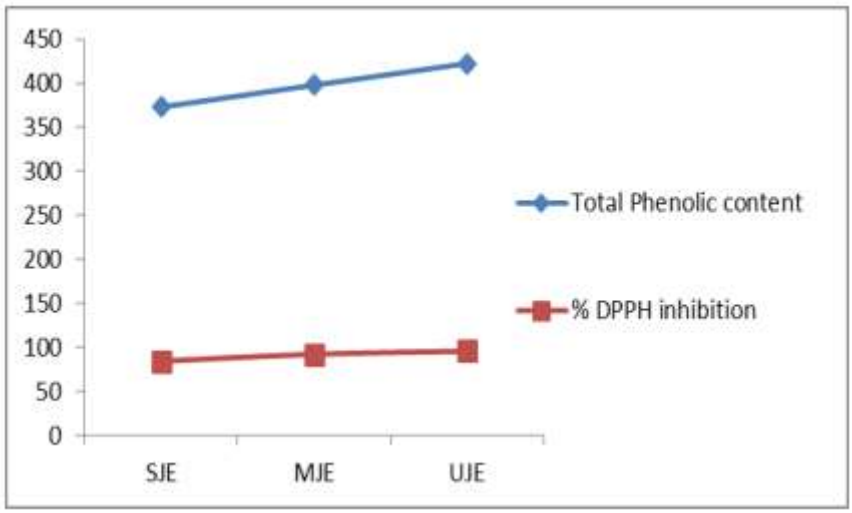

Fig 2: Total phenolic content and its correlation with DPPH inhibition

Table 3: DPPH Inhibition Percentage and Total Phenolic Content of Three Extracts

JSE	Total Phenolic content (mg of gallic acid equivalent /100mL of extract	% DPPH inhibition
SJE	376.28±6.11	84.73± 1.4
MJE	399.39±2.75	94.03±1.6
UJE	425.90±15.2	95.83± 0.50

8. CONCLUSION

For the treatment of a wide range of illnesses, several herbal medicines have been prescribed in medical texts. The Pongamia glabra tree serves several purposes and has great medical and commercial significance. It is important to continue developing Pongamia glabra as a powerful biofuel, and much more research is needed in the pharmacogenetic area. Books from India, such as Ayurveda, have long recommended herbs as a treatment for a variety of health problems. Antidiarrheal, astringent, digestive, antibacterial, antioxidant, and antiviral properties are only some of the other pharmacological activities shown by Syzygium cumini. The pulp of the S. cumini is rich in phytochemicals that provide the fruit with its antioxidant characteristics and may potentially have a role in diabetes management. Concentration-dependent and potentially significant DPPH radical scavenging activity was observed in methanolic extract of S. Cumini dried pulp. There are many different secondary metabolites in plants, and this is what gives them their therapeutic properties including anti-abortifacient, anti-inflammatory, antiviral, antibacterial, analgesic, and anti-oxidant properties.

9. REFERENCES

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