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To study anti-inflammatory and antioxidant effects of Syzygium cumini bark ethanolic extract in Wistar rats

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Abstract

Introduction: According to a UNESCO report from 1996, the use of both modern medicine and medicinal plants is crucial to the maintenance of health in the majority of developing countries. The widespread industrial use of medicinal plants can be traced back to the discovery and development of several drugs, as well as the extraction of chemotherapeutics from these plants and traditionally utilized rural herbal treatments.

Material and Methods: Syzygium cumini Linn. or Eugenia jambolan in this research, is a massive evergreen tree native to the tropics. Jamun is the botanical name for black plum, often known as jambolan, which is a common literary name for the fruit.

Results: Finding out how effective an antioxidant and anti-inflammatory a product derived from Syzygium cumini bark is will be the focus of this research. Carbohydrates, flavonoids, triterpenoids, phenols, glycosides, tannins, steroids, alkaloids, saponins, proteins, and amino acids were all found in EESC in a basic phytochemical analysis. All of the extract's phytoconstituents are included in the Table below.

Conclusion: The results of the investigation demonstrated the EESC's potent anti-inflammatory properties. This was demonstrated by a general lessening in the size of inflamed paws in histamine-induced inflammation models.

Keywords: Anti-inflammatory, antioxidant, syzygium cumini, ethanolic extract

INTRODUCTION

The term "medicinal plants" refers to a variety of plants used in herbalism, some of which have therapeutic properties. More than 3.3 billion people in the less developed countries regularly use medicinal herbs, which are regarded as the "backbone" of traditional medicine. A vast variety of environments on the Indian subcontinent support a very high diversity of plant species [1, 2]. There are almost 17,000 different plant species, of which 8,000 are said to have therapeutic properties in conventional medical systems like Ayurveda. These medicinal plants are regarded as a rich source of components for medication research and synthesis. Around the world, the development of human cultures is significantly influenced by plants. S. cumini, often known as the Black Plum or Indian Blackberry in English and by the Hindi names Jamun and Jambul, is a member of the Myrtaceae family. S. cumini is a hardy evergreen tree that can be found all over the Indian subcontinent, Southeast Asian nations, and eastern Africa [3-5]. S. cumini is used to treat diabetes and other ailments in India and other nations. Practitioners of traditional medicine have long been aware that this plant's many parts contain chemicals with medicinal potential. The plant's bark possesses helminthic, antibacterial, anti-hyperglycemic, carminative, and digestive effects. The fruits and seeds are used to treat a variety of illnesses, including ringworm infection, diabetes, pharyngitis, splenopathy, and urethrorrhea. Due to the leaves' antibacterial qualities, they are used to strengthen teeth and gums. Some of the ailments for which the leaves have been used include diabetes, constipation, leucorrhoea, fever, gastropathy, dermopathy, and the suppression of blood discharges in the faeces [6-8].

In most developing nations, the employment of modern medicine and medicinal plants serves as a foundation for the preservation of good health, as noted by UNESCO in 1996. Due to the creation of numerous medications and the extraction of chemotherapeutics from these plants as well as from conventionally used rural herbal cures, the usage of medicinal plants has expanded in industry. Traditional remedies have gained worldwide attention over the past ten years. According to recent estimates, a significant section of the population in many developing nations relies significantly on herbal remedies and traditional healers to address their primary healthcare needs. Although there may be access to modern medicine in some nations, herbal remedies frequently continue to be widely used for social, cultural, and historical reasons [9, 10].

In the majority of underdeveloped nations, medicines still count as health care since they are based on local customs and beliefs. The World Health Organisation (WHO) claims that

medicinal plants can significantly contribute to ensuring that all peoples worldwide will experience sustainable socioeconomic productive lives by the year 2000. Ayurveda, Unani, and Siddha are the three main branches of the indigenous medical system. These systems included three herbal formulas and a lot of raw components. Most traditional medicines come from plants and are used by 60% of people worldwide. The fruits of this family have a long history of usage as both consumables and traditional medicines in various ethnobotanical practises all throughout the tropical and subtropical world. Plants of this family are known to be rich in volatile oils that are reported for their uses in medicine. Around the world, tropics are planted with some of Syzygium's edible species [11-13]. The aim and the objectives of the study was to see how the ethanolic extract of Syzygium cumini bark works as an antioxidant and anti-inflammatory in Wistar rats.

Material and Methods

Plant profile

Plant introduction:

Eugenia jambolan is also known as Syzygium cumini Linn. is a very large, evergreen tropical tree that is a member of the Myrtaceae family. It is sometimes referred to in literature as Jamun, which is the botanical name for black plum or jambolan. The plant has long been valued for its medicinal virtues. India and the East Indies are the Syzygium's original habitats. This plant is also found in Thailand, the Philippines, and Madagascar. Extensive research has been done on Syzygium cumini plants to determine their pharmacological qualities. The presence of tannins, garlic acid, oxalic acid, and malic acid contributes to the therapeutic efficacy.

Plant description:

Figure 1: *Syzygium cumini*

Syzygium cumini

Table 1: Botanical illustration of *Syzygium cumini*

Sr. No.	Binomial Name	*Syzygium cumini*
1.	**Family**	Myrtaceae
2.	**Kingdom**	Plantae
3.	**Division**	Magnoliophyta
4.	**Class**	Magnoliopsida
5.	**Order**	Myrtales
6.	**Genus**	*Syzygium*
7.	**Species**	*Syzygium cumini*

Microscopic Features:

On the lowest portion of the trunk, the bark is cracked, flaked, discoloured, and rough; further up, it smoothes out and turns light grey. Oval, oblong, or elliptic leaves are 5–25 cm long and 2.5–10 cm broad. Flowers have joined petals and a funnel-shaped calyx, and they are fragrant and found in bunches.

History:

The tree is known to have grown for a significant amount of time over the period of recorded history on the Indian subcontinent and many other neighbouring regions of South Asia, including India, Bangladesh, Burma, Nepal, Pakistan, Sri Lanka, and Indonesia. The tree is revered by Buddhists in southern Asia, and because Lord Krishna considers it to be sacred, it is frequently planted next to Hindu temples. The plant has also been introduced to a variety of locations where it is used as an ornamental, a fruit producer, and for its wood. The plant can be found throughout India's plains all the way down to the southernmost tip of the country.

Active chemical constituents:

Compounds containing anthocyanins, glucoside, ellagic acid, isoquercetin, kaemferol, and myrecetin are abundant in jambolan. According to claims, the seeds contain the alkaloid jambosine and the glycoside jambolin, also known as antimellin, which prevents the diastatic conversion of starch into sugar. Java plums contain significant amounts of sugar, mineral salts, vitamin C, and PP, which strengthens the anti-inflammatory properties of vitamin C, anthocyanins, and flavonoids.

Medicinal properties:

The bark is used to treat ulcers, sore throats, coughing, asthma, thirst, diarrhoea, and biliousness. It also helps clean the blood. The fruit is sweet, sour, cooling, and astringent to the gut. It also gets rid of bad breath, is stomachic, astringent, helps with bile, makes you pee more, and fights diabetes. The fruit has been used as medicine for a very long time, and there is a big market for it now to treat severe diarrhea and other digestive problems. The ash from the leaves is used to make teeth and lips stronger. Vinegar made from the juice of ripe fruit is good for the stomach and relieves gas. It can also be used as a stimulant and to treat swollen spleens and chronic diarrhea. All parts of the plant, especially the leaves, seeds, stem bark, and flower buds, are used as medicine

Traditional uses:

All of the jambolan's parts can be used to make medicine. People from all over the world have used the fruits to treat coughs, diabetes, sickness, inflammation, and even ringworm.

It is found all over India, and Ayurvedic medicine, which is Indian folk medicine, says that it can be used to treat diabetes mellitus. Different parts of the plant are used by traditional healers in India to treat diabetes, mouth blisters, cancer, colic, diarrhoea, intestinal problems, dysentery, piles, pimples, and stomachaches. In the last 40 years, many articles have been written about how this plant has been used as a folk medicine to treat diabetes. In Unani medicine, different parts of jambolan are used to strengthen the liver, improve the blood, strengthen the teeth and gums, and make a good lotion for getting rid of a ringworm problem on the head.

Methodology

1. Choose the animal where animals live
2. A list of substances
3. A list of the tools used in the project
4. Looking into the chemicals in plants
5. In-vitro antioxidant studies.
6. Studies of short-term harm
7. The study of drugs
8. Testing for action against inflammation
9. The redness was caused by histamine

A look at the numbers

Selection of animal: For the study, albino female wistar rats weighing between 180 and

200 grammes were chosen.

Housing of the animals: The animals got used to the settings in the lab for a week. They were kept in polypropylene boxes and kept at 27°C + 2°C. Before the project work began, permission to use the animals was given by the institution's "ethical committee" for animals.

Table 2: List of chemicals used during experiment

Sl. No.	Chemicals
1	Acetic anhydride
2	Acetone
3	Alkaline reagent
4	Ammonia
5	Bardford's reagent
6	Benedict's reagent
7	Chloroform

Phytochemical investigation:

Collection: Ramasagara Village, Chandapura, Bangalore, is where the bark of Syzygium cumini was gathered.

Authentication: The bark of Syzygium cumini was verified by Dr. N. Karmegam, an assistant professor in the Botany Department at the Government Arts College in Salem. The twigs were dried in the shade. It was then ground into a coarse powder and stored in an airtight glass jar until it could be used again.

Extraction: In a soxhlet extractor, water was poured over the roughly ground barks of Syzygium cumini.

The extracts were concentrated in a rotating flash evaporator and kept in a desiccator until they were used again. The percentage yield of each extract was also figured out. The extract's colour and density were written down and summed up in table no. 6.

Preliminary Phytochemical Analysis of the Extract:

The information about the parts of the plant makes it clear how it can be used as medicine. Identifying and judging the quality of plant extracts is a basic step in the quality control process. A phytochemical study was done on the aqueous extract of Syzygium cumini bark to find out what kinds of plant parts were in the test samples and how much of each one was there. In phytochemical research, the following tests were done.

1. Qualitative chemical test
2. Estimate the total amount of phenol
1. Estimate the number of flavonoids

Qualitative chemical test:

The extract was put through qualitative chemistry tests to find out what kinds of secondary metabolites were in the aqueous extract of Syzygium cumini bark.

Preparation of test sample

Five millilitres of pure water were mixed with 500 mg of the extract, which was then filtered. The filtrate was tested to see if it had any of a number of phytochemical components.

A. Test for Alkaloids:

500 mg of the extract was mixed with 5ml of pure water and then filtered. Different phytochemicals were looked for in the liquid to see if they were there.

Dragendroff's Test:

Potassium bismuth iodide, which is Dragendroff's reagent, was added to the extract to make an orange-brown residue.

Mayer's Test:

When Mayer's solution (potassium mercuric iodide) is added to the extract, a creamy precipitate forms.

Hager's Test:

When Hager's reagent (a concentrated solution of picric acid) is added to the extract, it makes yellow precipitate.

B. Tests for Carbohydrates:-

Each extract was mixed with 5 ml of distilled water and then strained. The filtrates were used to find out if carbs were present.

Molisch's Test:

A few drops of concentrated H2SO4 were added to the sides of the test tube and mixed with an extract that had been treated with Molisch reagent (-naphthol in 95% ethanol). When a violet ring formed at the joint, it showed that carbohydrates were present.

Fehling's Test:

A small amount of the extract was treated with Fehling's reagent (Fehling's reagent A: copper sulphate in water and Fehling's reagent B: sodium potassium tartrate). The mixture was then cooked, and a brick-red colour showed that there were reducing sugars.

Barfoed's Test:

Copper sulphate in water (Barfoed's reagent) was used to treat the extracts. The mixture was then boiled in a water bath, and the red colour of the precipitate showed that sugars were present.

Benedict's test:

Extracts were treated with the Benedict reagent, which is a mixture of copper sulphate, sodium citrate, and sodium carbonate in water. The mixture was heated on a water bath for 10 minutes, and the red colour of the precipitate showed that sugars were present.

Test for Steroids, Triterpenoids and Cardiac glycosides:-

Liebermann-Buchard test:

A small amount of the extracts was mixed with 1ml of chloroform. Then, 1ml of acetic anhydride and 2ml of strong sulphuric acid were added from the sides of the test tube. When a dark violet colour forms, it means that steroids, cardiac glycosides, and triterpenoids are present.

Salkowski test:

When few drops of concentrated sulphuric acid was added to the test solution in chloroform shaken and allowed to stand for few minutes formation of red colour in the chloroform layer suggests the presence of steroids.

Keller Killani test:

Five milligrammes of extract were mixed with one millilitre of glacial acetic acid, and then a few drops of ferric chloride solution were added. Add 2 ml of concentrated sulphuric acid to this liquid, being careful to pour it along the sides of the test tubes. The presence of deoxy-sugar in the carbohydrates is shown by a dark brown colour at the seam of two layers and a bluish green colour on the top layer.

Baljet test:

A ml of the extract solution was mixed with a few drops of the sodium picrate reagent. Heart glycosides are found when the colour is yellow-orange.

Estimation of total phenolic content

Total phenolic content was measured using the standard Folin-Ciocalteu reagent method with tannic acid as a standard phenolic substance in the range of 100 g/ml to 1000 g/ml. One millilitre of extract was mixed with one millilitre of distilled water. Then, 250 millilitres of Folin-Ciocalteu solution were added. After mixing well, leave for 5 minutes at room temperature. 2.5 ml of an aqueous solution of sodium carbonate at a concentration of 7% was added, and the total amount was brought up to 6 ml with distilled water. 760 nm

was used to measure the absorption. The amount of phenolics is shown in words.

Estimation of total flavanoids content:

The aluminium chloride method was used to figure out flavonoids. Mix 0.5 ml of plant part extracts with 1.5 ml of 95% ethanol, 0.1 ml of 10% aluminium chloride, 0.1 ml of 1 M sodium potassium tartrate, and 2.8 ml of pure water. Let it sit at room temperature for 30 minutes. 415 nm was used to measure absorbance. The amount of flavonoids is given in words.

***In-vitro* antioxidant studies:**

Different ways are used to find out if a sample is an antioxidant. In this study, in vitro methods were used to find out how antioxidant the extract was. Based on the single antioxidant test method, it was not possible to say anything about the antioxidant qualities.

In practise, the antioxidant qualities of a sample are usually determined by running several in vitro tests. In this work, the DPPH and ABTS assays were used among other ways to get rid of free radicals.

DPPH

Principle:

Using the stable radical DPPH, the hydrogen-donating or radical-scavenging ability of the sample and the standard, L-Ascorbic Acid (Vitamin C), was determined.

Chemicals & Reagents:

- DPPH (Prepare 0.1mM in methanol, protect from light)
- Sample: Different concentrations of given sample diluted in warm distilled water(50-250 µg/ml)
- Ascorbic acid (50–250 µg/ml)

Method:

A 0.1mM DPPH solution in methanol was mixed with different amounts of sample (50–250 g/ml) and the reaction mixture was shaken hard. After 30 minutes of sitting at 27°C in the dark, spectrophotometry was used to measure the absorption at 517 nm. In the same concentration range as the test extract, ascorbic acid is used as a comparison. In the same way that the assay mixture was made, a control solution was made without the tested substance. The amount of decolorization shows how well the sample gets rid of free radicals. Ascorbic acid was used as a standard.

Calculations:

The percentage of blocking activity was found by multiplying [(A0-A1)/A0] by 100, where

A0 is the absorbance of the control and A1 is the absorbance of the extract/standard taken as ascorbic acid. All of the results are the mean standard error of the mean (SEM) of three separate experiments and are given as % DPPH radical scavenging activity.
Since these are coloured samples, only the OD of the coloured sample is needed to set the OD values.

ABTS Radical Scavenging assay

Principle:

Under dark conditions, when ammonium persulfate reacts with ABTS, the ABTS radical is made. The persulfate ions attack ABTS in a way that is called "nucleophilic," and this makes greenish-blue ABTS radicals (ABTS+). Which can be measured by spectrophotometry at 734 nm. Antioxidants in the sample, such as polyphenolics and flavonoids, will get rid of the ABTS radical that was made, causing the strength of the colour to go down.

Reagents:

- ABTS: Dissolve 5ml of ABTS and 5ml of 4.9 mM ammonium persulphate.
- Ammonium per sulphate (4.9mM): Dissolve 22mg of APS in 20ml of distilledwater.

Procedure:

Add 5 ml of a 4.9 mM APS solution to 5 ml of a 14 mM ABTS solution, and keep in the dark for 10 hours. This will make a fresh ABTS radical solution. The solution is diluted with pure water until the absorbance at 734 nm is 0.700.02, and the same solution is used for the test. Add 100 l of the extract (25-125 g/ml) to 900 l of the ABTS radical solution. Then, stir the mixture for 10 seconds. Using a spectrophotometer, measure the absorbance at 734nm against pure water six minutes later. Ascorbic acid was used as a standard.

Calculations:

The percentage of blocking activity was found by multiplying [(A0-A1)/A0] by 100, where A0 is the absorbance of the control and A1 is the absorbance of the extract/standard taken as ascorbic acid. All of the results are the mean standard error of the mean (SEM) of three separate experiments and are given as % ABTS radical scavenging activity.
Since these are coloured samples, only the OD of the coloured sample is needed to set the OD values.

Pharmacological study

Animals

Male Wistar rats that were 6 to 8 weeks old and weighed between 180 and 200 g were chosen for the study. All rats were kept in the same place with the same temperature (25 °C 5 °C), humidity (55 10 %), and light/dark cycle (12 h light/12 h dark). During the whole study, the animals were given commercial pellet food and drink as much as they wanted. Protocols for the study were accepted by the Institutional Animal Ethical Committee (IAEC) for Animal Care and were in line with guidelines from the Government of India's Committee for the Purpose of Control and Supervision of Experiments on Animals (CPCSEA).

Acute Toxicity Test

According to OECD-423 standards, a study of the effects of a single oral dose was done. The mice went without food and water for a full 24 hours. They were then split into four groups of three mice each and given the extract orally at doses of 5 mg/kg, 50 mg/kg, 300 mg/kg, and 2000 mg/kg body weight. They were watched for death, signs of poisoning like changes in behaviour, movement, and convulsions, and direct observation parameters like tremor, convulsion, salivation, diarrhoea, sleep, coma, changes in skin, fur, eyes, and mucous membranes, respiratory, circulatory, autonomic, and central nervous system (CNS), somatomotor activity, etc., every 30 minutes for the first 24 hours. And special care was given during the first four hours of each day for 14 days.

Screening of anti-inflammatory activity

Experimental method

Histamine-induced paw swelling in rats was used to test for anti-inflammatory action.

Histamine induced rat paw edema

Experimental design

Six Wistar white rats were put into each of four groups.

Table 3: Experimental design for histamine induced paw edema

GROUPS	TREATMENT
Group I	0.1 ml of freshly prepared histamine (0.1%)
Group II	Diclofenac (20 mg/kg), p.o
Group III	EESC (200 mg/kg), p.o
Group IV	EESC (400 mg/kg), p.o

Procedure

One hour after the drug treatment, 0.1 ml of newly made histamine (1%) in normal saline was injected under the plantar tissue of the right hind paw of rats. This caused inflammation. The volume of the paw was measured with a plythesmometer before and 1, 2, and 3 hours after the histamine shot. The following method was used to figure out the percentage inhibition (PI) of paw edoema;

Percentage of edema inhibition = (V_C - V_t/V_C) × 100

V_C = Mean edema volume in control

V_t = Mean edema volume in group treated with standard or extract

Results and Discussion

Extractive yield

Percentage Yield of EESC

With 95% ethanol, coarsely ground Syzygium cumini bark was recovered, and the w/w yield was found to be 22%.

Preliminary phytochemical analysis

Table 4: Preparation of calibration curve of Gallic acid

S. No.	Concentration (µg/ml)	Absorbance (Mean±SD) λmax 760 nm
1	0	0
2	25	0.249±0.012
3	50	0.544±0.016
4	75	0.799±0.020
5	100	0.987±0.024
6	125	1.170±0.015

The presence of phenolic compounds (TPC) is shown as mg/g of gallic acid equivalent of dry concentrate test. This is done by using a mathematical formula based on the calibration curve: Y = 0.0095X + 0.0305, R2 = 0.991, where Y is the absorbance and X is the Gallic acid equivalent (GAE).

In this study, 71.94 mg/g of gallic acid is equal to the amount of phenols in the Syzygium Cumini ethanolic bark concentrate.

Estimation of total flavonoid content of EESC

Table 5: Preparation of calibration curve of Quercetin

S. No.	Concentration (µg/ml)	Absorbance (Mean ± SD) λmax 420 nm
1.	0	0
2.	25	0.110±0.011
3.	50	0.189±0.020
4.	75	0.300±0.024
5.	100	0.401±0.011
6.	125	0.515±0.019

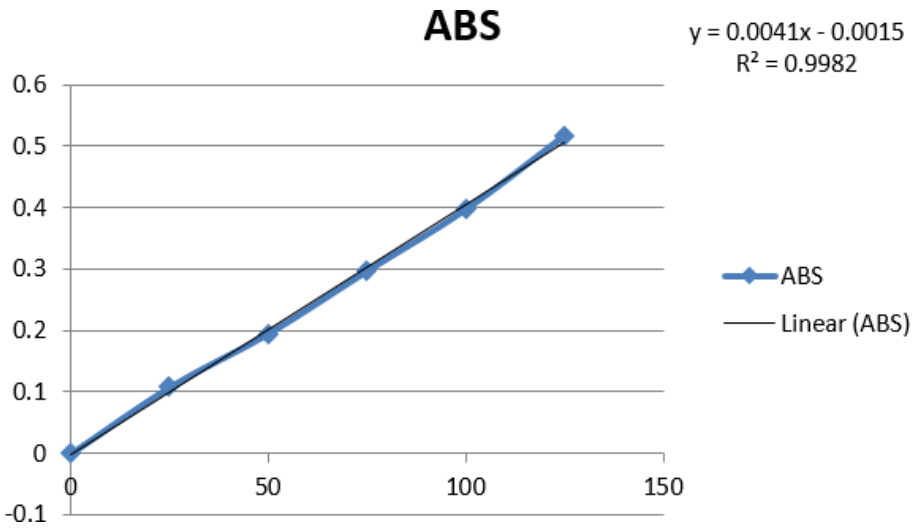

Figure 2: Calibration curve of Quercetin

Using the calibration curve, the absolute concentration of flavonoids was calculated as the quercetin proportionate (mg/g): Y=0.0041X-0.0015, R2=0.998, where Y is the absorption and X is the quercetin comparable (QE).

The finding shows that the Syzygium Cumini ethanolic bark concentrate shows 1.81 mg/g of flavonoids equal to quercetin.

In-vitro antioxidant study

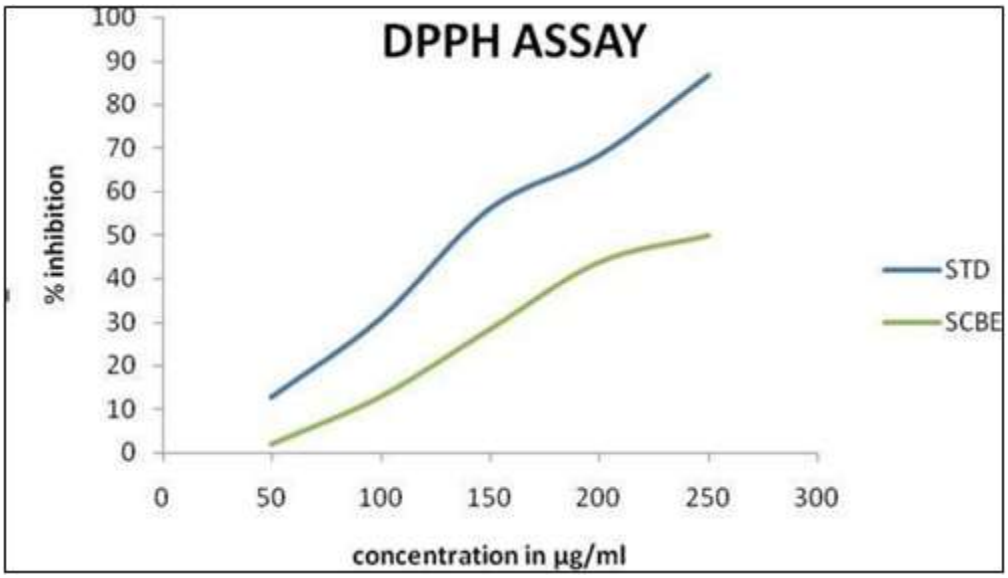

Figure 3: DPPH Assay

ABTS radical scavenging activity

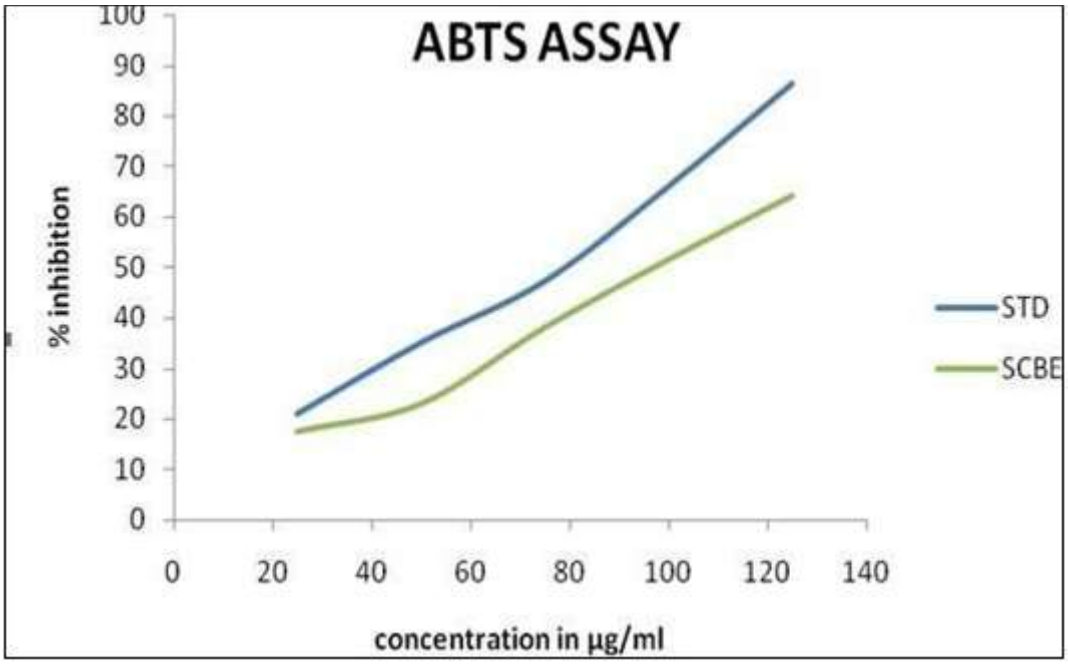

Figure 4: ABTS assay

Acute toxicity test

The EESC was used for the acute toxicity test at doses of 5 mg/kg, 50 mg/kg, 300 mg/kg, and 2000 mg/kg. The study was done in accordance with OECD standards 423. At a dose of

2000 mg/kg, it was seen that EESC did not kill rats. So, 200 mg/kg was chosen as the low dose for the study and 400 mg/kg was chosen as the high dose. The main points of the observations are shown in table:

Table 6: Acute toxicity study

Response	Group 1	Group 2	Group 3	Group 4
Alertness	Expected	Expected	Expected	Expected
Grooming	Expected	Expected	Expected	Expected
Touch response	Expected	Expected	Expected	Expected
Torch response	Expected	Expected	Expected	Expected
Pain response	Expected	Expected	Expected	Expected
Tremor	Expected	Expected	Expected	Expected
Convulsion	Expected	Expected	Expected	Expected
Lighting reflex	Expected	Expected	Expected	Expected
Gripping strength	Expected	Expected	Expected	Expected
Pinna reflex	Expected	Expected	Expected	Expected
Corneal reflex	Expected	Expected	Expected	Expected
Urination	Expected	Expected	Expected	Expected
Salivation	Expected	Expected	Expected	Expected
Skin color	Expected	Expected	Expected	Expected
Lacrimation	Expected	Expected	Expected	Expected
Diarrhoea	Expected	Expected	Expected	Expected

Histamine Induced Rat Paw Edema Method

Table 7: Effect of EESC on Histamine induced rat paw edema in rats

Group	Treatment and Dose	Mean edema volume(ml) and % inhibition			
		0 h	1 h	2 h	3 h
I	Histamine 0.1% (0.1 ml)	0.068±0.002	0.121±0.003	0.219±0.002	0.3200±0.003
II	Diclofenac(20 mg/kg)	0.069±0.003	0.062±0.0016*** (49.12%)	0.084±0.002*** (62.30%)	0.093±0.002*** (71.00%)

III	EESC (200 mg/kg)	0.064±0.003	0.100±0.006** (15.97%)	0.120±0.002*** (48.112%)	0.14±0.003*** (58.46%)
IV	EESC (400 mg/kg)	0.066±0.003	0.078±0.003*** (36.80%)	0.098±0.002*** (55.90%)	0.102±0.004*** (67.10%)

Values in brackets denote percentage inhibition of the edema paw volume.

Statistical comparison: Values show mean standard error of the mean (SEM), n=6, compared to control. Statistical analysis was done with one-way analysis of variance (ANOVA) and Dunnett's test. ***P0.001, **P0.01, *P0.05, and ns mean that they are not important.

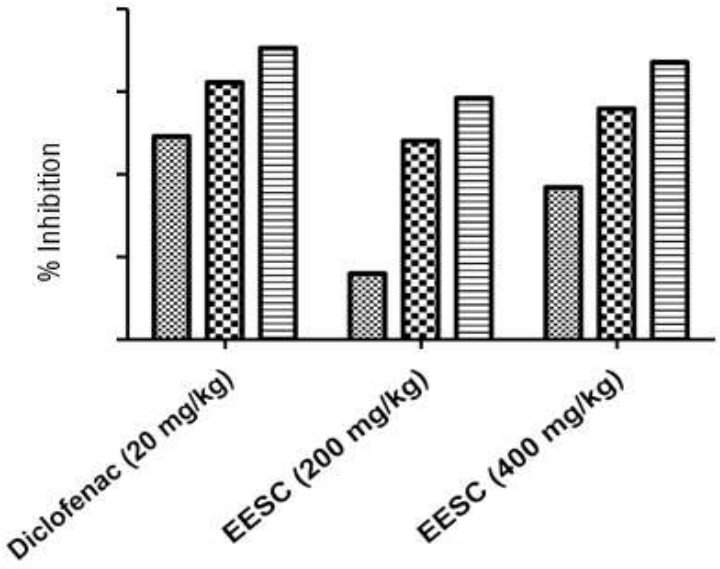

Figure 5: Anti-inflammatory effect of Diclofenac and EESC in histamine induced paw edema in rats

Statistical Analysis

Graph pad 5.0 software was used to do a one-way ANOVA followed by Tukey's multiple comparison test on the data. The numbers were given as Mean SEM.

DISCUSSION

The goal of the study is to find out how well a product of the bark of Syzygium cumini works as an antioxidant and anti-inflammatory. The basic phytochemical screening of EESC showed that it contains carbohydrates, flavonoids, triterpenoids, phenols, glycosides, tannins, steroids, alkaloids, saponins, proteins, and amino acids. In the Table, you can see all of the different phytoconstituents that are in the extract [14-16].

Phenolics and flavonoids normally get rid of free radicals and play a key role in the

prevention and treatment of PTL and many other diseases by activating the body's antioxidant defence system and drug-metabolizing enzymes, regulating different events at the cellular level, and stopping inflammation, hyperplasia, proliferation, and oxidative DNA damage. Polyphenolic substances, like quercetin, gallic acid, and rutin, are natural antioxidants that stop biomolecules that are needed for life from oxidising. Syzygium cumini bark extract was found to have 0.714 mg/g of Phenol, which is the same as gallic acid. As Quercetin equal, the total amount of flavonoids in EESC was found to be 0.0059 mg/g of extract [17-20].

Herbal drugs with radical scavengers are becoming more important for treating illnesses caused by oxidative stress. The action of the extract at different concentrations to get rid of DPPH radicals was compared to that of the standard quercetin. A higher antioxidant potential is shown by a smaller IC50 number. Both the standard extract and the test extract had IC50 values of 134.47 g/ml and 240 g/ml, respectively. When compared to the standard, the sample's higher IC50 numbers showed that it had less ability to get rid of free radicals [21-24].

The study showed that the extract's ability to donate hydrogen makes it a good candidate for getting rid of free radicals. The way the ABTS radical cation lost its colour showed how well the extract could give hydrogen atoms or electrons to get rid of the radical cation. The radical-scavenging activity of the standard was compared to that of the extract. The IC50 values for the standard and the extract were 44.495 g/ml and 97.928 g/ml, respectively [19].

In the histamine-induced rat paw edoema model, both amounts of extract (200 mg/kg and 400 mg/kg) stopped the swelling by 15.97% and 36.83% at 1 h, 48.1% and 55.89% at 2 h, and 58.46% and 69.09% at 3 h [25, 26]. It was seen that the extract could stop edoema caused by histamine. The ability of the extract to stop the production, release, or activity of histamine, which is involved in inflammation, may explain why the extract worked to stop edoema [27]. To make this traditional herbal remedy safer, more study is needed to find out what makes it stable and what makes it work. So, more research is needed to figure out how to separate and describe the active ingredients [28-30].

CONCLUSION

Syzygium cumini Linn is a well-known beneficial plant in the Ayurvedic system of medicine. It is in the family Myrtaceae. The goal of this study was to find out how anti-inflammatory and anti-oxidant ethanolic bark extract of Syzygium cumini works. EESC had a lot of antioxidant activity in the lab by stopping free radicals from doing their thing. Histamine-caused inflammation was used to test the extract's anti-inflammatory effects, and

Diclofenac (20 mg/kg) was used as the reference. So, the study showed that the EESC has significant (P0.05) anti-inflammatory activity. This was shown by a decrease in the average size of swollen paws in models of inflammation caused by histamine.

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Conflict of Interest

None

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