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Research Article

Phytochemical and antimicrobial potential of crude methanolic extract of fruits and fruit pulps of *Garcinia mangostana* Linn.

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Abstract

Aim: The main objective of this study was to conduct phytochemical screening and antimicrobial activity of fruits and fruit pulps of *Garcinia mangostana* Linn.

Methods: The preliminary phytochemical compounds were screened using different standard methods and anti-microbial activities of fruits and fruit pulps of *G. mangostana* Linn were evaluated against both organisms like bacteria and fungi using the disk - diffusion method.

Results: The results of the present study, preliminary phytochemical screening and identification of bioactive compounds in crude extracts of *Garcinia mangostana* Linn fruits and pulbs revealed the presence of phenols, flavonoids, glycosides, alkaloids, tannins and terpenoids and their ethanolic extract of fruits and pulps was observed that higher zone of inhibition active against *Escherichia coli* and *Candida albicans*. The conclusion of the present study suggests that the phenolic compounds of anthocyanins found in the fruits and pulp of *G. mangostana* contribute to antimicrobial activity.

Keywords: *Garcinia mangostana* Linn; fruits and pulps; antimicrobial activity;phytochemical compounds

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1. Introduction

Phytochemicals have become an intense focus of research interest because of their perceived beneficial effects for health, including anticarcinogenic, antiatherogenic, antiulcer, anti-thrombotic, anti-inflammatory, immunomodulating, antimicrobial, vasodilatory, and analgesic effects. Therefore, the search for exploitation of natural antioxidants, especially of plant origin, has greatly increased in recent years (Rao *et al*.,2014). *Garcinia mangostana Linn, belongs to the family Clusiacea/Guttiferae.* It is a tropical plant, and it is known as mangosteen. It originates from Southeast Asia. The literature review of this plant indicates that the fruit rind contains mangostins, which are popularly used in herbal cosmetics for anti-acne properties (Pothitirat et al., 2009). The plant is rich in xanthones and known to hold a wide range of naturally occurring polysaccharide (Bennett and Lee, 1989). Earlier report, active compounds of xanthone isolated from fruits of Garcinia species, which is good anti-inflammatory, antioxidant, anti-proliferative, anti-plasmodial and powerful antibacterial activity (Pedraza Chaverri *et al*., 2009). The present study was to evaluate the preliminary phytochemical screening and antimicrobial activities of *Garcinia mangostana* Linn, fruits.

2. Materials and Methods

2.1 Plant Collection

The plant materials of *Garcinia mangostana* Linn, was collected from Megamalai landscape in the Southern Western Ghats. Meghamalai located in the Western Ghats, Theni District of Tamilnadu, India.

2.2 Extraction

The fresh fruit were collected separately, washed with tap water, chopped into smaller pieces with a knife and then kept in the shade for 30 days to dry and then crushed using mortar and pestle, then further reduced to powder using an electric blender and then stored in airtight closed bottles until required. The powder materials were passed through sieve number 40 and used for further studies.

For the extraction, the plant materials were first ground into a fine powder using a grinding machine. The extraction of powder materials was a cold percolation method (Azwanida,2015). The powder materials were soaked in methanol for 24 h at room temperature for three successive days. Each day, the dissolved extracts were filtered through Whatman filter paper (No. 1), collected, and then evaporated at reduced pressure below 50 °C using a rotary evaporator. The working solution was prepared in 50% DMSO. The fruit extracts were maintained at 4 °C in the refrigerator until use (Farias et al.,2013). The percentage of yield extract was calculated by the following formula:

$$\text{Percentage of yield } (\%) = \left(\frac{\text{Dry weight of extract}}{\text{Dry weight of a plant}} \right) \times 100$$

2.3 Qualitative analysis of secondary phytochemicals

The phytochemical screening of the extracts was conducted using standard procedures described by Trease and Evans (1989).

The following qualitative tests were carried out: Extracts of fruits and pulps were evaluated for preliminary screening of secondary bioactive compounds such as alkaloids, quinones, coumarin, flavanoid, steroid, phenol and sugar/glycosides following the reported methods with minor modifications.

2.4. Antimicrobial activity

2.4.1 Tested microbial strains

Tested bacterial strains like *Bacillus subtilis, Escherichia coli, Klebsiella pneumonia, Salmonella thyphi* and fungal strains *Candida albicans* and *Aspergillus niger*.

2.4.2 The antibacterial properties

The antibacterial properties of various plant extracts were evaluated using a modified cup-plate method (Cappuccino and Natalie Sherman, 2009). To prepare the culture plates, 30 ml of Mueller Hinton Agar medium (MHA) was poured into sterile petri dishes. A uniform inoculum suspension was then spread across the agar surface with an L-spreader to ensure an even distribution of tested microorganisms. A flamed cork borer was employed to create wells measuring 6 mm in diameter, positioned 1-2 cm from the edge of the plates. Each plate was labelled, and 100µl of plant extract was aseptically introduced into the wells at varying concentrations of 100, 200, and 400µg/ml. The plates were subsequently incubated at 37°C for a period of 24 to 48 hours. The effectiveness of the extracts was assessed by measuring the diameter of the inhibition zones using an Antibiotic zone reader. The experiment was conducted in triplicate and repeated three times, with average values recorded. The results were then compared to the inhibition zones produced by a standard antibiotic disc, specifically Tetracycline (30µg/disc, Hi Media, Mumbai).

2.4.3 The antifungal properties

The antifungal properties of various plant extracts were evaluated using the cup-plate method as described by Cappuccino and Natalie Sherman (2009). To prepare the culture plates, 30 ml of Potato Dextrose Agar medium (PDA) was poured into sterile petri dishes. A uniform inoculum suspension was then spread across the agar surface with an L-spreader to ensure an even distribution of the microorganisms. Using a sterilized cork borer, wells measuring 6 mm in diameter were created in the agar, positioned 1-2 cm from the edge of the plates. Each plate was labelled, and 100 µl of each plant extract was aseptically introduced into the wells at varying concentrations of 100, 200 and 400µg/ml. The plates were subsequently incubated at 25°C for a period of 24 to 48 hours. The effectiveness of the extracts was assessed by measuring the diameter of the inhibition zones with an antibiotic zone reader. The experiment was conducted in triplicate and repeated three times, with average values recorded. The results were then compared to the inhibition zones produced by a standard antifungal disc, Fluconazole (10 µg/disc,).

3. Results and Discussion

3.1 Preliminary screening of phytochemicals

s demonstrate that extraction yield was achieved using anol, which recorded a yield of 7.5 (w/v). Qualitative assays to detect the existence of different classes of phytochemicals, such as phenolic compounds of flavonoids, phenol and Glycosides within ethanolic extracts of fruits and fruit pulps of *Garcinia mangostana* (Table-1). The phenolic compounds of flavonoids, phenol and glycosides were detected more amount while, terpenoids are moderated and alkaloids, saponin and tannin are in low quantity in fruit pulps.

In previous studies, Mahadeva Rao *et al*., (2016) reported that three extracts of methanol, ethanol and aqueous extracts of *Musa paradisiaca* were found to be phenols, glycosides, flavonoids, alkaloids, tannins and terpenoids and tested negative results for saponins. Fruit colour is an important marketing attribute of mangosteen, which is the attractive purplish-red of mangosteen is mainly due to anthocyanin (Du and Francis, 1977). Among them, the occurrence of anthraquinones is relatively rare, but other phytochemicals have homogeneous distributions in *Tapinanthus* species (Lu Wang,2022).

Table- 1: Preliminary phytochemical screening of crude methanolic extract of *Garcinia mangostana* fruits

Sl.no.	Bioactive compounds	Presence/ Absent
1	Alkaloids	+
2	Terpenoids	++
3	Flavonoids	+++
4	Glycosides	++
5	Phenols	+++
6	Saponin	+
7	Tannins	+

(+) indicates the present (-) absent.

Antimicrobial Activity

Medicinal plants have demonstrated that antimicrobial properties attributed to a range of phytochemicals, including alkaloids, flavonoids, and tannins, which are capable of suppressing the proliferation of bacteria, fungi, and other microorganisms (Vaou *et al*.,2021). The present study observed that the results of the ethanolic extract of *Garcinia mangostana* fruits are active against all tested bacteria and fungi represented in table -2.

The results of this study showed that increasing the concentration of fruit extracts which inhibited the bacteria and fungus has also been increased. The maximum activity of zone of inhibition of this fruit extract was active against *Escherichia coli* (19.6mm). Similar results of observed that ethanolic extracts of pomegranate (*Punica granatum*) are effective against *E. coli* (Ashraf et al.,2018). Ethanolic extracts derived from clove and rosemary exhibit notable antimicrobial properties against E. *coli*, (Vaou et al. 2021). Similar studies observed that several species of *Peganum harmala, Echinophora platyloba, Rosmarinus officinalis* and *Heracleum persicum* showed good antifungal activity (Somayeh Jahani *et al*., 2017). Earlier studies according to Ali *et al*.,(2011) reported that water extract of *Syzygium aromaticum* L. (Myrtaceae) buds, methanol extracts of *Ficus carica* L. (Moraceae) and *Olea europaea* L. (Oleaceae) leaves and *Peganum harmala* L. (Nitrariaceae) seeds and *S. aromaticum* maximum inhibited growth of *Staphylococcus aureus, Salmonella typhi, Pseudomonas aeruginosa* and *Candida albicans*. Saravanan *et al*., (2011) reported that ethanolic extracts of *Calophyllum inophyllum* have potential beneficial properties. According to Benkeblia, (2004) reported that organic solvent extracts displayed enhanced antimicrobial activity. Okemo, (1996) reported that alcoholic extracts are known to contain alkaloids, coumarins, and tannins and coumarins and tannins possess antibacterial and antihelminthic properties. Hedberg *et al*., (1983) have shown that alcohol is more effective than ethyl acetate and acetone in extracting phytochemicals from plant sources (Eloff, 1998; Cowan, 1999). The conclusion of the present study may be acted as phenolic compounds of anthocyanins found to be fruits and pulps of *G. mangostana* contribute to the antimicrobial activity. Further studies, isolation, and identification of the active compounds from the potential plants of *G. mangostana* are being conducted in our laboratory.

Table-3: Antibacterial activity of ethanolic extract of fruits and fruit pulbs of *Garcinia mangostana*

Sl.No.	**Tested Concentration mg/ml-1**	**Zone of inhibition in diameter (mm)**							
		Gram-positive Bacillus subtilis	Gram-Negative Salmonella typhi	Gram-negative Pseudomonas aeruginosa	Gram-positive Staphylococcus aureus	Gram-negative Escherichia coli	Gram-negative Vibrio cholerae	Fungi Candida albicans	Aspergillus niger
1	100	12.3±1.33	15.33±0.9	15.6±1.33	14.00±0.66	16.33±0.9	16.6±0.7	11.33±0.6	15.6±0.9
2	200	14.6±0.88	16.3±1.33	16.3±0.71	15.33±1.33	18.08±1.33	17.33±0.7	15.08±0.6	16.33±0.9
3	400	15.3±1.33	17.6±1.33	18.6±0.66	17.6±0.99	19.6±0.9	18.6±0.6	18.06±1.3	17.08±1.3
4	Std	16.33±0.9	18.6±0.88	17.33±1.33	18.6± 0.66	17.08±0.66	19.33±1.33	17.6±0.8	15.33±0.9

SD± SE Values are expressed as triplicates

Ethics approval and consent to participate
Ethics approval and consent to participate are not relevant in this case, as our research did not involve animals or human subjects.

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Conflicts of interest
There are no existing conflicts of interest.

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