PHYTOCHEMICAL AND ANTIMICROBIAL STUDIES ON GARCINIA LATTISSIMA MIQ. FRUIT EXTRACT

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ABSTRACT

Objective: The present investigation was aimed to explore the phytoconstituents present in the fruit part of Garcinia lattissima Miq. and their antimicrobial efficacy.

Methods: The preliminary phytochemical constituents were qualitatively analyzed using the standard procedures described in Materia Medica Indonesia. Antimicrobial screening was performed using disc diffusion and dilution methods.

Results: Phytochemical screening of different extracts of G. lattissima Miq. fruits revealed the presence of tannins, saponins, flavonoids, and alkaloids, and the results are shown in Table 1. The ethyl acetate and methanolic extracts of G. lattissima Miq. fruits showed antimicrobial activity, and the n-hexane extract failed to prove the inhibition against the selected pathogens.

Conclusion: The results of the phytochemical and bio-efficacy study revealed most valuable information and also support the continued sustainable use of G. lattissima Miq. fruits in the traditional system of medicine.

Keywords: Garcinia lattissima Miq., Antimicrobial, Phytochemical, Tannins, Saponins, Flavonoids, Alkaloids.

INTRODUCTION

This study proposed the existence of active phytochemical compounds and to explore the antimicrobial activity in different solvents of Garcinia lattissima Miq. fruit extract.

Plants as living chemical factories provide a vast number of important chemical substances that display a variety of biological actions. About 35,000 (some estimate up to 70,000) plant species are used worldwide for medicinal purposes. Researchers have investigated <0.5% of these for their phytochemical and pharmacological potentials. More latterly there has been a recovery of attracting in the medicinal possibilities of therapeutic trees as antimicrobials. Also, others species have been researched to be antimicrobials potential of plant species [1]. The Chusiaeeae or Guttiferae family contains 27 genera and 1,090 species, mostly restricted to lowland tropics [2]. Of which, Garcinia genus includes about 400 species of evergreen trees or shrubs, occurring from West Africa across tropical Asia to the Fiji Island [3], and most of these contain xanthones [2].

Garcinia lattissima Miq. commonly known as Dolomagota (Maluku, Indonesia) and the gland of the plant used as cure wound [4]. G. lattissima Miq. is distributed in East Sepik, East Highland, West Sepik, Southern Highlands, Western Highlands, Madang, Western Morobe, Milne Bay, Central Gulf, Britain, and Papua Islands [5]. In Indonesia, G. lattissima Miq. grows in Seram Island, Maluku, and in Papua, but it has been cultivated in the Bogor Botanic Gardens [6]. Constituents of the stem bark ethanol extract of G. lattissima Miq. gathered in Papua New Guinea Central Province were latissxanthone-A, latissxanthone-B, latissxanthone-C, and latissxanthone-D [7]. Latissxanthone is classified as pyranoxanthone. The G. lattissima Miq. stem bark ethanol extract collected in Papua New Guinea Central Province showed good antibacterial activity (inhibition zone was 8-12 mm) against Staphylococcus aureus and Bacillus subtilis (Gram-positive bacteria) and moderate activity (inhibition zone was 4-7 mm) against Escherichia coli [8]. With this knowledge, the present investigation deals with the phytochemical analysis and antimicrobial efficacy of G. lattissima Miq.

MATERIALS AND METHODS

Plant collection and extraction
G. lattissima Miq. fruits were collected and identified from the Center for Plant Conservation Bogor Botanical Gardens, Indonesian Institute of Sciences (LIPI), West Java, Indonesia. The sliced fruits were shade-dried at room temperature and powdered coarsely using a mechanical homogenizer. Powdered plant material was extracted by multilevel maceration using various solvents such as n-hexane, ethyl acetate, and methanolic in a row. The filtrate of the extracts was evaporated to dryness under reduced pressure using a rotary evaporator. The extraction yields were collected, weighted, and stored at 4°C before use [1]. The extraction yield can be calculated by

\[ \text{extraction yield} = \frac{\text{dry weight of extract}}{\text{dry weight of plant powder}} \times 100 \] [9]

Phytochemical and antimicrobial activities

The qualitatively analyzed phytochemical constituents used in the standard procedures were described by Fransworth and methods from Materia Medica Indonesia Volume VI [10-11]. Antimicrobial screening was performed by disc diffusion method [12]. Two Gram-positive bacteria (B. subtilis ATCC 6633 and S. aureus ATCC 25923), two Gram-negative bacteria (Pseudomonas aeruginosa ATCC 27853 and E. coli ATCC 25922), and two fungi (Candida albicans and Trichophyton mentagrophytes). The zone of inhibition against the selected pathogens was determined and recorded. The standard antibiotics used as positive control were gentamycin for S. aureus, erythromycin for B. subtilis, ciprofloxacin for P. aeruginosa, and amoxicillin for E. coli. The first step of the zone of
inhibition used crude extracts (100%) [13]. The positive results from that did the area of inhibition with 2% extracts in DMSO. These methods were in triplicate. The assay of minimum inhibitory concentration (MIC) and minimum bactericidal concentration (MBC) performed for extracts gave a zone of inhibition of 2% extracts. To determine the MIC test used the broth dilution method, and to determine the minimum bactericidal assay by plating out onto each appropriate agar plate [14].

RESULTS AND DISCUSSION

Fruits from G. lattissima Miq. for this research are shown in Fig. 1.

The results of extraction yields from G. lattissima Miq. fruits are shown in Table 2.

The screening of phytochemical for different extracts of G. lattissima Miq. fruits revealed the existence of different chemical compounds of tannins, saponins, flavonoids, and alkaloids, and Table 1 represents the results. Flavonoids and alkaloids (using Dragendorff’s and Bouchardat’s reagents) were present in ethyl acetate extracts of G. lattissima Miq. The methanolic extracts of G. lattissima Miq. demonstrated the presence of tannins and flavonoids. The n-hexane excerpts from G. lattissima Miq. illustrated the presence of saponins only.

The antimicrobial efficacy from n-hexane, methanolic, and ethyl acetate extracts (100%) of G. lattissima Miq. from this research are shown in Table 3. The inhibition zone diameters ≥ 10 mm were shown by the G. lattissima Miq. fruits’ ethyl acetate extracts opposed to P. aeruginosa and B. subtilis and the methanolic extracts of G. lattissima Miq. fruits opposed to S. aureus, P. aeruginosa, and B. subtilis. The n-hexane extracts of G. lattissima Miq. fruits against B. subtilis and the ethyl acetate extracts of G. lattissima Miq. fruits opposed to E. coli and S. aureus showed inhibition area diameter <10 mm. Methanolic extracts of G. lattissima Miq. fruits against E. coli, C. albicans, and T. mentagrophytes were resistant to all the extracts.

Table 4 shows the results of the antibacterial activities of 2% G. lattissima Miq. fruits’ extracts in DMSO. The antibacterial activity has been observed only in the G. lattissima Miq. fruits’ ethyl acetate and methanolic extracts against the selected bacterial assay. The n-hexane extracts were unsuccessful to give the inhibition against the bacterial assay. This research used the positive control with commercially available standard antibiotic disc (erythromycin for B. subtilis, gentamycin for S. aureus, and ciprofloxacin for P. aeruginosa).

The conventional medicine showed positive results against all the tested bacteria. The ethyl acetate extracts (2%) of G. lattissima Miq. fruits showed the maximum zone of inhibition against P. aeruginosa (9.82±0.978 mm) and then B. subtilis (9.62±0.431 mm). The methanolic extracts (2%) of G. lattissima Miq. fruits showed the highest zone of inhibition against S. aureus (9.97±0.448 mm) and then B. subtilis (9.53±0.416 mm) and P. aeruginosa (9.22±0.506 mm).

Table 5 shows the results of dilution assay of extracts’ antimicrobial activities. The results show that MIC and MBC of the methanolic extracts of G. lattissima Miq. fruits against E. coli, C. albicans, and T. mentagrophytes were similar.

### Table 1. Phytochemical screening of G. lattissima Miq. fruits

| Tests      | Reagents used       | n-hexane extracts | Ethyl acetate extracts | Methanolic extracts |
|------------|---------------------|-------------------|------------------------|---------------------|
| Tannins    | Acidic FeCl₃        | -                 | -                      | +                   |
| Saponins   | Gelatin             | -                 | -                      | +                   |
| Flavonoids | Frothing test       | +                 | +                      | -                   |
| Anthraquinones | Borntrager’s’s    | -                 | -                      | -                   |
| Terpenoids | H₂SO₄               | -                 | -                      | -                   |
| Alkaloids  | Dragendorff’s’s     | -                 | -                      | -                   |
|            | Mayer’s’s           | -                 | -                      | -                   |
|            | Bouchardat’s’s      | -                 | -                      | -                   |

### Table 2: The average of extraction yields from the result of multilevel maceration extraction from G. lattissima Miq. fruits

| Solvents | Yield (%) | Average (%)   |
|----------|-----------|---------------|
| n-hexane | 9.010     | 8.909±0.4123  |
|          | 9.262     |               |
|          | 8.456     |               |
| Ethyl acetate | 2.414 | 2.764±0.7217 |
|          | 2.284     |               |
|          | 3.594     |               |
| Methanol | 18.520    | 16.56±1.9201  |
|          | 14.682    |               |
|          | 16.490    |               |

### Table 3: Antibacterial ability of G. lattissima Miq. fruits’ extracts (100%)

| Organisms      | Zone of inhibition (mm) | Methanolic | Ethyl acetate | n-hexane |
|----------------|-------------------------|------------|---------------|----------|
| B. subtilis    | ++                      | ++         | +             |
| S. aureus      | ++                      | ++         | -             |
| P. aeruginosa  | ++                      | ++         | -             |
| E. coli        | +                       | +          | -             |
| C. albicans    | -                       | -          | -             |
| T. mentagrophytes | -                  | -          | -             |

++: Inhibition zone diameter ≥10 mm, +: Inhibition zone diameter <10 mm, -: No inhibition zone.

Fig. 1. Fruits of Garcinia lattissima Miq.
Table 4: Antibacterial activities from 2% *G. lattissima* Miq. fruits’ extracts in DMSO using agar diffusion method

| Bacteria   | The mean±SD of diameter of inhibition zone (mm) | n-hexane | Ethyl acetate | Methanolic | Antibiotic standard |
|------------|-----------------------------------------------|----------|---------------|------------|---------------------|
|            |                                               | 0        | 9.62±0.431    | 9.53±0.416 | 21.08±1.928         |
| *B. subtilis* |                                              | 0        | 9.97±0.448    | 9.52±0.448 | 23.70±1.928         |
| *S. aureus*  |                                              | 0        | 9.82±0.978    | 8.22±0.506 | 21.08±0.511         |
| *P. aeruginosa* |                                           | 0        |               |            |                     |

Antibiotic standard: Erythromycin 15 μg for *B. subtilis*, gentamycin 10 μg for *S. aureus*, ciprofloxacin 5 μg for *P. aeruginosa*, *G. lattissima*: Garcinia lattissima, *B. subtilis*: Bacillus subtilis, *S. aureus*: Staphylococcus aureus, *P. aeruginosa*: Pseudomonas aeruginosa, DMSO: Dimethyl sulfoxide

Table 5: MBC and MIC from the *G. lattissima* Miq. fruits’ methanolic and ethyl acetate extracts (in ppm)

| Solvents          | *B. subtilis* | *S. aureus* | *P. aeruginosa* |
|-------------------|---------------|-------------|-----------------|
|                   | MIC          | MBC         | MIC            | MBC         | MIC           | MBC           |
| Ethyl acetate     | 2500         | 5000        | -              | -           | 5000          | 5000          |
| Methanolic        | 1250         | 5000        | 5000           | 10000       | 2500          | 2500          |

Table 6: Comparison of the antimicrobial activity of *G. lattissima* Miq. fruits’ methanolic and ethyl acetate extracts with some common antibiotics.

Table 7: MIC and MBC of different phytochemical extracts from the leaves of *G. lattissima* Miq.

extracts consist of saponins only. The antimicrobial activity showed that the methanolic extracts of *G. lattissima* Miq. fruits had the best result than the others.

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