Potential of Harum Manis Mango (Mangifera Indica L.) Seed Extract for Nosocomial Infections

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Article history
Received 3 January 2023
Revised 2 May 2023
Accepted 11 May 2023

Nosocomial infections occur in hospitals and attack patients who are in the recovery process and have low immunity. The emergence of nosocomial conditions in the hospital environment is caused by bacteria and moist objects or materials, especially in the operating room and even the treatment room for children and babies. One type of bacteria that causes the infection is Pseudomonas aeruginosa. P. aeruginosa has been recognized as an irreversible problem in hospitals due to resistance to 3 antibiotic classes. The content of sweet mango seeds has a high phytochemical content in the form of steroid compounds, terpenoids, flavonoids, alkaloids, phenolics, tannins and saponins. This study aimed to determine the potential of sweet mango seed extract against nosocomial infections. The research method is quantitative experimental, using ethanol extract of sweet fragrant mango seeds with well diffusion and dilution tests (MIC and MBC). The results of the antibacterial activity test measured the inhibition zone formed and tested MIC and MBC. MIC value of sweet fragrant mango seed extract showed at 1.56 mg/mL and 0.78, and at MBC value of 25 mg/mL and 50 mg/mL. The results of sweet fragrant mango seed extract have the potential to be developed as an antibacterial agent, especially against nosocomial infections.

Keywords
Harum Manis Mango
Health Science
Nosocomial Infections
Seed Extract

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Introduction

Environmental infections that exist in hospitals are preventable. The emergence of nosocomial infections in the hospital environment is caused by bacteria and moist objects or materials, especially in the operating room and even the child and baby care room. The type of bacteria that causes the infection is Pseudomonas aeruginosa [1]. People infected with nosocomial infections have not been found when new patients enter the hospital but during treatment for approximately 72 hours. Nosocomial infections or Healthcare associated infections (HAIs). Hospitals are risky places as a source of infection with many microorganisms [2].

Nosocomial infections are defined as infections that occur in hospitals and affect patients who are recovering and have low immunity. According to WHO, in 55 hospitals from 14 countries representing 4 WHO working areas (Europe, Mediterranean, Southeast Asia, and Western Pacific), patients in hospitals experience nosocomial infections with an average of 8.7%. In contrast, the highest frequency based on reports occurs in Southeast Asia, with a prevalence of 11% [3].

Pseudomonas aeruginosa (P. aeruginosa) is a class of obligate aerobic gram-negative bacteria that adapt to low oxygen and nutrient conditions. P. aeruginosa can live on hospital equipment, so patients with low immunity are easily infected [4]. P. aeruginosa has been recognized as an irreversible problem in hospitals due to resistance to 3 antibiotic classes [5]. The beginning cause of antibiotic-resistant bacteria is using antibiotics consumed inappropriately or not according to the doctor’s prescription [6].

Antibiotic resistance occurs when excessive use of antibiotics so that bacteria do not respond to drugs to kill them. The occurrence of antibiotic resistance causes a decrease in the ability of antibiotics to treat infections and diseases in humans [7]. Natural ingredients are needed to overcome resistant bacteria. Many plants are used as traditional medicine, especially in treating infectious diseases caused by bacteria, such as the sweet fragrant Mango (Mangifera indica L.).

Sweet mango seeds ((Mangifera indica L.) are a fruit that is almost in all provinces and has the advantage of its distinctive flavour. Mango seeds have a bitter and astringent taste with 70% carbohydrates, 10% fat, and 6% protein. The content of sweet mango seeds has a high phytochemical content in the form of steroid compounds, terpenoids, flavonoids, alkaloids, phenolics, tannins and saponins [8], [9].

From the background description above, no research has been conducted on the ability of sweet fragrant mango fruit seeds to inhibit the growth of P.aeruginosa, so the authors are interested in researching the potential of sweet fragrant mango seed extract against MDR nosocomial infections.
Methods

The samples used in this study were ripe or old mango fruit seeds (Mangifera indica L.) obtained from Bulutanah village, Kajuara sub-district, Bone district, Makassar, South Sulawesi, Indonesia. And the bacteria used in this study are pure cultures of Multidrug-Resistant (MDR) P. aeruginosa whose samples are from nosocomial infection patients obtained from Telegorejo Hospital and isolation of the Health Analyst Microbiology Laboratory, Faculty of Nursing and Health Sciences, University of Muhammadiyah Semarang.

Extraction of sweet fragrant mango fruit seeds (Mangifera indica L.) was performed using the maceration method using 96% ethanol solvent and then evaporated to remove the solvent in the extract. Sweet fragrant mango fruit seeds (Mangifera indica L.) were concentrated, so the sample was obtained in paste form. The thick extract obtained was weighed 1000 mg and dissolved into DMSO as much as 1 mL, then diluted into concentration variations of 0.1; 1; 10; 100 mg/mL. The ethanol extract of sweet mango fruit seeds (Mangifera indica L.) was then tested for antibiotic activity in inhibiting the growth of Multidrug-Resistant (MDR) bacteria P. aeruginosa.

Results

The results of the average value of the diameter of the inhibition zone of the Potential of Sweet Harum Mango Seed Extract (Mangifera indica L.) against nosocomial infections are indicated by the presence of clear zones around the wells determined by measuring the diameter of the inhibition zone after incubation at 37°C for 24 hours. The inhibition zone formed was then measured using a calliper, and the results of the inhibition zone diameter are shown in Table 1. Tabel 2 shows results of MIC and MBC tests of applied seed ethanol extract against MDR P. aeruginosa.

Table 1. Mean values of inhibition zone diameter of tarra seed ethanol

<table>
<thead>
<tr>
<th>Concentration</th>
<th>Zone Diameter (mm)</th>
<th>PA 15A</th>
<th>PA19A</th>
<th>PA19</th>
<th>PA 20E</th>
<th>PA ATCC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Extract of tarra seed (A.elasticus)</td>
<td>0.1 mg/mL</td>
<td>7±0</td>
<td>7±0</td>
<td>6±0</td>
<td>7±0</td>
<td>10.5±0.5</td>
</tr>
<tr>
<td></td>
<td>1 mg/mL</td>
<td>11±0</td>
<td>12±0</td>
<td>11±0</td>
<td>12±0</td>
<td>14.75±0.4</td>
</tr>
<tr>
<td></td>
<td>10 mg/mL</td>
<td>26±0</td>
<td>18±0</td>
<td>18±0</td>
<td>18±0</td>
<td>19.5±0.5</td>
</tr>
<tr>
<td></td>
<td>100 mg/mL</td>
<td>22.75±0</td>
<td>21.75±0.4</td>
<td>23.5±0.5</td>
<td>23.5±0.5</td>
<td>24±0.5</td>
</tr>
<tr>
<td>Ampecilin 10 µg</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Ceftazidine 30 µg</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Tigencycline 15 µg</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Nitrofurantoin 300 µg</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Trimethoprim 25 µg</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Gentamicin 10 µg</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td></td>
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<tr>
<td>Aztreonam 30 µg</td>
<td>10</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Ciproloxaxin 5 µg</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Meropenem 10 µg</td>
<td>7</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
</tbody>
</table>
Table 2. Results of MIC and MBC tests of applied seed ethanol extract

<table>
<thead>
<tr>
<th>Kode Bakteri</th>
<th>MIC (mg/mL)</th>
<th>MBC (mg/mL)</th>
</tr>
</thead>
<tbody>
<tr>
<td>PA 15A</td>
<td>0.75</td>
<td>25</td>
</tr>
<tr>
<td>PA 19A</td>
<td>1.56</td>
<td>25</td>
</tr>
<tr>
<td>PA 19</td>
<td>1.56</td>
<td>50</td>
</tr>
<tr>
<td>PA 20E</td>
<td>1.56</td>
<td>50</td>
</tr>
<tr>
<td>PA ATCC</td>
<td>1.56</td>
<td>25</td>
</tr>
</tbody>
</table>

Discussion

This study aimed to know the potential of sweet fragrant mango seed extract (Mangifera indica L.) against nosocomial infections. This research begins with the extraction of sweet aromatic mango seed kernel (Mangifera indica L.) using the maceration method with 96% ethanol solvent, then evaporated to remove the solvent in the extract. The sweet fragrant mango seed kernel (Mangifera indica L.) is concentrated, so the sample is in paste form. The results of the calculation of the extract yield obtained are 22%, which can be calculated based on the ratio of the weight of the extract produced to the initial weight of the simplisia, then multiplied by 100%. The extraction results obtained were then weighed 1000 mg/mL and made concentration variations of 0.1; 1; 10; 100 mg/mL, then each was added with 1 mL of DMSO (Dimethyl Sulfoxide).

The results of the MIC test of ethanol extract of sweet mango seed core against Multidrug Resistant (MDR) Pseudomonas aeruginosa were indicated by the presence of a clear zone around the well. It was determined by measuring the diameter of the inhibition zone after incubation at 37°C for 24 hours at a concentration of 0.1; 1; 10; 100 mg/mL, respectively. The average inhibition zone on PA 15A was 7±0 to 7±0 on the code on PA 19A code was 7±0 to 21.75±0.4, PA 19 was 6±0; to 23.5±0.5 PA 20E was 7±0 to 23.5±0.5 and PA ATCC code was 10.5±0.5 to 24±0.5. The results of the diameter of the inhibition zone of sweet fragrant mango seed extract (Mangifera indica L.) against the obtained zone differ for each sample, but the higher the sample concentration, the higher the inhibition zone results.

The results of the MIC test of ethanol extract of sweet mango seed core against MDR P. aeruginosa showed that the extract could inhibit bacterial growth in the lowest code A. It was in the 7th well with a concentration of 0.78 mg/mL in codes B, C, D and E, respectively. The lowest concentration inhibited bacterial growth in the 6th well with a concentration of 1.56 mg/mL. MIC (Minimum Bactericidal Concentration) is the determination of the minimum concentration of antibiotics that can kill bacteria characterized by the absence of bacterial colony growth on Blood Agar Plate (BAP) media.

The results of the MBC test of ethanol extract of sweet mango seed kernel (Mangifera indica L.) against MDR P. aeruginosa showed that the extract could kill MDR P. aeruginosa
bacteria. The absence of bacterial colonies on BAP media in bacterial code PA 15 characterized it. A with the most negligible concentration of 25 mg/mL in bacterial code PA 19.A; PA 19; and PA 20.E had the most insignificant concentration of 50 mg/mL, while in bacterial code PA ATCC had a minimum kill concentration of 25 mg/mL.

A phytochemical screening test was conducted to determine the content of antimicrobial compounds in the ethanol extract of the sweet mango seed core (Mangifera indica L). Phytochemical tests on steroid compounds, terpenoids, flavonoids, alkaloids, phenolics, tannins and saponins contained in sweet fragrant mango seed core extract (Mangifera indica L). Based on the results of the study obtained, positive effects on terpenoid compounds marked purplish red and flavonoid compounds marked orange on the Bate Smite-Metcalfe reagent. Brownish red on 10% NaOH reagent, alkaloid compounds characterized by the formation of a yellow precipitate, phenolic compounds indicated black colour, tannin compounds characterized brown colour and saponin compounds represented by the appearance of foam.

Studies have shown that various plant-based by-products, including milled Carica papaya peels and seeds [10], avocado pear seeds, and indigenous dietary plants, have antimicrobial properties. A review focusing on the tropical regions highlights the antimicrobial activity of plant-food by-products [11]. Proximate, functional, antinutrient and antimicrobial properties of these plant-based by-products have been evaluated, with promising results in terms of their ability to inhibit the growth of bacteria such as Pseudomonas aeruginosa [12]. One study even evaluated the anti-quorum sensing activity of indigenous dietary plants against this bacteria [13]. These findings suggest that plant-based by-products may have potential as alternative sources of natural antimicrobial agents.

**Conclusion**

The ethanol extract of sweet mango seeds (Mangifera indica L.) inhibited the growth of MDR bacteria P. aeruginosa MIC. Value for MDR bacteria Pseudomonas aeruginosa code PA 15A was obtained at a concentration of 0.78 mg/mL. For bacteria PA ATCC, PA 19A, PA 19 and PA 20E were obtained at a concentration of 1.56 mg/mL. The MBC value for MDR Pseudomonas aeruginosa bacteria code PA 15A and PA ATCC got MBC value at a concentration of 25 mg/mL. In comparison, bacteria code PA 19 and PA 19A obtained MBC values at 50 mg/mL concentrations. The administration of sweet fragrant mango seed extract has an effect as an antibacterial against P. aeruginosa.

**Conflict of Interest**

The authors declare that there is no conflict of interest.
References


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