Assessment of Anti-methicillin Resistant \textit{Staphylococcus aureus} (MRSA) and Anti-Methicillin Susceptible \textit{Staphylococcus aureus} (MSSA) Properties of Malaysian Medicinal Plants

\textbf{BACKGROUND}

\textit{Staphylococcus aureus} is a leading cause of human bacterial infections, including MSSA and MRSA infections. The MRSA strains are resistant to first-line antibiotics used for the treatment of infections. Hence, this led to the administration of second and third-line medicines in combination which is often costly and more toxic. Plants are well-known sources of new drugs because of their lower cost, higher accessibility and fewer adverse effects relative to synthetic agents.

\textbf{Objectives}

This study aimed:
- to investigate the antibacterial activities of 21 Malaysian plant extracts against MSSA and MRSA strains,
- to investigate the interaction between the active extract and synthetic antibiotics against MSSA and MRSA strains, and
- to investigate the bactericidal activities of the active plant extract against MSSA and MRSA strains.

\textbf{Methodology}

\begin{itemize}
    \item Extraction: Maceration in 80\% ethanol
    \item Minimum inhibitory concentration (MIC) and minimum bactericidal concentration (MBC) determination using a microdilution assay
    \item Determine interaction between the active extract and the antibiotics (vancomycin and linezolid) using a checkerboard design
    \item Determine bactericidal property of the active extract using the time-killing methodology
\end{itemize}

\textbf{Results}

\textbf{MIC and MBC}

<table>
<thead>
<tr>
<th>Plant</th>
<th>Scientific name</th>
<th>MSSA ATCC 12600 (µg/mL)</th>
<th>MRSA ATCC 12493 (µg/mL)</th>
<th>MRSA ATCC 43300 (µg/mL)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pokok pinang (seed)</td>
<td>Areca catechu</td>
<td>400</td>
<td>400</td>
<td>400</td>
</tr>
</tbody>
</table>

Out of 21 extracts tested, Areca catechu seed extract showed significant antibacterial activity (MIC and MBC of 400µg/mL) against MSSA and MRSA strains.

\textbf{Extract interaction with vancomycin and linezolid}

\begin{itemize}
    \item Bacteria \quad \Sigma\text{FIC with vancomycin} \quad Interaction \quad \Sigma\text{FIC with linezolid} \quad Interaction
    \item MSSA 12600 \quad 1.016 \quad Additive \quad 1.016 \quad Additive
    \item MRSA 43300 \quad 1.016 \quad Additive \quad 1.016 \quad Additive
    \item MRSA 12493 \quad 1.016 \quad Additive \quad 1.016 \quad Additive
\end{itemize}

The extract in combination with vancomycin and linezolid showed an additive interaction against MSSA and MRSA strains.

\textbf{Bactericidal effect of the extract}

The extract also showed significant bactericidal activity when compared to the nontreated MRSA ATCC 43300 culture.

\textbf{Conclusion}

\textit{Areca catechu} has the potential to be used for the treatment of MSSA and MRSA infections and further studies are crucial.

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