Antimicrobial Activity and Prebiotic Effects of *Senna alata* Leaf Extracts

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**Abstract**

Medicinal plants are a great source of antibacterial and prebiotic properties that can treat a wide range of human diseases. *Senna alata*, also known as "candle bush," has many health benefits. It has antimicrobial properties and has been used for centuries to treat skin infections [1] and digestion-related problems such as constipation, stomach discomfort, and liver diseases [2]. This study aimed to screen the phytoconstituents of *S. alata* leaf extracts, study their antimicrobial activity against several intestinal pathogens, and investigate their potential prebiotic effects against a few probiotic strains.

Aqueous and ethanolic *S. alata* leaf extracts were obtained by the maceration method, then dried and stored until used. A qualitative phytochemical analysis of *S. alata* leaf extracts was performed to determine the presence of biomolecules such as anthraquinones, carbohydrates, flavonoids, phenols, saponins, tannins, and alkaloids. For the antimicrobial study, serial two-fold dilutions of leaf extracts in concentrations ranging from 10 mg/mL to 0.02 mg/mL were performed in a 96-well microplate to determine the minimum inhibitory concentration (MIC) and minimum bactericidal concentration (MBC). For the prebiotic study, serial two-fold dilutions of leaf extracts in concentrations ranging from 10 mg/mL to 1.25 mg/mL were conducted in a 96-well microplate to study the growth rate of probiotics by measuring its optical density (OD) at 0 and 24 hours of incubation at 600 nm.

Aqueous and ethanolic *S. alata* leaf extracts showed the presence of tannin, saponins, alkaloids, carbohydrates, and flavonoids. Anthraquinones were not detected in any of the extracts, and phenols could only be detected in the ethanolic leaf extract. At the tested concentrations, both leaf extracts showed antimicrobial activity against *Escherichia coli, Staphylococcus aureus, Salmonella Typhi*, and *Klebsiella pneumoniae* based on the MIC values (Table 1). The growth rate of *Lactobacillus helveticus* and *Bifidobacterium longum* were significantly increased (p <0.05) after being treated with aqueous leaf extract at 24 hours of incubation (Figure 1). A similar growth pattern was obtained with *L. helveticus and B. longum* treated with ethanolic leaf extracts (Figure 2).
Table 1: The MIC and MBC values of S. alata aqueous and ethanolic leaf extracts against pathogenic intestinal bacteria

<table>
<thead>
<tr>
<th>Pathogens</th>
<th>Aqueous extract</th>
<th>Ethanol extract</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>MIC (mg/mL)</td>
<td>MBC (mg/mL)</td>
</tr>
<tr>
<td>Escherichia coli</td>
<td>10</td>
<td>-</td>
</tr>
<tr>
<td>Staphylococcus aureus</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>Salmonella Typhi</td>
<td>10</td>
<td>-</td>
</tr>
<tr>
<td>Vibrio cholerae</td>
<td>*-</td>
<td>-</td>
</tr>
<tr>
<td>Klebsiella pneumoniae</td>
<td>10</td>
<td>-</td>
</tr>
</tbody>
</table>

*Undetermined by the tested range of extract concentrations

Figure 1: The growth rate of a) L. helveticus and b) B. longum after being treated with aqueous extract of S. alata (10 mg/mL to 1.25 mg/mL) within 24 hours of incubation

Figure 2: The growth rate of a) L. helveticus and b) B. longum after being treated with ethanolic extract of S. alata (10 mg/mL to 1.25 mg/mL) within 24 hours of incubation

In conclusion, aqueous and ethanolic S. alata leaf extracts displayed antimicrobial activities to certain intestinal pathogenic bacteria at the preliminary extract concentrations employed in the present study. Besides, the extracts have a stimulative effect on the growth of probiotic microorganisms which are typical members of intestinal microbiota. This study provides further
evidence that suggests *S. alata* is one of the prebiotics which could potentially be used to ease the related digestive problems.

**Keywords**
Antimicrobial activity, Prebiotics, Probiotics, *Senna alata* leaf extracts

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**References**