Antibacterial effect of *Stryphnodendron adstringens* (Mart) Coville (Fabaceae) extract on dental caries

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Abstract

It is common knowledge the current trend of developing and testing products accrued from natural plants. On that premise, *Stryphnodendron adstringens* (Mart) Coville is highlighted and was the aim for evaluating its antibacterial effect on dental caries. A crude dried methanolic extract was prepared and applied from 50 to 500 mg/mL to determine the Minimum Inhibitory Concentration (MIC) on seven distinguished bacterial cultures. Results revealed by 0.01% resazurin demonstrated *Stryphnodendron adstringens* (Mart) Coville extract exerted antibacterial effect on all tested bacterial strains, with MIC > 250 mg/mL for *Lactobacillus casei*, *Streptococcus mitis* and *Streptococcus salivarius* and MIC > 400 mg/mL for Enterococcus faecalis, *Streptococcus mutans*, *Streptococcus sanguinis* and *Streptococcus sobrinus*. In view of outcomes, the tested crude vegetal extract presents antibacterial potential for application in dental caries.

Keywords: Antibacterial potential, *Stryphnodendron adstringens* (Mart) Coville, oral microbiome, caries

Introduction

Currently, there is an interest increase in medicinal plants, due to the great demand for alternative therapies [1]. That is mainly owing to the ineffectiveness of some synthetic products, the cost of allopathic medicines and the search for less aggressive treatments [2]. Herbal medicines are pharmaceutical preparations (extracts, tinctures, ointments and capsules) obtained from one or more plants and used for the treatment of various diseases. There are countless advantages for their therapeutic use, such as low cost and wide availability for the low-income population [3].

*Stryphnodendron adstringens* (Mart) Coville (*S. adstringens*) is a legume considered as a medicinal plant widely distributed throughout the Brazilian Cerrado [4]. Mainly known as barbatimão, also receives several popular names, which vary according to the region: alaramotemo, barba-detinam, charãozinho-roxo, ilatimó, ulatimó, casca do Brasil, casca-da-virginidade e casca-da-mocidade [5]. It presents as chemical constituents alkaloids, flavonoids, terpenes, stilbenes, steroids, protease inhibitors (such as trypsin) and particularly tannins [6, 7, 8]. Tannins are the major components of *S. adstringens*, and these compounds have been associated to its antimicrobial effects [6, 7]. There are three general properties of tannins that are responsible for most of the pharmacological activities: the formation of complexes with metallic ions (iron, aluminum, calcium, copper, etc.), the antioxidant activity and scavenging of free radicals and the ability to form complexes with other molecules such as proteins and polysaccharides [9].

*S. adstringens* has been used in folk medicine as an antimicrobial, healing, anti-inflammatory, hemostatic, anti-edematogenic, antiseptic and anti-diarrheal agent [10, 11, 12]. However, a small number of studies have been carried out to evaluate the antimicrobial activity of *S. adstringens* on microorganisms related to oral diseases, such as dental caries [13, 14]. The versatile therapeutic potential of *S. adstringens* made it be included in the National List of Medicinal Plants of Interest to SUS [15] and recommended in the Brazilian Pharmacopoeia 5th [16]. Based on its potential, this work aimed to evaluate the antibacterial effect of *S. adstringens* extract on dental caries.
Material and Methods

Extract obtaining
Su. adstringens crude dried methanolic extract was prepared as described by Santana et al. (2023) [17].

Evaluation of antibacterial activity

To determine the Minimum Inhibitory Concentration (MIC), the Kirby-Bauer method of plate diffusion was applied [19]. Seven bacterial cultures from the American Type Culture Collection (ATCC) were used: Enterococcus faecalis (ATCC 49248), Lactobacillus casei (ATCC 11578), Streptococcus mitis (ATCC 49456), Streptococcus mutans (ATCC 25175), Streptococcus salivarius (ATCC 29579), Streptococcus sanguinis (ATCC 10556) and Streptococcus sobrinus (ATCC 33478). The strains belong to the Laboratory of Clinical Microbiology from the University Center Brasilia de Goiás. As a negative control, dimethyl sulfoxide (DMSO, Merck®) from 1 to 10% was applied; and as a positive control, a solution of chlorhexidine digluconate (Sigma®) at concentrations from 0.015 to 5.9 mg/mL was used. To define the sensitivity of bacterial strains to the concentrations of Su. adstringens crude extract, serial dilutions were performed: 50 mg/mL, 100 mg/mL, 150 mg/mL, 200 mg/mL, 250 mg/mL, 300 mg/mL, 350 mg/mL, 400 mg/mL, 450 mg/mL and 500 mg/mL.

The sterility control of the broth, solvent and culture was performed. The inoculum was standardized by comparing it with the 0.5 tube of McFarland scale (0.1 mL of 1.0% barium chloride + 9.9 mL of 1.0% sulfuric acid) by checking the absorbances at 625 nm (Quimis Q898UV-DB) [19]. Microplates were sealed with parafilm and incubated at 35 ± 2 °C for 24 hours. After the incubation period, 30 µL of 0.01% resazurin (Sigma®) was added to each well. This revealing system allows immediate observation, whereby the blue color represents the absence of microbial growth and the red color, the positivity. Microplates were reincubated for 30 minutes and then descriptively analyzed.

Results

S. adstringens crude dried methanolic extract generated 20.14% yield (w/w) and a content determination for extractives content of 11.88% [17]. As presented in Table 1, S. adstringens demonstrated antibacterial effect on all tested bacterial strains, with MIC > 250 mg/mL for Lactobacillus casei, Streptococcus mitis and Streptococcus salivarius; and MIC > 400 mg/mL for Enterococcus faecalis, Streptococcus mutans, Streptococcus sanguinis and Streptococcus sobrinus. The positivity. Microplates were reincubated for 30 minutes and then descriptively analyzed.

Table 1: Minimum Inhibitory Concentration (MIC) of S. adstringens extract and the positive control, chlorhexidine digluconate.

<table>
<thead>
<tr>
<th>Bacterial strains</th>
<th>MIC (mg/mL)</th>
<th>S. adstringens (mg/mL)</th>
<th>Chlorhexidine digluconate (mg/mL)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Enterococcus faecalis</td>
<td>&gt; 400</td>
<td>0.290</td>
<td></td>
</tr>
<tr>
<td>Lactobacillus casei</td>
<td>&gt; 250</td>
<td>0.190</td>
<td></td>
</tr>
<tr>
<td>Streptococcus mitis</td>
<td>&gt; 250</td>
<td>0.310</td>
<td></td>
</tr>
<tr>
<td>Streptococcus mutans</td>
<td>&gt; 400</td>
<td>0.030</td>
<td></td>
</tr>
<tr>
<td>Streptococcus salivarius</td>
<td>&gt; 250</td>
<td>0.030</td>
<td></td>
</tr>
<tr>
<td>Streptococcus sanguinis</td>
<td>&gt; 400</td>
<td>0.190</td>
<td></td>
</tr>
<tr>
<td>Streptococcus sobrinus</td>
<td>&gt; 400</td>
<td>0.190</td>
<td></td>
</tr>
</tbody>
</table>

Discussion

The antibacterial properties evaluation of crude methanolic extract from Su. adstringens leaves follows the current trend of developing and testing products accrued from natural plants

Conclusion

In view of the obtained results, it is believed that Su. adstringens crude dried methanolic extract presents antibacterial potential for application in dental caries.

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Declaration of interest statement

Authors report no declarations of interest. Authors alone are responsible for paper content and writing.

References