ANTIBACTERIAL ACTIVITY OF *JUSTICIA NODICAULIS* NEES (LEONARD) (ACANTHACEAE) LEAVES FOUND IN SEMI-DECIDUOUS DRY FOREST, ANÁPOLIS, GOIÁS

Julie Paiva Souza[1]
Josana de Castro Peixoto[2]
Evangelical University of Goiás – UniEVANGÉLICA[12]

ABSTRACT

INTRODUCTION: Although great advances have been made in the discovery of plant-based antimicrobials, research involving the investigation of the pharmaceutical properties of regional products is still very scarce, especially with regard to the antibacterial potential of *Justicia nodicaulis*. **METHODOLOGY:** Thus, considering the ethnopharmacological use of this plant species for the treatment of respiratory tract diseases, given that bacteria, together with viruses, are the etiological agents of many respiratory diseases, we sought to investigate the antibacterial activity of the essential oil extracted from the aerial parts of this medicinal species through broth microdilution tests performed according to the recommendations of *the Clinical and Laboratory Standard Institute (*CLSI), with modifications, against gram-positive and gram-negative microorganisms from four *American Type Culture Collection (*ATCC) standard strains. **RESULTS:** The results of this study demonstrated that the bactericidal activity of the essential oil obtained from *J. nodicaulis* was satisfactory, since, although one strain of *Escherichia coli* showed resistance, the oil had weak antibacterial action against *Pseudomonas aeroginosa* and moderate antibacterial activity against strains of *Staphylococcus aureus* and S*. epidermidis.* **CONCLUSION:** Although preliminary, this study may open up new paths for the development of an effective herbal medicine for the treatment of infectious diseases.

Keywords: Antibacterial activity; Acanthaceae; *Justicia.*

INTRODUCTION

The use of plants for therapeutic purposes is an ancient practice and continues to be relevant, especially with the advancement of technologies that enable the development of safe and effective herbal medicines (VEIGA JUNIOR *et al*., 2005; HARVEY *et al*., 2015; SCHENKEL *et al*., 2003). However, despite the rich biodiversity and tradition in the use of medicinal plants in Brazil, few drugs derived from Brazilian flora are registered (CALIXTO, 2000).

The Cerrado biome is home to a vast diversity of plant species with medicinal potential, including *Justicia nodicaulis*, of the Acanthaceae family, which contains compounds such as flavonoids and saponins (MOURA *et al.,* 2018; VARGEM, 2015). Although there are few studies on its biological activities, ethnopharmacology suggests their use for respiratory diseases (VARGEM, 2015). This study aims to

investigate the antibacterial activity of the hydroalcoholic extract of the leaves of this species, especially against Gram-positive and Gram-negative bacteria.

METHODOLOGY

The study was conducted with samples of adult leaves of *Justicia nodicaulis* occurring in an urban area in the Semideciduous Dry Forest of the state of Goiás.

To evaluate antibacterial activity, broth microdilution tests were conducted, following the guidelines of *the Clinical and Laboratory Standard Institute* (CLSI), with some modifications to adapt to procedures with aerobic bacteria. The extract was tested against American Type Culture Collection (ATCC) standard strains, including *Staphylococcus aureus, Escherichia coli,* and *Pseudomonas aeruginosa,* described in Table 1.

1 **Table.** Microorganisms used to determine the minimum inhibitory concentration (MIC).

MICROORGANISMS	***ATCC***
Gram (+) bacteria	
Staphylococcus aureus	25
Staphylococcus epidermidis	12228
Gram (-) bacteria	
Escherichia coli	25312
Pseudomonas aeruginosa	27853

Source: Author.

To perform the microbiological tests and ensure the maintenance of microbial cultures, the strains were maintained and preserved according to the procedure described, but with modifications. To prepare the inoculants, the McFarland turbidity standard was used to adjust the bacterial concentration.

The extract was diluted to concentrations ranging from 2000 to 312.5 µg.mL-1. Resazurin (0.001%) was used as an indicator of bacterial viability, based on its color-changing property, which indicates microbial growth activity. The Minimum Inhibitory Concentration (MIC) was defined as the lowest concentration capable of visibly inhibiting bacterial growth in the microdilution wells. The positive control consisted of

Muller Hinton broth with bacterial inoculum, while the negative control used broth without inoculum.

RESULTS

The results for the viability test as a control of the microbiological assay technique using chloramphenicol are highlighted in Table 2.

Table2 . Minimum inhibitory concentration (MIC) (µg.mL-1) of the antibiotic chloramphenicol against Gram-positive and Gram-negative bacteria from the ATCC strains tested.

TESTED BACTERIA	***Chloramphenicol (µg.$^{mL-1}$)***
Staphylococcus aureus ATCC 25923	2
Staphylococcus epidermidis ATCC 12228	2
Escherichia coli ATCC 25312	2
Pseudomonas aeruginosa ATCC 27853	2

Source: Author's own work.

The results of the minimum inhibitory concentration (MIC) of the microbiological test to evaluate the *in vitro* antibacterial activity of the essential oil obtained from the aerial parts of *J. nodicaulis* are listed in Table 3.

Table3 . Minimum inhibitory concentration (MIC) (µg.mL-1) of the hydroalcoholic extract of *J. nodicaulis* leaves against Gram-positive and Gram-negative bacteria from the ATCC strains tested.

TESTED BACTERIA	***J. Pectoralis* essential oil (µg.$^{mL-1}$)**
Staphylococcus aureus ATCC 25923	12
Staphylococcus epidermidis ATCC 12228	125
Escherichia coli ATCC 25312	< 200
Pseudomonas aeruginosa ATCC 27853	10

Source: Author's own work.

The data obtained demonstrate that the hydroalcoholic extract of *Justicia nodicaulis* leaves exhibited varied antibacterial activity against the tested strains. The MIC was determined for Gram-positive and Gram-negative bacteria, with emphasis

on the strains of *Staphylococcus aureus* and *Staphylococcus epidermidis,* which presented a MIC of 125 µg.mL, indicating moderate antibacterial activity.

For the *Pseudomonas aeruginosa* strain, the MIC was 1000 µg.mL, characterizing weak antibacterial activity. The *Escherichia coli* strain showed resistance, with MIC above 2000 µg.mL, indicating low efficacy of the extract against this microorganism.

Although the study showed promising results against Gram-positive bacteria, activity against Gram-negative bacteria was limited. The data suggest that the extract contains bioactive compounds that may be more effective against Gram-positive species, and further studies are needed to investigate specific fractions of the extract and optimize the concentration of the active substances.

CONCLUSION

It is concluded that the bactericidal activity of the hydroalcoholic extract obtained from *J. nodicaulis* leaves was satisfactory, since, although one strain of *Escherichia coli* showed resistance, the oil had weak antibacterial action against *Pseudomonas aeruginosa* and moderate antibacterial activity against strains of *Staphylococcus aureus and S. epidermidis.*

Furthermore, we suggest further studies to evaluate the antibacterial activity of the extract fractions and oil at other concentrations, as well as appropriate toxicological studies to verify the possibility of their safe use in combating infections.

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