

**Propiedad antibacteriana de un extracto
de semilla de *Mangifera indica* L. sobre
Staphylococcus aureus resistente a la meticilina**

**Antibacterial properties of *Mangifera indica*
L. seeds extracts on methicillin-resistant
*Staphylococcus aureus***

Nirza Noguera Machado

Instituto de Investigaciones Biomédicas “Dr. Francisco Javier Triana Alonso” de la Universidad de Carabobo (BIOMED-UC). Maracay-Venezuela/Departamento de Ciencias Básicas de la Escuela de Bioanálisis sede Aragua de la Universidad de Carabobo. Maracay-VENEZUELA
nirza.noguera@gmail.com

Javier Trejo, Libia Torres, Pierina Valera, Rosmina Visconti & Naiglet Zambrano

Instituto de Investigaciones Biomédicas “Dr. Francisco Javier Triana Alonso” de la Universidad de Carabobo (BIOMED-UC). Maracay-VENEZUELA

Franklin Pacheco Coello

Instituto de Investigaciones Biomédicas “Dr. Francisco Javier Triana Alonso” de la Universidad de Carabobo (BIOMED-UC). Maracay-Venezuela/Departamento de Ciencias Básicas de la Escuela de Bioanálisis sede Aragua de la Universidad de Carabobo. Maracay-VENEZUELA

María Méndez

Departamento Clínico Integral de la Escuela de Bioanálisis sede Aragua de la Universidad de Carabobo. Maracay-VENEZUELA

Luis Ojeda

Instituto de Investigaciones Biomédicas “Dr. Francisco Javier Triana Alonso” de la Universidad de Carabobo (BIOMED-UC). Maracay-Venezuela/Departamento de Bioquímica y Fisiología de la Escuela de Medicina sede Aragua de la Universidad de Carabobo. Maracay-VENEZUELA

Abstract

The “mango” tree (*Mangifera indica* L.) have been use in traditional medicine for the treatment of different ailments. Is a known that diversity extracts of various parts plants have activity microorganism pathogenic. In this work were investigated the antimicrobial activity of mango seeds extract against *Staphylococcus aureus* methicillin-resistant strains (MRSA) 1025 and 1920. The seeds extractions prepared by maceration whit ethanol 90%. The phytochemical constituents of extracts were characterized for total phenol content (TPC) and total flavonoids (TF). Antibacterial activity of extracts were determined using disk diffusion, agar dilution methods. The results showed that the seeds extracts contents higher to TPC (85.60 ± 2.13 mg EAG/g of extract) and TF (49.32 ± 1.12 mg CE/g of extract). The result revealed that the extracts possess good antibacterial activity against *S. aureus* MRSA 1025 and 1920, the inhibition zones ranged from 6.0 mm to 19 mm, at different concentration extracts probed. The results probed that the mango seed extract contained many compounds such as phenolic that could be affect bacteria *S. aureus* MRSA, and these bioactive compounds to be isolated for the production of new antibiotics.

Keywords: *S. aureus* MRSA, “mango”, *Mangifera indica*, natural antimicrobial

Resumen

El árbol de “mango” (*Mangifera indica* L.) se ha utilizado en la medicina tradicional para el tratamiento de diferentes dolencias. Es conocido que los extractos de diversidad de plantas de diversas partes tienen actividad patógena de microorganismos. En este trabajo se investigó la actividad antimicrobiana del extracto de semillas de “mango” contra dos cepas resistentes a la meticilina de *Staphylococcus aureus* (MRSA) 1025 y 1920. Las extracciones de semillas preparadas por maceración se realizó con etanol al 90%. Los componentes fitoquímicos de los extractos se caracterizaron por el contenido total de fenol (TPC) y flavonoides totales (TF). La actividad antibacteriana de los extractos se determinó mediante difusión en disco, métodos de dilución en agar. Los resultados mostraron que las semillas poseen contenidos de TPC superiores ($85,60 \pm 2,13$ mg EAG /g de extracto) y TF ($49,32 \pm 1,12$ mg CE /g de extracto). El resultado de las pruebas microbiológicas reveló que los extractos poseen buena actividad antibacteriana contra los dos cepas de *S. aureus* MRSA, obteniendo zonas de inhibición que variaron de 6,0 mm a 19 mm, a diferentes concentraciones de extractos. Los resultados demostraron que el extracto de semilla de “mango” contenía muchos compuestos fenólicos que podrían afectar la viabilidad del *S. aureus* MRSA. Estos compuestos bioactivos del extracto se pudieran aislar para la producción de nuevos antibióticos.

Palabras clave: *S. aureus* MRSA, “mango”, *Mangifera indica*, antimicrobiano natural.

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Introduction

The problem of multi-resistant bacteria to antimicrobial drugs has increased the need for new antibiotics or modifications of older antibiotics. Plants can regarded as safe and alternative source of bioactive compounds whit antimicrobial activity (Poongothai & Rajan, 2013). The beneficial medicinal effects of plant materials typically

result from the combinations of secondary products present in the plant, such as alkaloids, steroids, tannins and phenol compounds (Karumanchi *et al.*, 2016).

In this context, “mango” tree (*Mangifera indica* L.) is a known and widely used for treatment of several bacterial, hongos and virus infections. Many researches about

antioxidant capacity and antimicrobial activity of extracts from different parts of mango tree are available, these due to high phenolic content (Masud, 2016). Characterization of polyphenolic compounds shows flavonoids like quercetin, kaempferol, phenolic acids, galloyl glycosides, abundant amounts gallic acid and mangiferin (Raju *et al.*, 2019).

The seed extracts of mango could be activity against many microorganism pathogenic as such *Escherichia coli*, *Staphylococcus aureus*, *Pseudomonas aeruginosa*, *Listeria monocytogenes*, *Aspergillus niger*, *Candida albicans* (Raju *et al.*, 2019; Vega-Vega *et al.*, 2015; Ahmed, 2015; Noguera-Machado *et al.*, 2017). Mango seed is abundant source of polyphenols, antioxidants, flavonoids, etc. Have been detected seed mango vr. Kent presents 3.727 mg Gallic Acid Equivalent (GAE) for 100 g of fresh weight, which is higher than that reported in the pulp 48.84 mg GAE/100 g, respectively (Ayala-Zavala *et al.*, 2010).

Staphylococcus aureus is one of the most common pathogenic bacteria, which can invade the body and cause a wide range of diseases such as skin infections and food poisoning. Due to excess use of lactam drugs, multidrug-resistant *Staphylococcus aureus*, especially the methicillin-resistant *S. aureus* (MRSA), became a high risk for the health human (Hu *et al.*, 2019). As MRSA can produce enterotoxin and α -pore-forming toxin, it can cause skin infection and respiratory disease. MRSA is resistant to many antibiotics, not only methicillin, but also macrolide antibiotics, aminoglycoside antibiotics, so MRSA shows multiple antibiotics resistance (Lin *et al.*, 2018).

For these reason, in this work has been investigated the antimicrobial activity of mango seeds extract against *S. aureus*

mutants strain MRSA-1025 and MRSA-1920.

Materials and Methods

Bacterial Strain

S. aureus MRSA 1025 and MRSA 1920 were isolated for Bastidas *et al.*, 2020 and donated for Integral Clinical Department of the School of Bioanalysis, Carabobo University.

Preparation of mango seed extract

The variety used was “mango” “Bocado”. The seeds were collect manually from mango fruits, washed thoroughly with water to remove the pulp and then dried in hot air oven at 60°C until constant weight. The seeds were grinded by using grinder until became powder (Noguera-Machado *et al.*, 2019).

Estimation of total phenol content (TPC)

The total phenol content was determined by Folin-Ciocalteu chloride method, whit modifications (Noguera-Machado *et al.*, 2019), and expressed in terms of gallic acid equivalent (mg/g).

Estimation of total flavonoids (TF)

The total flavonoid content was determined methodology used by (Pacheco *et al.*, 2018) and expressed in terms of catequine equivalent (mg/g).

Determination of antibacterial activity

Antibacterial effect were test on Mueller-Hinton agar by disc diffusion method (Noguera-Machado *et al.*, 2017). Was probed the extract of mango seeds in four concentrations 100, 50, 25 y 12.5 mg/mL against strains MSRA of *S. aureus*. How negatives controls were used the ethanol (90%) and Oxacillin antibiotic. The

Vancomycin antibiotic was the positive control.

The extract and controls were incorporate in paper dishes of 5 mm, which were bored onto the Mueller Hinton agar plates, which have inoculated whit strains. After 24 h at 37°C incubation, the plates were observed for the results and zone of inhibitions measured. The experiment was done in triplicate and values are presented as Mean \pm SD.

Results and Discussion

Phytochemical constituents of extracts (TPC, TF)

The total phenolic and flavonoids contents of extract were higher, comparative whit the values reported for Ayala-Zabala *et al.* 2010. This difference probably due for variety utilized, in this work "Bocado" (Table 1).

Table 1. Phytochemical constituents of *Mangifera indica* seed extracts

Antibacterial Activity

The result revealed that the extracts of *M. indica* seed possess good antibacterial activity against strain probed. For strain *S. aureus* MRSA 1025 and 1920, the inhibition zones ranged from 6.0 mm to 19 mm, at different concentration extracts probed. Were observed on dependent effect doses in function of extract concentration, whereas major concentration more zone inhibition (figure 1).

Figure 1. Plates cultivaded with MRSA strains with 100 mg/mL, of extract of *M. indica* L. and Vancomycin 67 μ g/mL.

The Oxacillin and ethanol showed minimal inhibition (6.0 ± 1.0 mm). The Vancomycin (positive control) exhibited the maxima inhibition of 19.7 ± 0.6 mm (Table 2).

The maxima concentration of extracts produced zone inhibition of 16.7 ± 2.5 mm, near value of positive control (Vancomycin), indicative the sensibility to extract. Additionally, these finding coincide of Ahmed, (2015), who reported zone inhibition of 20 mm whit mango seeds ethanol extract against *S. aureus*. Additionally, these value resulted higher than the zone inhibition described for El-Gied *et al.* (2012), enter 8 and 13 mm, for *S. aureus* MRSA clinical isolate.

Table 2. Antimicrobial activity of seed extract of *M. indica* L. against *S. aureus* MRSA

Conclusion

Plant and fruits derived products are potential sources of novel antimicrobial compounds especially against bacterial pathogens. In this work showed that, the extractions of mango seeds bioactive compounds whit ethanol solvent, is efficient and to have advantage for considered to safe and nontoxic in bio treatments. Moreover, present study probed that the mango seed extract contained many compounds such as phenolic that could be affect bacteria *S. aureus* MRSA. These bioactive compounds to be isolated so that they can serve as templates for the production of new antibiotics.

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Author contributions

L.E.O y N.N.M.: desing, writing original draft preparation. J.T., N.Z., R.V., P.V and L.T: bacterial viability assay, redaction. F.P:

assay phytochemical and M.M.: writing review and editing.

Conflict of interests

The authors express that they have no conflict of interest

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Table 1. Phytochemical constituents of *Mangifera indica* seed extracts

Determination	Mean ± DS
TPC	85.60 ± 2.13 mg EAG/g of extract
TF	49.32 ± 1.12 mg CE/g of extract

Table 2. Antimicrobial activity of seed extract of *M. indica* L. against *S. aureus* MRSA

Disk content (mg/ mL)	Mean ± DS zone of inhibition (mm)	
	<i>S. aureus</i> MRSA 1025	<i>S. aureus</i> MRSA 1920
Extract 100	12.7 ± 0.6	16.7 ± 2.5
Extract 50	10.0 ± 0.5	13.0 ± 1.6
Extract 25	8.0 ± 1.6	12.0 ± 0.7
Extract 12.5	6.0 ± 1.7	9.0 ± 2.0
Ethanol (90%)	7.0 ± 1.0	6.5 ± 1.0
Oxicillin (166 µg/ mL)	6.0 ± 1.0	6.0 ± 1.0
Vancomycin (67 µg/mL)	19.7 ± 0.6	19.7 ± 0.6