International Journal Dental and Medical Sciences Research
Volume 6, Issue 5, Sep - Oct 2024 pp 381-385 www.ijdmsrjournal.com ISSN: 2582-6018

Evaluation Of Antifungal And Antibacterial Properties OfSolanumXanthocarpum (Kandankathiri)

Dr.Hamsavardini[1], Dr. Indumathi. K. P[2*], Dr.Sibyl.S[3], Dr. Krishnaprakash.G[4]

1) Intern, Department of Public Health Dentistry, SRM Kattankulathur Dental College and Hospital, SRM Institute of Science and Technology, Kattankulathur, Chengalpattu District, Tamilnadu -603203, India.

2) Assistant Professor, Department of Public Health Dentistry, SRM Kattankulathur Dental College and Hospital, SRM Institute of Science and Technology, Kattankulathur, Chengalpattu District, Tamilnadu -603203, India.

3) Associate Professor, Department of Public Health Dentistry, SRM Kattankulathur Dental College and Hospital, SRM Institute of Science and Technology, Kattankulathur, Chengalpattu District, Tamilnadu -603203, India.

4) Assistant Professor, Department of Public Health Dentistry, SRM Kattankulathur Dental College and Hospital, SRM Institute of Science and Technology, Kattankulathur, Chengalpattu District, Tamilnadu -603203, India.

*CORRESPONDING AUTHOR: Dr. INDUMATHI K.P

E-mail: indumatp@srmist.edu.in, indhuparthiban@yahoo.co.in

Submitted: 10-10-2024 Accepted: 20-10-2024

ABSTRACT: The study you've described investigates the antibacterial activity of Solanumxanthocarpuma plant from the Solanacea family, against various human pathogens using the agar-well diffusion method.Both methanol and acetone were employed as solvents to extract bioactive compounds from fresh leaves. The findings suggest that Staphylococcus aureus,a common and serious pathogen responsible for wound infections, was particularly susceptible to the plant's extracts. The antibacterial effect was tested at different concentrations (30%, 50%, 70%, and 100%).The conclusion emphasizes the potential of S. xanthocarpum leaf extracts, especially in combating S. aureus infections, warranting further research into its therapeutic applications.

I. INTRODUCTION:

There are many different kinds of medicinal plants on our globe, and people have been usingthem for health benefits since ancient times. The ancient Indian medical system known asAyurveda contains a plethora of information regarding herbal medicines. Rural populations in developing nations, particularly India, frequently use traditional plant-based remedies to treat common diseases. These populations comprise indigenous people, farmers, and residents of far-off settlements. Less wealthy people are more likely than others to participate in this behavior.[1] To treat a variety of illnesses, these medicinal herbs are ingested as drinks, Rural populations in developing nations, particularly India, frequently use traditional plant-based remedies to treat common diseases. These populations comprise indigenous people, farmers, and residents of far-off settlements. Less wealthy people are more likely than others to participate in this behavior.[2]

Plants have been used as a source of potential antibiotics throughout history, offering antimicrobial properties including antiviral, antibacterial, and antifungal effects. This therapeutic potential is mainly attributed to the

International Journal Dental and Medical Sciences Research
Volume 6, Issue 5, Sep - Oct 2024 pp 381-385 www.ijdmsrjournal.com ISSN: 2582-6018

bioactive compounds that plants produce during their secondary metabolism.[3]

The research tested the plant's effectiveness against selected human pathogens (candida albicans and Staphylococcus) using the agar-well diffusion method with varying extract concentrations. Most of people in developed countries use traditional medicines containing bioactive compounds from medicinal plants. This widespread use underscores the need for further research into these plants to better understand their properties, safety, and efficacy.[4]

Solanumxanthocarpum, commonly known as Indian nightshade or Yellow-berried Nightshade, is also called Kantakari. It is scientific synonym is Solanumsurattense, and it belongs to the Solanaceae family. This plant is notable for its rich phytochemical composition, including: Alkaloids, Phenolic compounds, Flavonoids, Sterols, Saponins and their glycosides, Carbohydrates, Fatty acids, Tannin, Amino acids. S. xanthocarpum has a long history of medicinal use. In Ayurvedic medicine, all parts of the plant are considered valuable, including: Roots, Leaves, Stems, Flowers, Fruits.[5]

The roots of S. xanthocarpum are particularly significant, as they are a key ingredient in a well-known Ayurvedic preparation. The types of plants or substances commonly used in traditional medicine for infections, wounds, or burns and process of making poultices and their application.[5] The study concluded that methanolic and acetone leaf extracts of Solanumxanthocarpum effectively inhibited the growth of Staphylococcus aureus and candida albicans. So the purpose is to gain a understanding of a significant human pathogen responsible for wound infections. These findings suggest that the leaf extracts of this plant warrant further investigation to explore their therapeutic potential.[6]The aim of the study is to investigate and validate the antimicrobial potential of *Solanumxanthocarpum*.

II. MATERIALS AND METHODS :

Objectives:

The main objectives of this study are:

1. To evaluate the antifungal and antibacterial properties of *Solanumxanthocarpum* extracts.
2. To compare the efficacy of ethanol and methanol extracts of*Solanumxanthocarpum* against staphylococcus aureus and pseudomonas aeruginosa stains.
3. To determine the minimum inhibitory concentration (MIC) of the extracts.

Collection of plant material

Leaves of S. xanthocarpum were collected from city kovilpatti ,districtthoothukudi, tamilnaduindia. The collected plant material was taken to the laboratory for further analysis.

Process of plant material

Collection and Cleaning of collected leaves from the plant is done.Washedthroughly under tap water.Rinsed with 2% Mercuric chloride solution.Preparation for Drying, Cut the cleaned leaves into smaller pieces to facilitate quicker drying,Drying it in Shade dried the leaves for 20-25 days.Powder Preparation is Crushed the dried leaves into a fine powder using a pestle and mortar.Stored the fine powder in an airtight container at room temperature.[7]

Preparation of plant extract:

Preparation of Methanolic Extract of Solanumxanthocarpum :

Dried leaf material of Solanumxanthocarpum (100g),Methanol (600 ml),Acetone (600 ml), Erlenmeyer flasks,Aluminium foil,Whats-man filter paper no. 2, Rotary evaporator,Stock solution preparation materials (e.g., suitable container for storage, solvent for dilution).Pulverization of Weigh 100 g of dried leaf material of Solanumxanthocarpum.Pulverize the dried leaf material in a blender to obtain a coarse powder.[8]Extraction, Divide the coarse powder into two equal parts (50 g each). Place one part in an Erlenmeyer flask and add 600 ml of methanol.Place the other part in a separate Erlenmeyer flask and add 600 ml of ac…To revive pathogens, the collected samples were introduced into a nutrient broth, which provides essential nutrients to support their growth and proliferation. After revival, these pathogens were transferred and stored on nutrient agar slants at 4°C, ensuring their preservation and viability for future use.[8]

1) Revival in Nutrient Broth:Pathogen samples are added to a nutrient broth, a liquid medium rich in nutrients that facilitate the growth of a wide range of microorganisms. The broth is typically incubated at an appropriate temperature (often 38°C for many pathogens) to allow the organisms to grow and multiply.[9]

2) Transfer to Nutrient Agar Slants:After sufficient growth in the nutrient broth, the pathogens were

International Journal Dental and Medical Sciences Research
Volume 6, Issue 5, Sep - Oct 2024 pp 381-385 www.ijdmsrjournal.com ISSN: 2582-6018

transferred to nutrient agar slants. These slants are tubes of solid agar medium that have been allowed to solidify at an angle to increase the surface area for microbial growth.This transfer is done under sterile conditions to avoid contamination.[9]

3) Storage at 4°C: The inoculated nutrient agar slants are stored at 4°C, a temperature that slows down the metabolic activity of the pathogens, thereby preserving them in a viable but dormant state.[9]This temperature is low enough to prevent the pathogens from growing significantly but not so low as to kill them, ensuring they can be easily revived when needed for further study.This technique is frequently applied in microbiology to preserve and store microbial cultures for long periods of time.[10]

Preparation of Acetone Leaf Extracts of Solanumxanthocarpum :

Preparation of Nutrient Agar Medium: Ingredients used are Yeast extract 4 g, Sodium Chloride 2, pep-tones10 g,Agar 40 g, Distilled Water 2000ml. Then Combine and dissolve all ingredients in distilled water, Adjust the pH to around 7.0, Sterilize by autoclaving at 121.6°C for 30, Preparation of Petri Plates are used to Pour the sterilized nutrient agar medium into sterile Petri plates. Allow the medium to cool and solidify.[11]Preparation of Bacterial Culture are Inoculate the bacteria in nutrient broth and incubate for 24 hours to achieve the log phase of growth.[12]

Agar-Well Diffusion Method are made by Preparation of Spread 100µl of the bacterial suspension uniformly on each nutrient agar plate.Use a sterilized stainless steel cork borer to create 8 mm diameter wells in each Petri plate.[13]

Application of Leaf Extracts are Prepared in different concentrations (30%, 50%, 70%, and 100%) of the methanol and acetone leaf extracts of Solanumxanthocarpum. Load each well with 100µl of the respective extract concentrations.Prepare a control plate with wells containing only the pure solvent (methanol or acetone).[14]

Incubate the plates at 38±2°C for 24 hours in an incubation chamber.After incubation, observe the plates for zones of inhibition around the wells.Measure the diameter of the inhibition zones (including the well diameter) in millimeters.Take readings in perpendicular directions for each well across three replicates to ensure accuracy.Calculate the average diameter of inhibition zones and tabulate the values.[15]

CALCULATION OF PERCENTAGE DIFFERENCES AND SIMPLIFIED PERCENTAGE DIFFERENCE:

Calculation of Percentage Inhibition is Subtract the control inhibition zone diameter (if any) from the inhibition zone diameter of each extract concentration.Use the control value as the standard for calculating the percentage inhibition of bacterial growth.The formula for percentage inhibition can be expressed as:Extract Concentration (%) | Inhibition Zone Diameter (mm) | Average Inhibition Zone (mm) | Control Zone Diameter (mm) | Corrected Inhibition Zone (mm) | Percentage Inhibition (%) |This method provides a comprehensive assessment of the antimicrobial efficacy of the Solanumxanthocarpum leaf extracts at various concentrations.[16]The formula provided calculates the percentage of growth inhibition of bacterial colonies due to a treatment.[16]

This formula gives you the percentage by which the bacterial colonies' diameter in the test group differs from the control group. A positive value would indicate a reduction in diameter in the test group, while a negative value indicates an increase.

$$\text{Percentage difference} = \left(\frac{Difference}{Control}\right) x100$$

Simplified :

$$\text{Percentage difference} = \left(\frac{Control - Test}{Control}\right) x100$$

III. RESULT :

The present study brings out that methanolic and acetone leaf extract of Solanumxanthocarpum andproved itself as good antibacterial agent. The methanolic extracts of S. xanthocarpum showed considerable growth inhibition of test bacteria at different concentrations (30%, 50%, 70%, 100%) as compared to acetone leaf extract of the plant. The methanolic extract of Solanumxanthocarpum was found to be most effective against S. aureus at (18mm at 100%) followed by (15mm at 70%), (13mm at 50%), (11mm at 30%), and it offered minimum inhibition in P. aeruginosa (13mm at

International Journal Dental and Medical Sciences Research
Volume 6, Issue 5, Sep - Oct 2024 pp 381-385 www.ijdmsrjournal.com ISSN: 2582-6018

100%), (11mm at 70%), (9mm at 50%) and (9mm at 30%) as given in table 1 and figure 1.

The acetone extract of Solanumxanthocarpum was found to be most effective against S. aureus at (16mm at 100%) followed by (14mm at 70%), (13mm at 50%), (10mm at 30%), and it showed minimum inhibition towards P. aeruginosa (12mm at 100%), (11mm at 70%), (9mm at 50%) and (Nil at 30%) as given in table 2 and figure 2.

Table 1: DIFFERENT CONCENTRATION OF METHANOLIC EXTRACT OF SOLANUM XANTHOCARPUM

Methanolic extract of Solanum xanthocarpum:

Concentration (%)	Staphylococcus aureus	Pseudomonas aeruginosa
30	11	9
50	13	9
70	15	11
100	18	13

Table 2: DIFFERENT CONCENTRATION OF ACETONE EXTRACT OF SOLANUM XANTHOCARPUM

Acetone extract of Solanum xanthocarpum:

Concentration (%)	Staphylococcus aureus	Pseudomonas aeruginosa
30	10	0
50	13	9
70	14	11
100	16	12

International Journal Dental and Medical Sciences Research
Volume 6, Issue 5, Sep - Oct 2024 pp 381-385 www.ijdmsrjournal.com ISSN: 2582-6018

FIGURE 1: INHIBITION ZONE OF METHANOLIC EXTRACT OF SOLANUM XANTHOCARPUM:

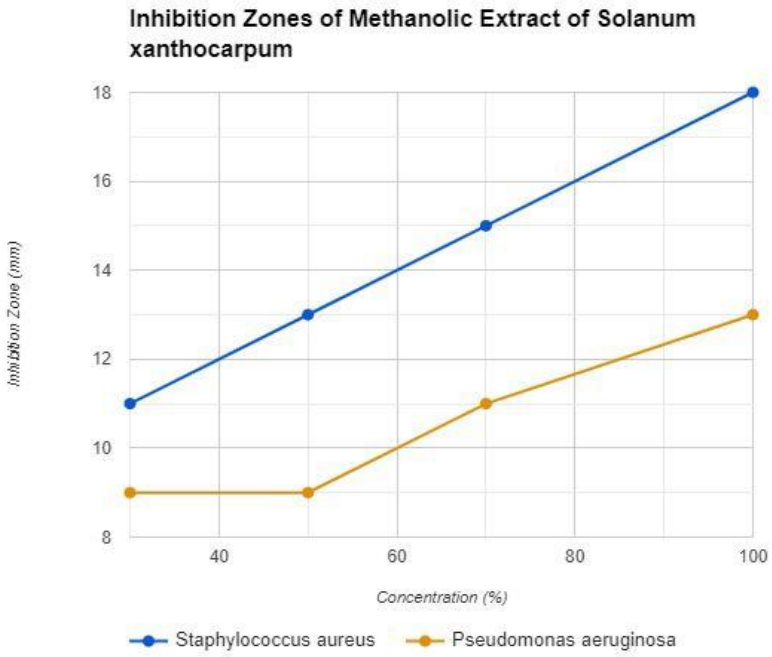
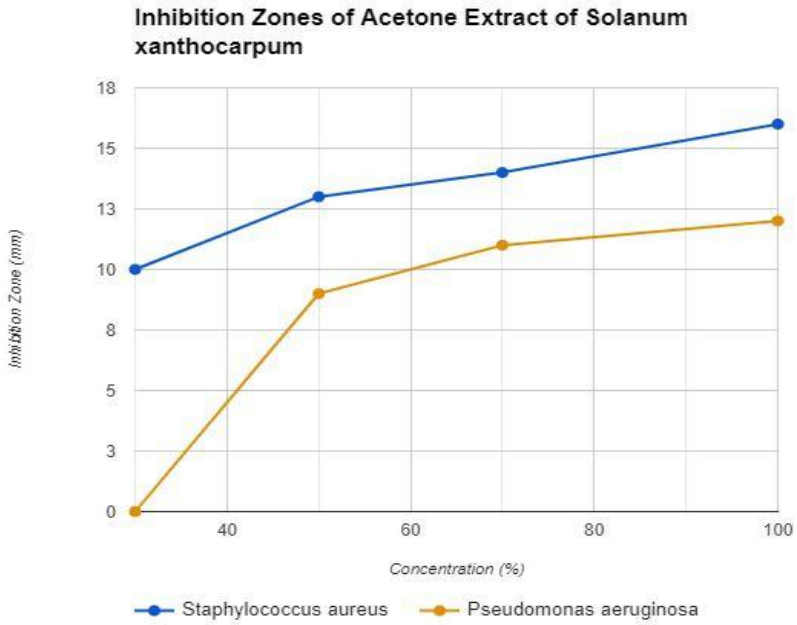


FIGURE 2: INHIBITION ZONE OF ACETONE EXTRACT OF SOLANUM XANTHOCARPUM:



IV. DISCUSSION :

It was concluded from the results that methanolic as well as acetone leaf extract of S. xanthocarpum were quite effective in inhibiting the growth of Staphylococcus aureus which is considered as a serious human pathogen causing infections in wounds. Possible reason for this antibacterial activity of S. xanthocarpum are presence of alkaloids, phenolics and flavanoids in its leaves[17]. Majority of phytochemical components are known to produce the therapeutic activity like antibacterial, antifungal and antioxidant etc[18]. These finding are in accordance with the work carried out by Salie[19]and Kannabiran[20].Our study was also found to be in accordance with the results of on phytochemicals extracted from the leaves of S. xanthocarpum reported by Kumar[21].

V. RECOMMENDATION:

The antifungal, antibacterial, and anti-inflammatory qualities of Solanumxanthocarpum (Kandankathiri) are highlighted and suggest that the ethanol extract from the plant is found to lower inflammation during chronic periods, especially during the proliferative cycle. The fruit may have medicinal potential since it may be more effective than the entire plant at treating inflammation[21].

VI. CONCLUSION :

The study demonstrates that both methanolic and acetone leaf extracts of Solanumxanthocarpum exhibit antibacterial activity, with the methanolic extract showing greater efficacy in inhibiting bacterial growth, particularly against Staphylococcus aureus. This activity is attributed to the presence of phytochemicals such as alkaloids, phenolics, and flavonoids. Further clinical trials are required to confirm its therapeutic potential in humans.

REFERENCE :

[1]. Stuart B. Levy (2002) Factors impacting on the problem of antibiotic resistance Journal of Antimicrobial Chemotherapy Vol. 49;(1): 25-30

[2]. Srivastava J, J., Labert and N. Vietmeyer, (1996) Medicinal plants: An expanding role in development. World Bank Technical, pp; 320.

[3]. Bonjar, S., (2004) Evaluation of Antibacterial Properties of Some Medicinal Plants Used in Iran. J. Ethnopharmacol, 94; 301-05.

[4]. Islam, B.; Khan, S.N.; Haque, I.; Alam, M.; Mushfiq, M.; Khan, A.U. Novel, (2008), Anti-adherence Activity of Mulberry Leaves: Inhibition of Streptococcus mutans Biofilm by 1-Deoxynojirimycin Isolated from Morus alba J. Antimicrob. Chemother; (in press).

[5]. De Boer, H.J.; Kool, A.; Broberg, A.; Mziray, W.R.; Hedberg, I.; Levenfors, J., (2005) Antifungal and Antibacterial Activity of Some Herbal Remedies from Tanzania. J. Ethnopharmacol; 96; 461- 69.

[6]. Amir, M., Kumar, S. 2004. Possible industrial applications of genus Solanum in twenty first century- A review. J. Sci.Ind. Res., 116–124.

[7]. Gavimath, C.C., Kulkarni, S.M., Raorane,C.J., Kalsekar, D.P., Gavade, B.G., Ravishankar, B.E., Hooli, R.S. 2012. Antibacterial potentials of Solanumindicum, Solanumxanthocarpum and Physalis minima. Int. J. Pharma. Appl., 14–41.

[8]. Hemashenpagam, N., Selvaraj, T. 2010. Antibacterial potential of different extracts of Solanumxanthocarpum Chard and Wendt. Pl. Arch., 387–390.

[9]. Kannabiran, K., Kuma, M., Gunasekar, V. 2009. Evaluation of antimicrobial activity of saponin isolated from Solanumxanthocarpum and Centellaasiatica. Int. J. Nat. Engg. Sci., 22–25.

[10]. Kannan, P., Ramadevi, S.R., Hopper, W. 2009. Antibacterial activity of Terminaliachebula fruit extract. Afr. J. Microbiol., 180–184.
[11]. Kumar, R.U., Velmurugank, D., Srinivasan, R., Krishna, R. 2003. Phytochemical and antimicrobial studies of extracts of Solanumxanthocarpum. Ancient Sci. Life, 1–5.
[12]. Neelima, N., Devidas, N.G., Sudhaker, M., Kiran, V. 2012. Prelimnary phytochemical investigations on the leaves of Solanumxanthocarpum. Int.J. Res. Ayurveda and Pharm., 845–850.
[13]. Oudhia, P., KaduPani, A. 2007. SpeciallyPrepared Herbal Decoction for Body Int.J.Curr.Microbiol.App.Sci (2016) 5(4): 323-328Wash Used by the Chhattisgarh, India November 16, 2010).
[14]. Verbist, J.F., Monnet, R. 1974. Steroid alkaloids in Solanumxanthocarpum: Cultivated in the nantes region France. Pl. Med., 269–280.
[15]. Yoshida, T., Yokoyama, K., Namba, O., Okuda, T. 1991. Tannins and related polyphenols of Euphorbiaceous plants: 7 tirucallin-a, tirucallinb and euphorbin- f, monomeric and dimeric ellagitannins from Euphorbia tirucalli L. Chem. Pharm., 1137–1143.
[16]. Aas, J. A., Paster, B. J., Stokes, L. N., Olsen, I. and Dewhirst, F. E. (2005). Defining the normal bacterial flora of the oral cavity. Journal of clinical microbiology, 43(11), 5721–5732.
[17]. Abbas, K., Niaz, U., Hussain, T. Saeed, M. A, Javaid Z. and Idrees, A. (2014). Antimicrobial activity of fruits of Solanum nigrum and Solanumxanthocarpum. Acta Pol. Pharm., 71, 415-42.
[18]. Aksoy, A., Duran, N., Toroglu, S. and Koksal, F. (2007). Short- term effect of mastic gum on salivary concentrations of cariogenic bacteria on in orthodontic patient. Angle. Orthod., 77, 124-128.Antimicrobial effect Pistacia atlantica leaf extract. Bioinformation, 12, 19-21.
[19]. Salie, F., Eagles, P.F.K., Leng, H.M.J. 1996. Preliminary antimicrobial screening of four South African Asteraceae species. J. Ethnopharmacol., 27–33.
[20]. Kannabiran, K., Kuma, M., Gunasekar, V. 2009. Evaluation of antimicrobial activity of saponin isolated from Solanumxanthocarpum and Centellaasiatica. Int. J. Nat. Engg. Sci., 22–25
[21]. Kumar, R.U., Velmurugank, D., Srinivasan, R., Krishna, R. 2003. Phytochemical and antimicrobial studies of extracts of Solanumxanthocarpum. Ancient Sci. Life, 1–5.