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Preparation of Mouth Wash Using *Musa sapientum* Mediated Silver Nanoparticles and Its Antimicrobial Activity

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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Original Research Article

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ABSTRACT

Introduction: *Musa sapientum* are primarily grown in tropical and subtropical countries, and are commonly used around the world for their nutritional values. Peels were examined for mineral, nutritional content. The product of the mineral content is that the concentration of potassium, calcium, magnesium, iron, manganese, bromine, and rubidium are high. *M. sapientum* pulp showed high antimicrobial activity against 13 gram-positive and gram-negative bacteria.
Materials and Methods: The plant extract was prepared. Silver nanoparticles were taken in the form of AgNO3. The plant extract was tested for its anti-inflammatory activity by protein denaturation assay. To assess the antimicrobial activity, the prepared extract was inoculated in different culture plates containing different microorganisms. The results obtained were collected and statistically analyzed in SPSS software and graphs were obtained.
Results: Analysis of antimicrobial activity shows The zone of inhibition in Mueller Hinton agar showed *C. albicans* zone of inhibition in the cultured plate with the diameter of 10 mm, 12 mm and

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25 mm in 25 µL, 50 µL, and 100 µL respectively. *S. mutans* zone of inhibition in the cultured plate with the diameter of 15 mm, 18 mm, and 22 mm at 25 µL, 50 µL, and 100 µL respectively.
Conclusion: From the results obtained and analyzed we may conclude that silver nanoparticles synthesized using *Musa sapientum* extract can be used as a good anti-microbial agent. Its anti-microbial activity can be enhanced by increasing the concentration. Hence furt her advancements in this study could lead to producing and marketing natural product-based antimicrobial and anti-inflammatory agents.

Keywords: Anti-microbial; Musa sapientum; mouth wash; Muller Hinton agar; silver nanoparticles; green synthesis.

1. INTRODUCTION

Musa sapientum is primarily grown in tropical and subtropical countries, and are commonly used around the world for their nutritional values [1]. *Musa sapientum* popularly known as 'banana' is used predominantly in Indian folk medicine for the treatment of diabetes mellitus [2]. Peels were examined for mineral and nutritional content. The product of the mineral content is that the concentration of potassium, calcium, magnesium, iron, manganese, bromine, and rubidium are high [3]. The peels of *Musa sapientum* fruits have gained recognition as a natural source of antioxidants and phytochemicals abundant in free radical scavenging compounds [4,5]. *Musa sapientum* overcomes sprue, uremia, nephritis, and gout [6]. *Musa sapientum* tends to have prominent antidiabetic anti-ulcer agents [7] antioxidant and anti-inflammatory effects [8,9].

Metallic silver nanoparticles have made a remarkable return as a possible antimicrobial agent [10]. Antimicrobial action of silver nanoparticles against *yeast, Escherichia coli, and Staphylococcus aureus* has been investigated and is successful [11]. Silver nanoparticles have gained recognition related to physical, chemical, and biological properties, which have been linked to catalytic action and bactericidal effects and have been used in nanobiotechnology study [12].

Antimicrobial activity means the killing or inhibition of microbial disease [13]. Both research samples had strong inhibitory effects on the bacteria community examined under the parameters. Unripe banana has a high antimicrobial activity for all test species with a zone of 8 mm. *M. sapientum* pulp showed high antimicrobial activity against 13 gram-positive and gram-negative bacteria [14].

Both plankton and biofilm types present periodontal bacteria [15]. Although bad oral hypothesis results in bacterial aggregation, the first step to successful oral hygiene is the elimination of these microbes. Usually, this is done by using mouthwash solutions [16]. Mouthwashes typically have bacteria-struggling components. Zinc gluconate, quaternary ammonium, and cetylpyridinium chloride, and essential oils are among these additives [17]. Mouthwash is usually an antiseptic solvent to cleanse or revitalize the mouth and teeth [18]. The study aims to evaluate *Musa sapientum* mediated silver nanoparticle *mouthwash and its* antimicrobial activity.

2. MATERIALS AND METHODS

2.1 Preparation of Plant Extract

The samples were collected by using a Randomized sampling method. Dried, crushed, and powdered roots of *Musa sapientum* were used to prepare the extract (Fig. 1). The plant extract was purchased in a readymade manner for this study. 0.5 g of Preparation of plant extract *Musa sapientum* extract was added to 100 ml of distilled water and was boiled for 5 minutes at 50 degrees Celsius. Now the solution was filtered. 1millimolar of Silver nitrate was dissolved in 80 ml of distilled water. Then 20% filtered plant extract was added with an 80% nano mixture to prepare the extract of *Musa sapientum* assisted with silver nanoparticles. (Figs. 2,3) Then the sample of extracts was placed in different cultures plate to observe the zone of inhibition and was recorded.

2.2 Antimicrobial Activity

Antibacterial activity of respective nanoparticles against the strain *Staphylococcus aureus, Bacillus, and E. coli.* Muller Hinton agar (MHA) agar was utilized for this activity to determine the zone of inhibition. Muller Hinton agar was prepared and sterilized for 45 minutes at 120lbs. Media poured into the sterilized plates and let

stabilize for solidification. The wells were cut using the good cutter and the test organisms were swabbed. The nanoparticles with different concentrations were loaded and the plates were incubated for 24 hours at 37°C. After the incubation time the zone of inhibition was measured. Multiple culture plate study to be done for analyzing the zone of inhibition. Validation of the procedure was done by a nano research guide.

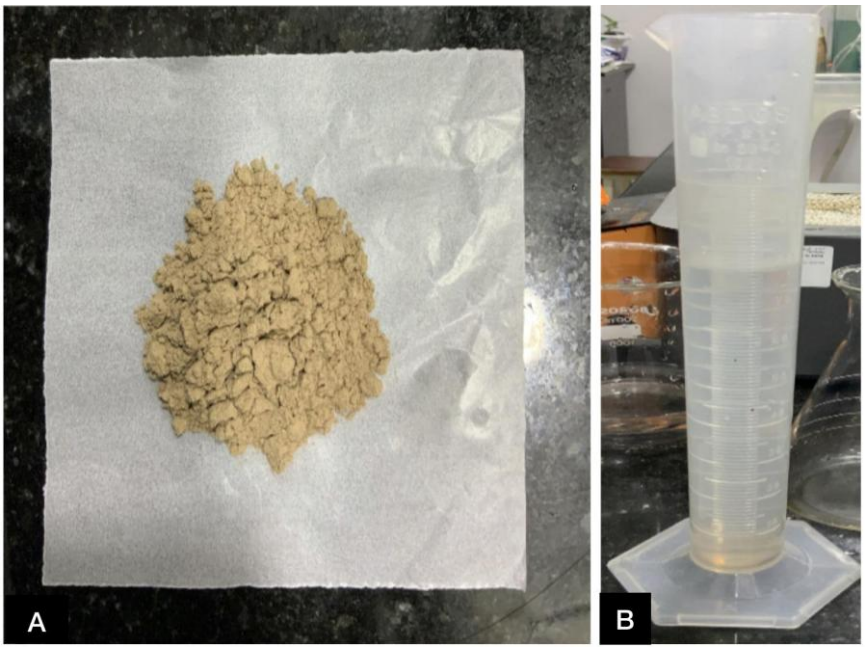

Fig. 1. A) Commercially available powdered extract of *Musa sapientum*, B) *Musa sapientum* plant extract

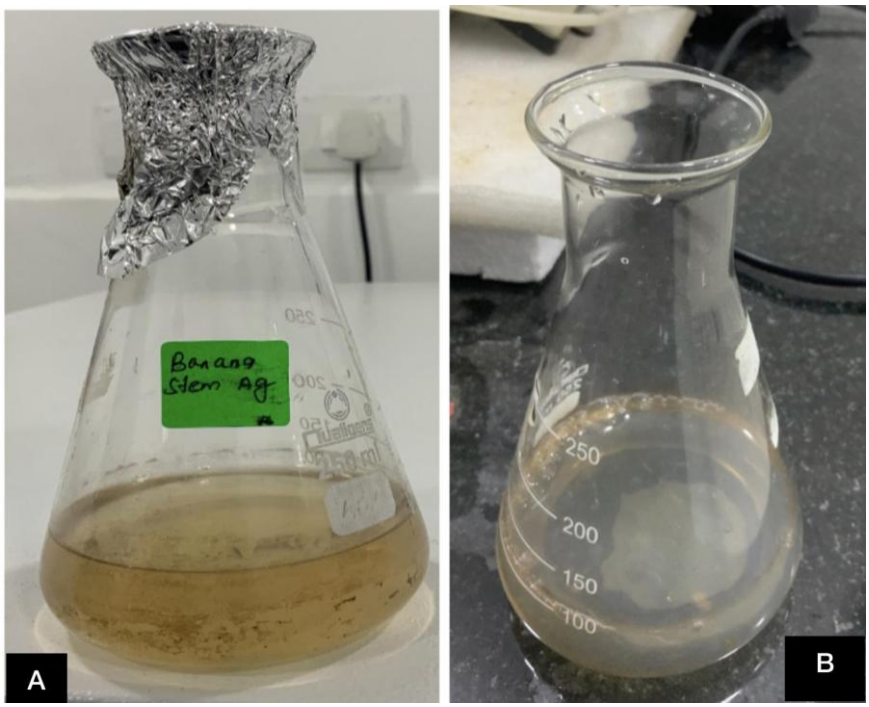

Fig. 2. Image showing the preparation of *Musa sapientum* mediated silver nanoparticles. A - *Musa sapientum* extract. B - Silver nanoparticles solution

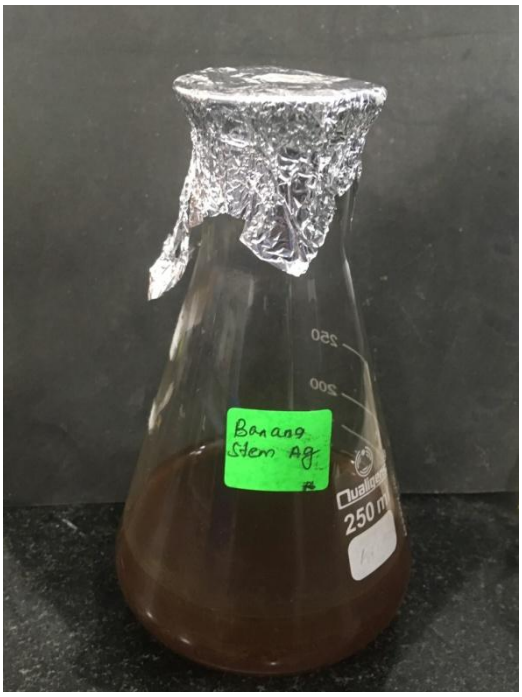

Fig. 3. The characteristic color and property of the prepared extract are observed. There was also a characteristic color change observed after the filtration of the extract

The correlation analysis was done to analyze the antimicrobial activity of silver nanoparticles synthesized using *Musa sapientum* using SPSS. Also to analyze the cytotoxic and antitumor property of *Musa sapientum*.

3. RESULTS AND DISCUSSION

By observing the prepared extract a characteristic color change was observed. The silver nanoparticles synthesized using *Musa sapientum* plant extract showed various color changes in the due course of shaking and mixing. The zone of inhibition in Mueller Hinton agar showed *C.albicans* zone of inhibition in the cultured plate with the diameter of 10 mm, 12 mm, and 25 mm in 25 µL, 50 µL, and 100 µL respectively. *S.mutans* zone of inhibition in the cultured plate with the diameter of 15 mm, 18 mm, and 22 mm at 25 µL, 50 µL, and 100 µL respectively. *S.aureus* zone of inhibition in the cultured plate with the diameter of 9 mm, 9 mm, and 9 mm at 25 µL, 50 µL, and 100 µL respectively (Fig. 4). The extract of *Musa sapientum* with silver nanoparticles has shown better results in antimicrobial activity than the existing antibiotic against *C. albicans* (Fig. 5). The antimicrobial activity against *C. albicans* shows a good zone of inhibition in the cultured plate with the diameter of 10 mm, 12 mm and 25 mm in 25 µL, 50 µL and 100 µL respectively. The antibiotic-containing well showed inhibition of 20 mm.

In a previous study by [19] the zone of inhibition of *C. albicans* against Ag-Nps increased with an increase in the concentration of Ag-Nps in agar well. Which is similar to our study. In a previous study by [20] the zones of inhibition were 9 mm, 10 mm, and 12 mm at 50 µL, 100 µL, 150 µL respectively against *C. albicans.* The antimicrobial effect kept increasing as concentration increased, similar to our study.

The extract of *Musa sapientum* with silver nanoparticles has shown better results in antimicrobial activity than the existing antibiotic against *S. mutans.* The antimicrobial activity against *S. mutans* shows a good zone of inhibition in the cultured plate with the diameter of 15 mm, 18 mm and 22 mm in 25 µL, 50 µL, and 100 µL respectively. The antibiotic-containing well showed inhibition of 23 mm.

In previous research by [21] Ag-NPs zones of inhibition against *S. mutans* were measured as 14 mm, 15 mm, and 20 mm in 50 µL,100 µL, 150 µL. Our study had proved better than this study. In a previous study by Swarna Maiti et al Ag-NPs exhibited their antimicrobial activity (MIC) against *S. mutans* at 50 µL.

The extract of *Musa sapientum* with silver nanoparticles has shown decreased antimicrobial activity than the existing antibiotic against *S. aureus.* The antimicrobial activity against *S. aureus* shows a good zone of inhibition in the cultured plate with the diameter of 9 mm, 9 mm, and 9 mm in 25 µL, 50 µL, and 100 µL respectively. The antibiotic-containing well showed inhibition of 20 mm. The antimicrobial activity remains the same as the concentration increases.

In a previous study by [19] Ag-NPs activity against *S. aureus* was recorded as a zone of inhibition of 9 mm, 18 mm, and 20 mm in 50 µL,100 µL, 150 µL respectively. Unlike our study, the activity kept increasing as concentration increased. In a previous study by anima nanda activity of Ag-NPs remained constant even when concentrations of extract were increased [22].

According to the findings of the research study, unripe bananas have an antimicrobial function and are thus medicinal plants [23]. The potency of unripe banana plants was found to be improved by the form of solvent used in this analysis, suggesting that some of the active ingredients in these medicinal plants dissolve better in ethanol than in water. When used with two different solvents (ethanol and water), unripe bananas had more antibacterial activity than

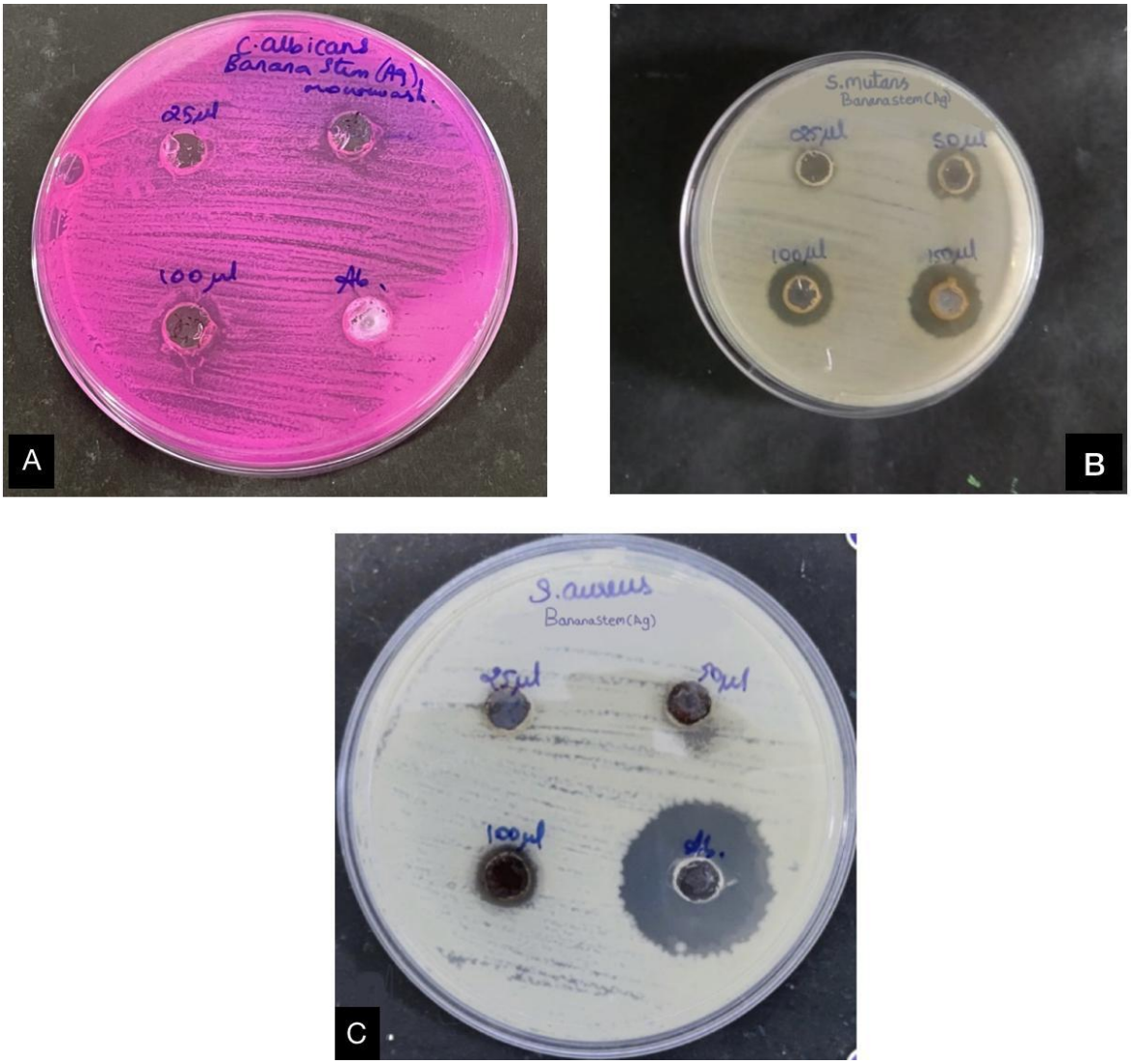

Fig. 4. Antimicrobial activity seen in agar plates at different concentrations. In plate A, the zone of inhibition of *C. albicans* was observed at different concentrations. In plate B, the zone of inhibition of *S. mutans* at different concentrations was observed. In plate C, the zone of inhibition of *S. aureus* was observed at different concentrations

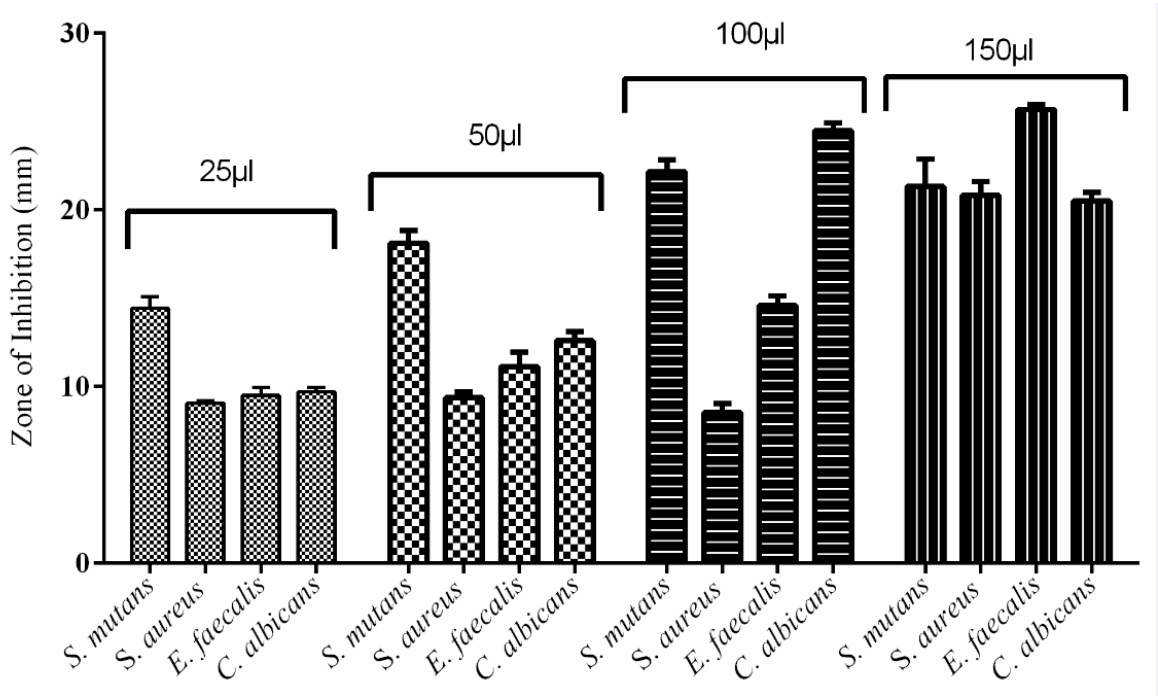

Fig. 5. The graph represents the antimicrobial activity of *Musa sapientum* extract over different microorganisms. The X-axis represents different concentrations and the Y-axis represents a zone of inhibition of the extract of *C. albicans*, *S. mutans, S. aureus*, and the standard antibiotic at different concentrations. *C. albicans* , *S. mutans* showed an increased zone of inhibition at 50 µL and 100 µL

lemongrass and turmeric, which had a strong antibacterial activity with the only ethanolic extract. Unripe bananas have antimicrobial properties, according to the researchers [24]. This suggests that there is already a lot to be gained by using medicinal plants as an antimicrobial pointer to new sources of experimental medicines, which needs further study. Many plants are used in Nigeria to cure various diseases in the form of rudimentary oils, infusions, and plasters, with little clear proof of efficacy [25]. Limitations of the study, Lower concentration of extract is taken, Multiple culture plates should be done and Multiple activity tests should be done. Future research with this combination can lead to effective mouthwash with a greater antimicrobial effect. Our team has extensive knowledge and research experience that has translate into high quality publications [26,27–40,41-45].

4. CONCLUSION

The combination of *Musa sapientum* with silver nanoparticles has shown an effective antimicrobial property against *Candida albicans and S. mutans.* But no effect was seen against *S. aureas.* Further research on this combination can lead to a better antibiotic with enhanced antimicrobial effect than the existing mouthwashes.

CONSENT

It is not applicable.

ETHICAL APPROVAL

It is not applicable.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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