
| RESEARCH ARTICLE**Evaluation of Sugarcane Juice As A Natural Antibacterial Agent Against *Staphylococcus aureus* From Human Wounds****Daminabo Victoria^{1✉}, Okorite George-West² and Anele Bright Chidi³**^{1,&2}Department of Science Laboratory, Captain Elechi Amadi Polytechnic, Rumuola, Port Harcourt, Rivers State, Nigeria³Department of Microbiology, Madonna University, Nigeria, Elele, Rivers State**Corresponding Author:** Daminabo Victoria, **E-mail:** vicjodish@yahoo.co.uk**| ABSTRACT**

Wound infections caused by *Staphylococcus aureus* infection remain a significant public health challenge due to delayed wound healing, prolonged hospitalization, and increasing antimicrobial resistance. This study evaluated the antibacterial activity of fresh sugarcane juice (*Saccharum officinarum*) against *Staphylococcus aureus* isolated from human wound patients attending selected healthcare facilities in Rumuola, Rivers State, Nigeria. A laboratory-based experimental design was employed involving the collection of wound swab samples, bacterial isolation and identification using standard microbiological techniques, and antibacterial susceptibility testing using the agar well diffusion method. Different concentrations of sugarcane juice were tested against standardized bacterial isolates, while a conventional antibiotic served as the positive control. The results revealed that sugarcane juice exhibited concentration-dependent antibacterial activity against *Staphylococcus aureus*. The highest inhibition zone was observed at 100% concentration with a mean inhibition diameter of 24mm, whereas lower concentrations produced smaller inhibition zones. Traumatic wounds recorded the highest frequency of *Staphylococcus aureus* isolates among the wound categories examined. Comparative analysis showed that the standard antibiotic demonstrated greater antibacterial activity with a mean inhibition zone of 31mm. Despite its lower efficacy compared to the antibiotic control, sugarcane juice displayed notable antibacterial properties, suggesting the presence of bioactive phytochemical compounds with therapeutic potential. The study concludes that sugarcane juice may serve as a promising natural source of antimicrobial agents for complementary wound infection management and future pharmaceutical development.

| KEYWORDSSugarcane juice, *Staphylococcus aureus* infection, Antibacterial Activity, Wound Infection, Phytochemical Compounds**| ARTICLE INFORMATION****ACCEPTED:** 23 April 2026**PUBLISHED:** 21 May 2026

1. Introduction

Wound infections remain a major public health concern worldwide due to their significant contribution to prolonged hospitalization, delayed tissue healing, increased healthcare costs, and mortality. The disruption of skin integrity creates a favourable environment for microbial colonization and infection, particularly by opportunistic bacterial pathogens. Among these pathogens, *Staphylococcus aureus* is one of the most frequently isolated organisms from infected wounds and is recognized for its virulence, adaptability, and increasing resistance to conventional antimicrobial agents (Morguette et al., 2023; Sharma & Kalita, 2025). The organism is capable of producing several virulence factors, including toxins, enzymes, and biofilm-forming structures that enhance tissue invasion and resistance to host immune responses.

The global emergence of multidrug-resistant *Staphylococcus Aureus*, especially methicillin-resistant *Staphylococcus aureus* (MRSA), has intensified the challenge of wound management and infection control. Antibiotic resistance has reduced the

effectiveness of many commonly used antimicrobial drugs, thereby increasing the need for alternative and complementary therapeutic approaches (Woo et al., 2023). In many developing countries, including Nigeria, the burden of antimicrobial resistance is compounded by limited access to effective healthcare, self-medication practices, and the indiscriminate use of antibiotics. Consequently, there is growing scientific interest in natural products and medicinal plants as potential sources of novel antimicrobial compounds.

Plant-derived substances have historically played an important role in traditional medicine and drug discovery. Recent studies have shown that several medicinal plants possess antibacterial, anti-inflammatory, antioxidant, and wound-healing properties due to the presence of bioactive phytochemicals such as flavonoids, alkaloids, tannins, phenols, saponins, and terpenoids (Breijyeh & Karaman, 2024). These natural compounds may inhibit bacterial growth through different mechanisms, including disruption of cell membranes, inhibition of protein synthesis, suppression of biofilm formation, and interference with bacterial metabolic pathways. The renewed interest in phytomedicine has therefore encouraged the scientific evaluation of edible plants and fruits traditionally used for health promotion and infection management.

Sugarcane is a major tropical crop of considerable nutritional, industrial, and medicinal importance, extensively cultivated across many regions of the world, including Nigeria. In addition to its economic value, fresh sugarcane juice is rich in bioactive phytochemical compounds such as polyphenols, flavonoids, organic acids, and naturally occurring sugars, many of which have been associated with antimicrobial, antioxidant, and anti-inflammatory properties. Recent scientific interest in plant-derived therapeutic agents has stimulated investigations into the potential health benefits of sugarcane and its by-products. Emerging evidence indicates that sugarcane-derived substances may possess inhibitory effects against certain pathogenic microorganisms while also supporting tissue healing and immune responses. Nevertheless, despite the growing global interest in natural antimicrobial alternatives, there remains a paucity of well-documented scientific studies evaluating the antibacterial efficacy of fresh sugarcane juice against clinical isolates of *Staphylococcus aureus* infection recovered from infected human wounds (Singh & Rao, 2024).

The exploration of natural antibacterial agents from readily available plant sources is particularly important in resource-limited settings where access to advanced antimicrobial therapies may be restricted. Furthermore, the identification of affordable and locally accessible bioactive substances could contribute to the development of complementary strategies for wound infection management. Scientific validation of the antibacterial potential of sugarcane juice may also provide a basis for future pharmacological investigations and the development of plant-based antimicrobial formulations (Sharma & Kalita, 2025).

Therefore, this study was designed to evaluate the antibacterial activity of sugarcane juice against *Staphylococcus aureus* isolated from human wound patients attending selected healthcare facilities. The study seeks to contribute to the growing body of evidence on natural antimicrobial agents and their possible application in combating wound-associated bacterial infections.

2. Literature review

2.1 Overview of Sugarcane

Sugarcane is a tropical crop widely cultivated for its high sucrose content and economic importance. It belongs to the family Poaceae and is scientifically known as *Saccharum officinarum*. Apart from its industrial use in sugar production, sugarcane juice has been traditionally consumed as a refreshing beverage and used in folk medicine for its perceived therapeutic properties. The juice contains carbohydrates, vitamins, minerals, phenolic compounds, flavonoids, and antioxidants which may contribute to its medicinal value (Miglani et al., 2023). Recent scientific studies have explored the antimicrobial potential of plant-derived substances, including sugarcane juice, against pathogenic microorganisms (Woo et al., 2023).

2.2 Composition and Nutritional Properties of Sugarcane Juice

Sugarcane juice is rich in natural sugars such as sucrose, glucose, and fructose. It also contains calcium, magnesium, potassium, iron, and vitamins including vitamin C and B-complex vitamins. Additionally, bioactive compounds such as flavonoids, polyphenols, and organic acids are present in the juice. These compounds are believed to possess antioxidant and antimicrobial activities (Barrera et al., 2020; Shafiqa-Atikah et al., 2020). The presence of phytochemicals in sugarcane juice has attracted attention in medical and microbiological research as potential alternatives to synthetic antimicrobial agents.

2.3 Antibacterial Properties of Plant-Based Natural Products

Natural plant products have long been used in traditional medicine for the treatment of infections and wounds. Many medicinal plants contain phytochemicals capable of inhibiting the growth of bacteria, fungi, and other pathogens. Due to the increasing problem of antibiotic resistance, researchers are investigating plant extracts as possible sources of new antibacterial agents (Breijyeh & Karaman, 2024). Studies have shown that compounds such as tannins, flavonoids, alkaloids, and phenols can disrupt

bacterial cell walls and interfere with microbial metabolism (Shafiq-Atikah et al., 2020). Sugarcane juice, being rich in some of these bioactive substances, may therefore exhibit antibacterial properties against pathogenic bacteria (Singh & Rao, 2024).

2.4 *Staphylococcus aureus* and Human Wound Infections

Staphylococcus aureus is a Gram-positive bacterium commonly associated with skin and soft tissue infections. It is one of the major pathogens isolated from infected human wounds and can cause severe systemic diseases. Some strains, particularly Methicillin-Resistant *Staphylococcus aureus* (MRSA), have developed resistance to multiple antibiotics, making treatment difficult (Osei et al., 2023). This growing resistance has created a need for alternative antimicrobial agents derived from natural sources (Sharma & Kalita, 2025).

2.5 Wound Infections and Challenges of Antibiotic Resistance

Wound infections remain a significant public health concern worldwide. Poor wound management and emergence of resistant bacterial strains contribute to delayed healing and increased healthcare costs. Antibiotic resistance among *Staphylococcus Aureus* strains has become a major clinical challenge (Osei et al., 2023). Consequently, attention has shifted toward natural antimicrobial substances that may provide safer and affordable treatment options (Woo et al., 2023).

2.6 Previous Studies on the Antimicrobial Activity of Sugarcane Juice

Several studies have reported that sugarcane contains compounds with antioxidant, anti-inflammatory, and antimicrobial activities (Singh & Rao, 2024). Sugarcane-derived products such as molasses and bagasse extracts have demonstrated inhibitory effects against pathogens including *Staphylococcus aureus* (Charoensopa et al., 2024; Hernández-López et al., 2024). However, most studies focus on processed derivatives rather than fresh sugarcane juice, leaving a gap in knowledge regarding its direct antibacterial effect on wound pathogens.

2.7 Knowledge Gap

Although plant extracts have been widely studied for antimicrobial activities, limited documented evidence exists on the effectiveness of fresh sugarcane juice against *Staphylococcus aureus* isolated from human wounds. Most research emphasizes sugarcane's nutritional and industrial applications rather than its medicinal potential (Iwuozor et al., 2022). Therefore, this study seeks to evaluate the antibacterial activity of sugarcane juice against *Staphylococcus aureus* from human wounds and determine its potential as a natural antibacterial agent (Morguette et al., 2023).

3. Materials and Methods

3.1 Study Area

This study was conducted in selected healthcare facilities located in Rumuola, Obio/Akpor Local Government Area of Rivers State, Nigeria. Rumuola is a densely populated urban community within Port Harcourt metropolis characterized by increased commercial activities and a growing population. The healthcare facilities selected for this study regularly attend to patients presenting with different categories of wounds, including surgical wounds, traumatic wounds, diabetic ulcers, and infected skin lesions.

3.2 Study Design

A laboratory-based experimental study design was adopted to evaluate the antibacterial activity of sugarcane juice against *Staphylococcus aureus* isolated from wound patients. The study involved the collection of wound swab samples, isolation and identification of bacterial pathogens, preparation of sugarcane juice extracts, and assessment of antibacterial activity using standard microbiological procedures.

3.3 Sample Collection

Wound swab samples were collected aseptically from patients attending selected healthcare facilities in Rumuola. Sterile swab sticks were used to obtain samples from infected wound sites following standard clinical procedures. The samples were immediately transferred into sterile transport media and transported to the microbiology laboratory for bacteriological analysis within a few hours of collection.

3.4 Isolation And Identification Of *Staphylococcus Aureus*

The wound swab samples were inoculated onto Mannitol Salt Agar (MSA) and Blood Agar plates using the streak plate technique. The inoculated plates were incubated aerobically at 37°C for 24–48 hours. Colonies showing characteristic golden-yellow pigmentation on Mannitol Salt Agar were further examined.

Preliminary identification was carried out based on colony morphology, Gram staining reaction, and biochemical characteristics. Gram-positive cocci arranged in clusters were subjected to catalase and coagulase tests for confirmation of *Staphylococcus aureus*. Isolates that were catalase-positive and coagulase-positive were identified as *Staphylococcus aureus*.

3.5 Collection and Preparation of Sugarcane Juice

Fresh mature sugarcane stems (*Saccharum officinarum*) were obtained from local vendors within Port Harcourt, Rivers State. The sugarcane stems were thoroughly washed with clean water followed by sterile distilled water to remove surface contaminants. The outer bark was carefully peeled under aseptic conditions, and the inner portion was crushed mechanically to obtain fresh juice.

The extracted juice was filtered using sterile muslin cloth and Whatman No. 1 filter paper to remove suspended particles and debris. The filtrate was collected in sterile containers and stored at 4°C prior to use. Different concentrations of the sugarcane juice were prepared using sterile distilled water for antibacterial susceptibility testing.

3.6 Standardization of Bacterial Inoculum

Pure colonies of confirmed *Staphylococcus aureus* isolates were inoculated into sterile nutrient broth and incubated at 37°C for 18–24 hours. The turbidity of the bacterial suspension was adjusted to correspond with 0.5 McFarland standard, equivalent to approximately 1.5×10^8 CFU/mL.

3.7 Antibacterial Susceptibility Testing

The antibacterial activity of sugarcane juice against *Staphylococcus aureus* isolates was determined using the agar well diffusion method. Sterile Mueller–Hinton agar plates were prepared according to the manufacturer's instructions. Standardized bacterial inocula were evenly spread on the surface of the agar plates using sterile swab sticks.

Wells of approximately 6 mm diameter were aseptically bored into the agar using a sterile cork borer. Different concentrations of sugarcane juice were carefully dispensed into the wells. Sterile distilled water was used as the negative control, while a standard antibiotic disc was used as the positive control.

The plates were allowed to stand for diffusion at room temperature for about 30 minutes and subsequently incubated at 37°C for 24 hours. After incubation, the zones of inhibition around each well were measured in millimeters using a transparent ruler. The antibacterial activity was determined based on the diameter of the inhibition zones produced.

3.8 Determination of Minimum Inhibitory Concentration (MIC)

The minimum inhibitory concentration of sugarcane juice against the isolates was determined using the broth dilution method. Serial dilutions of the juice were prepared in sterile nutrient broth tubes containing standardized bacterial inocula. The tubes were incubated at 37°C for 24 hours and examined for visible turbidity. The lowest concentration of sugarcane juice that inhibited visible bacterial growth was recorded as the MIC.

3.9 Data Analysis

The experimental data obtained were organized and analyzed using descriptive statistical methods. Results were presented in tables and charts as mean values and standard deviations where appropriate. The antibacterial activity of different concentrations of sugarcane juice against *Staphylococcus aureus* isolates was compared and interpreted accordingly.

3.10 Ethical Consideration

Ethical approval for the study was obtained from the relevant healthcare authorities and ethical review committee of the participating healthcare facilities. Informed consent was obtained from patients before sample collection, and all information obtained during the study was treated with confidentiality. Standard biosafety and laboratory safety guidelines were strictly observed throughout the study.

4. Results

The antibacterial activity of different concentrations of sugarcane juice against *Staphylococcus aureus* isolated from human wound samples is presented below. The results demonstrated concentration-dependent antibacterial activity, with higher concentrations producing larger zones of inhibition against the test organism.

4.1 Distribution of *Staphylococcus aureus* Isolates from Wound Samples

Frequency of *Staphylococcus aureus* isolated from different wound categories among patients attending selected healthcare facilities.

Figure 1 shows the distribution of *Staphylococcus aureus* isolates obtained from different wound categories. Traumatic wounds recorded the highest frequency of isolates (24), followed by surgical wounds (18), while burn wounds had the lowest frequency (10).

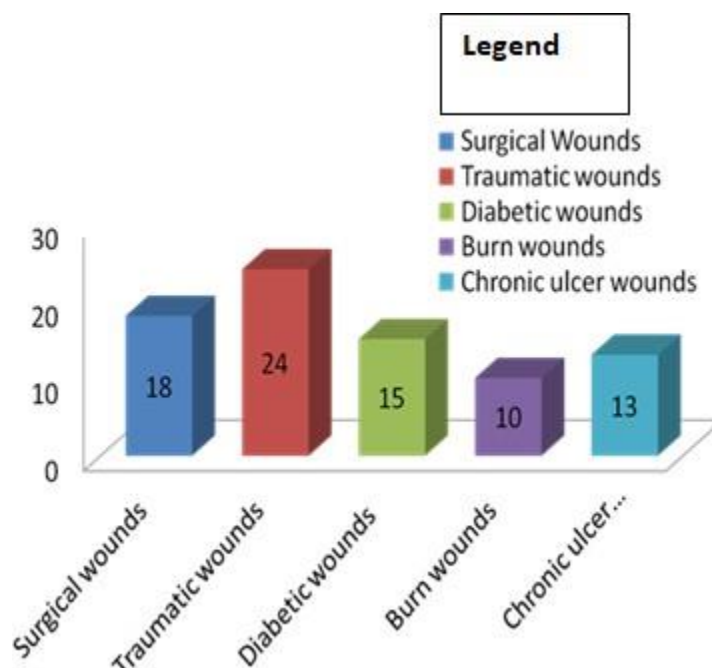


Figure 1: Distribution of *Staphylococcus aureus* isolates obtained from different wound categories of selected Healthcare facilities in Rumuola, Rivers State, Nigeria

4.2 Antibacterial Activity of Different Concentrations of Sugarcane Juice against *Staphylococcus aureus*

Figure 2 demonstrates the antibacterial activity of sugarcane juice against *Staphylococcus aureus*. The result revealed a progressive increase in antibacterial activity with increasing concentration of sugarcane juice. The highest inhibition zone was observed at 100% concentration (24 mm), while the lowest activity occurred at 20% concentration (7 mm).

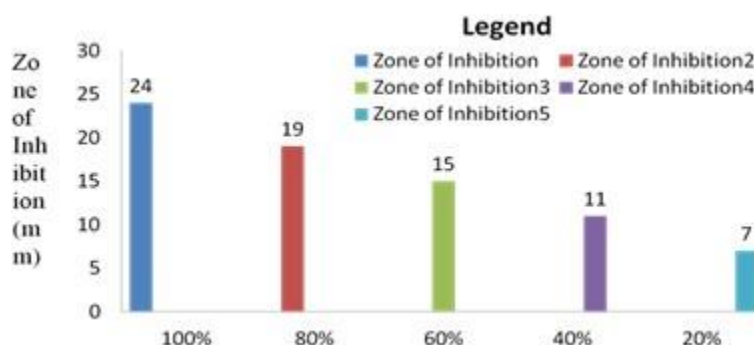


Figure 2: Antibacterial Activity of different concentrations of Sugarcane juice against *Staphylococcus aureus* isolated from different wounds

4.3 Comparison Between Sugarcane Juice and Standard Antibiotic against *Staphylococcus aureus*

A comparative evaluation of the antibacterial activity of sugarcane juice and the standard antibiotic control against *Staphylococcus aureus* infection revealed that the standard antibiotic exhibited stronger antibacterial efficacy. The standard antibiotic produced a mean zone of inhibition of 31 mm, whereas sugarcane juice showed a comparatively lower mean inhibition

zone of 24 mm, indicating that although sugarcane juice possesses notable antibacterial properties, its activity was less pronounced than that of the conventional antibiotic control.

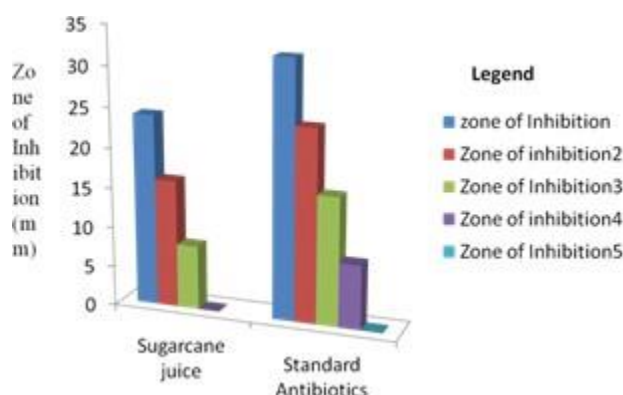


Figure 3: Comparison between Sugarcane Juice and Standard Antibiotic against *Staphylococcus aureus*

5. Discussion

The present study investigated the antibacterial activity of sugarcane juice against *Staphylococcus aureus* isolated from human wound infections. The findings demonstrated that sugarcane juice possesses measurable inhibitory activity against the test organism, supporting the growing scientific interest in plant-derived antimicrobial agents for wound infection management.

The high occurrence of *Staphylococcus aureus* isolates in traumatic and surgical wounds observed in Figure 1 agrees with the findings of Osei et al. (2023), who reported that *Staphylococcus aureus* remains one of the predominant bacterial pathogens associated with wound infections in healthcare facilities. The high prevalence of the organism in wound environments may be associated with its ability to colonize damaged tissues, survive under stressful environmental conditions, and form protective biofilms that enhance persistence and pathogenicity.

The present study further revealed that the antibacterial activity of sugarcane juice increased with increasing concentration, as shown in Figure 2. This concentration-dependent inhibitory effect suggests that sugarcane juice contains bioactive phytochemical constituents capable of suppressing bacterial growth. The finding agrees with the report of Morquette et al. (2023), who stated that natural plant products rich in flavonoids, tannins, phenolic compounds, and organic acids exhibit significant antibacterial activity against *Staphylococcus aureus*. The progressive increase in inhibition zones at higher concentrations may therefore be attributed to increased availability of these active phytochemicals.

The antibacterial activity observed in this study is also consistent with the findings of Singh and Rao (2024), who reported that sugarcane extracts demonstrated inhibitory effects against several Gram-positive bacterial pathogens due to the presence of polyphenolic compounds and natural antioxidants. Similarly, Breijyeh and Karaman (2024) emphasized that medicinal plant products possess antibacterial and wound-healing properties capable of reducing microbial colonization in infected wounds.

The observed antibacterial activity of sugarcane juice against *Staphylococcus aureus* further supports the growing interest in alternative antimicrobial agents in response to increasing antibiotic resistance. Woo et al. (2023) noted that plant-derived antimicrobial substances are increasingly being explored because of the global emergence of multidrug-resistant bacterial strains. Since wound infections caused by resistant *Staphylococcus aureus* strains continue to pose serious therapeutic challenges, natural products may provide useful complementary treatment options.

However, Figure 3 revealed that the standard antibiotic produced greater antibacterial activity than sugarcane juice. This finding disagrees partially with the study of Sharma and Kalita (2025), who reported that purified plant-derived bioactive compounds exhibited antibacterial activity comparable to some synthetic antibiotics against methicillin-resistant *Staphylococcus aureus*. The variation between the present study and previous reports may be attributed to differences in extraction methods, purification procedures, concentration of active constituents, environmental factors affecting plant composition, and bacterial strain variability. In the present study, fresh crude sugarcane juice was used without phytochemical purification, which may have reduced the concentration and potency of the active antimicrobial compounds.

Nevertheless, the measurable antibacterial activity demonstrated by sugarcane juice in this study indicates that the plant may possess promising therapeutic potential. The findings provide scientific evidence supporting the traditional use of natural plant products in infection management and suggest that sugarcane juice could serve as a source of bioactive compounds for future antimicrobial drug development.

Further studies involving phytochemical characterization, toxicity profiling, molecular analysis, and purification of active compounds are recommended to establish the exact mechanisms responsible for the antibacterial activity of sugarcane juice and its possible clinical applications in wound care management.

6. Conclusion

This study demonstrated that fresh sugarcane juice possesses significant antibacterial activity against *Staphylococcus aureus* isolated from infected human wounds, thereby confirming its potential as a natural antimicrobial agent. The observed concentration-dependent increase in inhibition zones indicates that higher concentrations of sugarcane juice enhance its antibacterial effectiveness, suggesting the presence of biologically active phytochemical compounds capable of suppressing bacterial growth. These compounds may include flavonoids, phenolics, and other secondary metabolites known for their antimicrobial properties and ability to disrupt bacterial cell membranes and metabolic activities.

Although the standard antibiotic exhibited superior antibacterial efficacy, the appreciable inhibitory activity produced by crude sugarcane juice highlights its possible therapeutic relevance in complementary wound infection management. This suggests that sugarcane juice may not replace conventional antibiotics but could serve as an adjunct therapy, especially in cases where antibiotic resistance is a growing concern. The findings align with increasing global research attention on plant-based antimicrobials as safer, cost-effective, and readily available alternatives for managing infectious diseases.

Furthermore, the results reinforce the growing scientific evidence supporting plant-derived substances as alternative strategies for combating antimicrobial resistance. The increasing prevalence of multidrug-resistant *Staphylococcus aureus* strains underscores the urgent need for novel antimicrobial agents derived from natural sources. Sugarcane juice, being easily accessible and widely consumed, presents a promising candidate for further pharmaceutical exploration.

In addition, the study contributes to the broader understanding of the medicinal value of agricultural products beyond their nutritional and industrial applications. The antibacterial potential observed suggests that sugarcane juice may serve as a source for isolating and developing novel bioactive compounds for wound healing and infection control.

Therefore, sugarcane juice may represent a promising source of natural antimicrobial agents for future drug development. Further studies are recommended to isolate, characterize, and purify the active compounds responsible for its antibacterial activity, as well as to evaluate its clinical efficacy and safety in vivo.

4. Recommendations

1. Further phytochemical and molecular studies should be conducted to identify and characterize the active antibacterial compounds present in sugarcane juice.
2. Toxicological and clinical evaluations are necessary to establish the safety and therapeutic suitability of sugarcane juice for wound management.
3. Future research should investigate the efficacy of purified sugarcane extracts against multidrug-resistant strains of Methicillin-resistant *Staphylococcus aureus*.
4. The potential synergistic effect of sugarcane-derived compounds in combination with conventional antibiotics should be explored for improved antimicrobial therapy.

5. Contributions to Knowledge

1. This study provides scientific evidence that fresh Sugarcane juice possesses measurable antibacterial activity against *Staphylococcus aureus* infection isolated from infected human wounds, thereby validating its potential as a natural antimicrobial agent for complementary wound management.
2. The study established a concentration-dependent antibacterial effect of sugarcane juice, demonstrating that higher concentrations produce greater inhibitory activity against *Staphylococcus aureus*, which contributes new knowledge on the therapeutic potential and dose-related efficacy of crude sugarcane extracts.
3. The research expands existing knowledge on plant-based antimicrobial therapy by highlighting sugarcane juice as a locally available, affordable, and environmentally sustainable source of bioactive phytochemical compounds that may contribute to future development of alternative antimicrobial formulations against antibiotic-resistant wound pathogens.

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