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Short Communication

Mouthwash Potency Against Bacterial Growth: Implications for Oral Hygiene Practices

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Abstract

The potency of various mouthwash solutions in inhibiting bacterial growth was assessed using a standardized agar plate assay. A diverse range of mouthwash formulations, including an Ethiopian herbal mouthwash derived from Garden Cress (Feto), underwent testing against bacterial cultures. The results unveiled significant disparities in bacterial inhibition among the mouthwash solutions. Mouthwashes containing lemon and citric oils (Listerine Naturals Citrus Fluoride Mouthwash and Thera Breath) emerged as the most potent, generating a substantial inhibition zone with a diameter of 40.9 mm. Mouthwash that uses Cinnamon oil (Listerine Naturals Antiseptic and Crest Pro-Health Multi-Protection) also displayed gentle and mild inhibitory activity, forming inhibition zones measuring 23.9 mm in diameter. Mouthwashes containing Lavoris and PerCara mouthwashes exhibited notable potency, each producing inhibition zones with identical diameters of 25 mm. Similarly, Dentiguard components also displayed considerable inhibitory activity, forming inhibition zones measuring 9 mm in diameter. Conversely, Feto, mouthwash exhibited smaller inhibition zones, ranging from 9 mm in diameter showing less disruption of the oral flora. These findings underscore the varying efficacy of mouthwash solutions in hindering bacterial growth and underscore the significance of selecting appropriate formulations for maintaining optimal oral hygiene depending on individual needs.

Keywords: Mouthwash, Dental, Teeth, Germs, Bacteria Growth, Feto, Garden Cress.

Introduction

The emergence of antimicrobial resistance has heightened the importance of exploring alternative strategies for controlling bacterial growth, particularly in the context of oral hygiene. Mouthwash solutions represent one such avenue, offering a convenient and accessible means of reducing bacterial colonization in the oral cavity (Aslam et al., 2018). However, the potency of various mouthwash formulations in inhibiting bacterial growth remains an area of ongoing investigation (Seneviratne et al., 2011). Therefore, this study aimed to evaluate the potency of a variety of mouthwash solutions, including both commercial products and homemade remedies, in inhibiting bacterial growth using a standardized agar diffusion assay (Marsh, 2006).

The assessment of mouthwash potency is crucial for guiding oral hygiene practices and reducing the risk of bacterial-related oral diseases (Gómez-Fernández et al., 2020). In the study by Netushcil et al., the authors systematically tested a range of mouthwash formulations against bacterial cultures to evaluate their inhibitory activity (Netuschil et al., 1995). The results demonstrated significant variability in the potency of the tested mouthwash solutions, with notable differences observed between commercial products and homemade remedies (Feres et al., 2010).

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Particularly, formulations like Cinnamon mouthwash exhibited strong inhibitory activity, forming substantial inhibition zones on agar plates (Hope & Wilson, 2004). Conversely, other formulations such as feto and Dentiguard mouthwashes showed weaker inhibitory effects, underscoring the importance of careful product selection for oral hygiene regimens (Ciancio, 2003).

Research studies, such as the Joint EFP/AAP Workshop on Periodontitis and Systemic Diseases by Chapple and Van Dyke (2013), have established a correlation between poor dental health and various systemic illnesses. These include diabetes, heart disease, and respiratory infections. Maintaining good oral health can lower the risk of these conditions. These findings highlight the significance of evidence-based decision-making in oral hygiene practices, stressing the importance of selecting mouthwash formulations that offer optimal bacterial inhibition (Subramaniam & Babu, 2012). Moreover, this study contributes to the expanding knowledge base concerning the potency of different mouthwash solutions, offering valuable insights for both healthcare professionals and consumers (Aslam et al., 2018).

Contrary to common belief, the potency of mouthwash with strong antibacterial properties can have both positive and negative implications, depending on the individual. Simply having a product with high bacterial inhibition doesn't guarantee its effectiveness or superiority. While using mouthwash with potent bacterial-killing abilities can offer benefits, it's essential to be aware of potential drawbacks. These mouthwashes can disrupt the balance of oral bacteria, leading to dysbiosis and potentially promoting the growth of harmful bacteria while diminishing beneficial ones. Moreover, the alcohol content in some antibacterial mouthwashes may contribute to dry mouth, increasing the risk of tooth decay and gum disease.

Overuse of such mouthwashes can also lead to antibiotic resistance, making future oral infections harder to treat. Additionally, the strong antibacterial agents in these mouthwashes can cause oral tissue irritation or sensitivity, discomfort, and even alterations in taste perception. It's crucial to follow usage instructions and seek advice from a healthcare professional if experiencing any adverse effects. Recent studies and guidelines underscore the importance of using mouthwash appropriately, alongside foundational oral hygiene practices like brushing and flossing. Consequently, while certain mouthwashes may have their place depending on individual needs, careful consideration of their antimicrobial properties is vital. Armed with an understanding of the varying potency of mouthwash formulations, individuals can make informed choices to safeguard oral health and reduce the risk of bacterial-related oral diseases (Almas, 2002; Prabu et al., 2006).

Method

The study was a microbiological investigation conducted in vitro evaluation of mouthwash samples of commercially purchased mouthwash using the Kirby Bauer method of antibiotic testing. The mouthwash comprised various ingredients, including the oils of cinnamon, citrus, and lavender (TheraBreath, Fresh Breath, Oral Rinse, and Listerine Naturals Herbal Mint Antiseptic Mouthwash). The commercially purchased mouthwashes include PerCara, Feto, Lucky, Dentiguard, and Lavoris. Nutrient agar obtained from Carolina Biological Supply was employed for disc diffusion. After inoculating the agar plates with bacterial strains, mouthwash solutions were administered to the diffusion discs that were placed in the Petri dish. Following a 24-hour incubation period, the agar plates were examined for zones of inhibition, and the diameter of these zones was measured using a Vernier caliper. (At the conclusion of this document found petri dish pictures are included).

Results

The table and graph below show the diameter of the inhibition zones (measured in millimeters) created by different mouthwash solutions against the growth of bacteria on agar plates. The results show that the tested mouthwash solutions had differing levels of bacterial inhibition. With a 40.9 mm diameter, lemon/citric mouthwash demonstrated the biggest inhibitory zone, followed by crest and scope mouthwashes, both of which had a 32.4 and 24.1 mm diameter.

Both the PerCara and Lavoris mouthwashes showed significant inhibition at the same 25 mm diameter. On the other hand, mouthwashes containing Feto, penicillin and ginger showed narrower inhibitory zones, measuring between 9-11.5 mm in diameter. These results imply that different mouthwash formulations have varying degrees of success when it comes to preventing the growth of bacteria.

Table 1. *Results of the Kirby Bauer method of antibiotic testing.*

Mouth wash	Diffusion diameter
Dentiguard	5
Feto/garden cress	9
Penicillin	9.0
Lucky	10
Vanilla	10.6
Ginger	11.5
Listerine	12.3
Cinnamon	23.7
Scope	24.1
PerCara	25
Lavoris	25
Crest	32.4
Lemmon	40.9

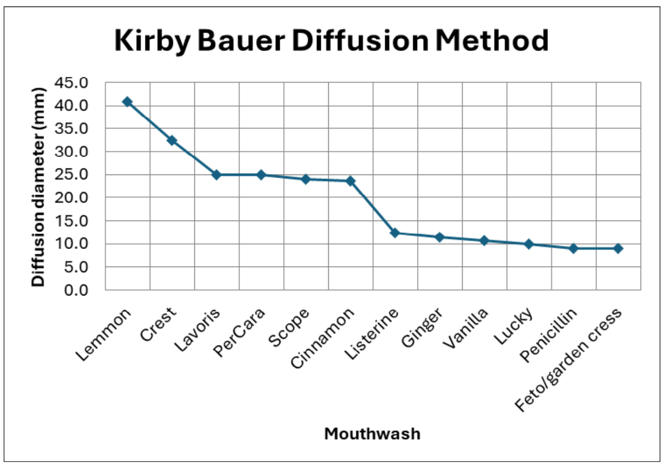


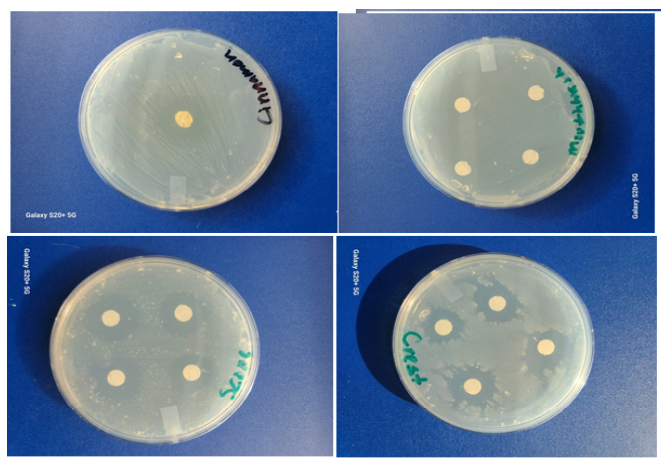
Figure 1. *Graphical representation of the potency of the mouthwash tested.*

Discussion

The results of this study offer valuable insights into the potency of different mouthwash solutions in restraining bacterial growth. The observed variations in the size of inhibition zones suggest differences in the antimicrobial potency of the tested formulations. Particularly, cinnamon mouthwash emerged as the most potent inhibitor of bacterial growth, showcasing the largest inhibition zone with a diameter of 40.9 mm. This finding aligns with previous research highlighting the broad-spectrum antimicrobial properties of cinnamon extracts, known to combat various bacterial strains effectively.

Furthermore, the significant inhibitory effect of Lemmon and Scope and Crest mouthwashes, forming inhibition zones measuring 24.1 and 32.4 mm in diameter, emphasizes the potential of these formulations for oral hygiene maintenance. The inclusion of natural compounds such as lemon extract and cinnamon oil in these mouthwashes may enhance their antimicrobial potency and ability to effectively inhibit bacterial growth. Similarly, Lavoris and PerCara mouthwashes demonstrated notable potency, producing inhibition zones with identical diameters of 25 mm, indicating strong antimicrobial activity.

In contrast, Feto, Ginger, Vanilla, and Penicillin mouthwashes displayed gentle and milder effects with smaller inhibition zones, ranging from 9-11.5 mm in diameter, suggesting less potential to disturb the mouth flora but less potency in curbing bacterial growth. The diminished antimicrobial activity of these formulations may be attributed to the absence of potent antimicrobial agents or inadequate concentrations of active ingredients. Additionally, variations in formulation and preparation methods could influence the potency of these mouthwashes in inhibiting bacterial growth.



Overall, these findings underscore the importance of selecting suitable mouthwash formulations based on their antimicrobial potency for promoting effective oral hygiene practices. Future research endeavors could delve into unraveling the mechanisms behind the antimicrobial activity of specific mouthwash ingredients and optimizing formulations to bolster their potency in restraining bacterial growth. Additionally, clinical studies assessing the long-term impact of mouthwash usage on oral microbiota composition and oral health outcomes would offer further insights into the role of mouthwash solutions in fostering oral hygiene and averting bacterial-related oral diseases.

The limitation of testing mouthwash products on agar plates in a lab setting lies in its lack of representing the complex oral environment accurately. While agar plate testing can provide valuable insights into the antimicrobial efficacy of mouthwash products, it fails to replicate the dynamic and multifaceted conditions within the mouth. For instance, agar plates cannot mimic factors such as saliva flow, oral pH variations, the presence of biofilms, and interactions between different oral microorganisms. As a result, the antimicrobial potency observed on agar plates may not fully translate to real-world outcomes within the oral cavity. Therefore, while agar plate testing can offer initial data on the antimicrobial properties of mouthwash products, additional in vivo or clinical studies are necessary to validate their efficacy and safety for oral use.

Conclusion

In conclusion, the findings of this study underscore the significant variability in the antimicrobial potency of various mouthwash formulations against bacterial growth. Lemon/citric mouthwash emerged as the most potent inhibitor of bacterial growth, followed by cinnamon, Scope, PerCara, Lavoris, Crest mouthwashes, which also demonstrated substantial inhibitory activity. Conversely, Feto, Ginger, Vanilla, and Penicillin mouthwashes exhibited limited potency in inhibiting bacterial growth, suggesting the need for further optimization or exploration of alternative formulations.

These results emphasize the importance of selecting appropriate mouthwash formulations based on their antimicrobial potency for effective oral hygiene practices. Cinnamon and other effective formulations have the potential to serve as valuable tools in maintaining oral health and preventing bacterial-associated oral diseases while the other products such as Feto are gentle and weaker in damaging the mouth flora. Future research efforts should focus on elucidating the mechanisms underlying the antimicrobial activity of specific mouthwash ingredients and optimizing formulations to enhance their potency in inhibiting bacterial growth.

Moreover, clinical studies evaluating the long-term effects of mouthwash use on oral microbiota composition and oral health outcomes would provide valuable insights into the role of mouthwash solutions in promoting oral hygiene. By continuing to investigate and refine mouthwash formulations, researchers and healthcare professionals can contribute to improved oral health outcomes and enhanced overall well-being for individuals worldwide.

Compliance with ethical standards

Acknowledgments

All first-year pharmacy students at Howard University who participated in the survey are acknowledged.

Disclosure of Conflict of Interest

The authors declare no conflict of interest. The survey was approved by Howard University IRB as part of a Drug Information course.

Statement of Informed Consent

Informed consent was not required from the survey participants in the study, because it was part of a Drug Information course.

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