Antibacterial Properties of Local Texan Honey against *Staphylococcus Aureus*

Gracie João, Teno Awotu-Utunedi
The University of Texas at San Antonio, San Antonio TX, 78249

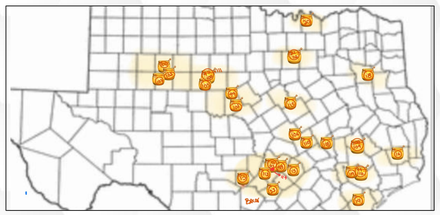
Abstract

This study is motivated by the notable absence of recorded resistant bacteria attributed to honey's unique synergetic mechanism of action. Focusing on the escalating threat posed by multi-drug-resistant Staphylococcus aureus, a prominent member of the ESKAPE pathogens, the research aims to evaluate the effectiveness of locally sourced Texan honey in inhibiting bacterial growth. Employing Mueller-Hinton agar plates as the experimental platform, the investigation goes into the intricate relationship between honey's compositional attributes—namely, moisture content, pH levels, and hydrogen peroxide activity—and the resulting zones of inhibition (ZOI). A total of 36 Texan honey samples were analyzed and the former mentioned parameters were quantified. 86% of the honey samples exhibited ZOI values exceeding the literature standard of 16 mm, indicating robust antibacterial properties. Additionally, 11 of them (31%) had a water content of 18% or lower, which is congruent with honey's literary moisture content. Based on the results collected, an inverse relationship can be noted between honey's water content and its measured ZOI. These findings underscore honey's potential as a viable therapeutic agent for illnesses instigated by ESKAPE pathogens as well as address the urgent global challenge of antibiotic resistance. Further research is recommended to deepen the application of local Texan honey as an effective and cost-efficient alternative to treat bacterial infections.

Introduction

Honey, an ancient marvel produced by bees, is renowned for its medicinal potential, notably as an antibiotic. This study delves into the antibiotic properties of honey, focusing on 12 Texan samples and their efficacy against the ESKAPE pathogen ***Staphylococcus aureus***. These pathogens, resistant to conventional antibiotics, pose a global health threat. Understanding their resistance mechanisms is crucial.

Texas, with its diverse flora, provides an ideal backdrop for studying honey's medicinal properties. The research explores how honey's composition, influenced by nectar sources and environment, interacts with this pathogen. It goes into honey's hydrogen peroxide activity and presents the methodology for analyzing Texan honey. The findings could inform medical practices, offering honey as a potential adjunct therapy against antibiotic-resistant infections. In the face of rising antimicrobial resistance, investigating honey's antibiotic properties offers hope for novel therapeutic solutions to combat the global health crisis.



Objective

This experiment aims to evaluate the antibiotic properties of Texan honey against the antibiotic-resistant ESKAPE pathogen ***Staphylococcus aureus***, offering insights into honey's potential as a therapeutic agent to combat global antimicrobial resistance.

Materials and Methods

For the Zone of Inhibition (ZOI) testing, Mannitol Salt Agar with 7.5% NaCl was utilized along with overnight-grown Staphylococcus aureus cultures, McFarland 0.5 Standard, undiluted honey samples (100%), a large Petri dish, 70% ethanol for cleaning, micropipettes, 1000 ul micropipette tips, toothpicks, autoclaved beads for cell spreading, a Bunsen burner, and Parafilm. The procedure involved stringent cleanliness measures, plate labeling, bacterial density standardization, inoculation, honey application, photographing, and incubation at 37°C for 24 hours. After incubation, the ZOI of each honey sample was measured, and the average was calculated.

For the H_2O_2 analysis, materials such as 50% (w/v) honey solution, HRP enzyme, o-dianisidine substrate, phosphate-buffered saline (PBS), sulfuric acid (H_2SO_4), microfuge tubes, a microplate reader, and hydrogen peroxide (H_2O_2) solutions were employed. The process involved generating a standard curve, diluting honey samples, adding colorimetric reagents, stopping the reaction, washing, and measuring absorbance to determine HRP activity.

Additionally, pH and moisture content were assessed using honey samples, DI water, a pH probe, a refractometer, centrifuge tubes, a vortex, and a scale. Dilution, pH measurement, and moisture determination were conducted according to specified procedures for each sample.

Sample ID	County	Sample ID	County	Sample ID	County
23H-13	Kendall	23H-102	Mitchell	23H-23	Guadalupe
23H-14	Harris	23H-103	Mitchell	23H-24	Bexar
23H-15	Bastrop	23H-104	Scurry	23H-97	Taylor
23H-16	Hardin	23H-105	Taylor	23H-98	Travis
23H-17	N/A	23H-106	Bell	23H-99	Brown
23H-18	Smith	23H-107	Brown	23H-100	Taylor
23H-19	Damon	23H-108	Walker	23H-101	Travis
23H-20	Grayson	23H-109	Walker	23H-120	N/A
23H-21	Tarrant	23H-110	Milam	23H-118	Brazos
23H-22	N/A	23H-111	Taylor	23H-119	Harris
23H-116	Tarrant	23H-112	Hays	23H-114	Travis
23H117	Harris	23H-113	Travis	23H-115	McLennan

Results

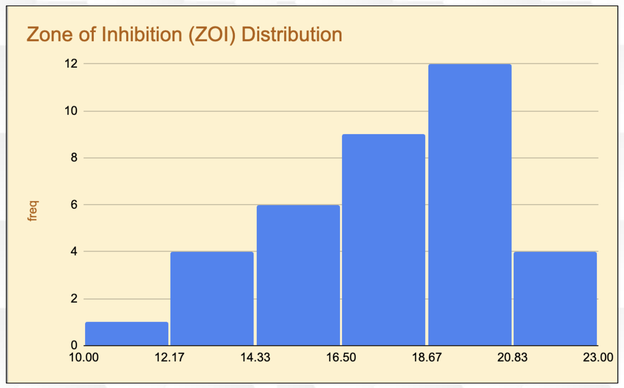


Figure 1. Graph showing zone of inhibition of honey samples against ***Staphylococcus aureus***

Results

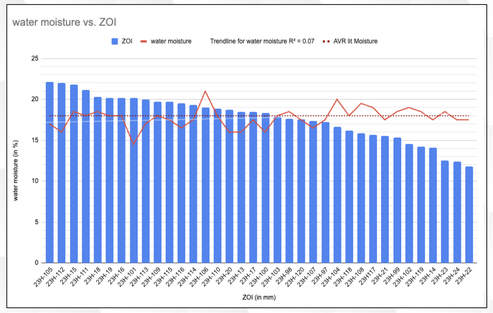


Figure 2. ZOI of honey samples against ***Staphylococcus aureus*** vs. water content of honey

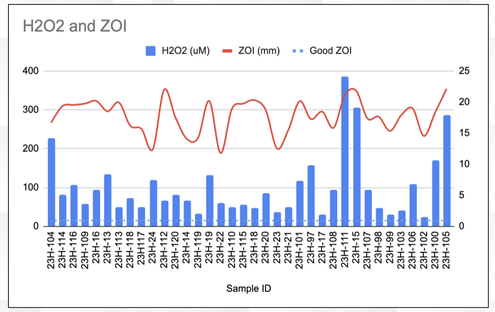


Figure 3. ZOI of honey samples against ***Staphylococcus aureus*** vs. hydrogen peroxide activity of honey

Figure 4. Zone of inhibition (ZOI) measurements for a few of the samples used in this study

Conclusions & Future Research

TX Honeys:

- 86% of Texan honey samples surpassed the 16 mm benchmark for antibacterial activity against Staphylococcus aureus.
- Lower moisture content correlates with stronger inhibitory effects.
- pH range of 3 to 4 enhances antimicrobial activity.
- Hydrogen peroxide activity showed no direct correlation with inhibition.
- Potential for honey as a cost-effective antimicrobial alternative.

Future Applications:

- Potential application on other ESKAPE pathogens

References

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