Honey Bioactivity and Authenticity: Grocery Store vs. Local Beekeepers' Honey in San Antonio, TX

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Abstract

Honey has been utilized across civilizations for its antimicrobial and antioxidant benefits. This study assessed the bioactivity of honey sourced from both local beekeepers and grocery stores in San Antonio, Texas. Analysis included antimicrobial activity, antioxidant potential, and physicochemical characteristics to ensure authenticity and bioactivity. Antimicrobial activity was determined via agar well-diffusion assay against *Staphylococcus aureus*, while antioxidant potential was assessed through DPPH assay.

Results indicated significant differences between honey from local beekeepers and grocery stores. Local honeys exhibited higher antimicrobial and antioxidant activity with darker color in comparison to grocery store honeys. Further research could enhance consumer awareness and establish industry standards for honey quality.

Introduction

Honey, as defined by the Codex Alimentarius, is a natural sweet substance produced by honeybees from flower nectar or plant secretions. To qualify as honey, it must not contain any added ingredients. According to the US Pharmacopeia Journal of Food Science, it is among the top three most adulterated food products in the world. This raises questions about the authenticity, as well as quality of honey sold in the grocery stores.

Honey is recognized as a medicinal food due to its high bioactivity, originating from its antimicrobial and antioxidant properties. Thus, it is vital to ensure access to high-quality honey for consumers seeking its therapeutic benefits. Yet, fraudulent practices, including selling counterfeit or substandard honey, persist in the market.

This research examines the authenticity and bioactivity of honey sourced from both major grocery stores and local beekeepers in San Antonio, Texas, aiming to provide insights into the comparative quality of these products and inform consumers about their choices.

Objective

The objective of this study is to determine the bioactivity potential of honey samples from local TX beekeepers and grocery stores, which is a significant indicator of honey authenticity.

We hypothesize that honey from local beekeepers will exhibit higher bioactivity levels, thus indicating greater authenticity, compared to honey from grocery stores, as identified through antimicrobial and antioxidant activities.

Methods

In this study, DPPH radical scavenging assay was used to assess antioxidant activity, zone of inhibition method to evaluate antibacterial efficacy against *Staphylococcus aureus*, and color analysis using a spectrophotometer at 560 nm to compare honey sourced from grocery stores and local beekeeper sources.

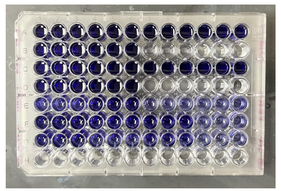

Figure 1. 96-Well Plate for DPPH radical scavenging assay (RSA)

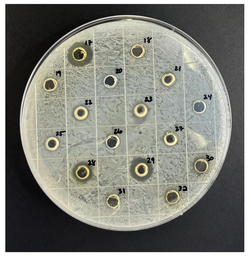

Figure 3. Agar well-diffusion assay used to determine Zone of Inhibition (ZOI) of honey samples against *Staphylococcus aureus*

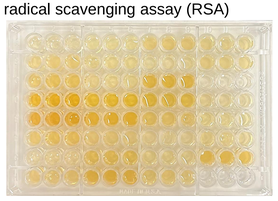

Figure 2. Color analysis of honey samples

Results

Staphylococcus aureus is the leading cause of skin and soft tissue infections such as abscesses (boils), furuncles, and cellulitis. Although most staph infections are not serious, S. aureus can cause serious infections such as bloodstream infections, pneumonia, or bone and joint infections.

Local Texas beekeeper honey samples displayed a higher zone of inhibition (ZOI) against *S. aureus*, with an average of 20.93mm, in contrast to grocery store honeys, which exhibited an average of 12.85mm. According to Clinical Laboratory Standards Institute (CLSI), ZOI higher than 16mm represents high antibacterial activity.

Numerous studies reported that most chronic diseases such as cancer, coronary, and neurological degeneration are a consequence of oxidative damage. Therefore, antioxidants are critical to prevent these diseases as they scavenge free radicals.

High radical scavenging activity (RSA) percentages indicate stronger antioxidant properties. Local TX honey samples, with an average of 66.41%, demonstrated a 20% higher antioxidant potential compared to the average of grocery store honey, which remained at 46.41%. These differences emphasize the overall antioxidant capacity of local TX beekeeper honey in contrast to grocery store honey.

By referencing the USDA Color Standard Designation for color, averages were calculated, revealing absorbance rates indicating an average of amber hue for local TX beekeepers honeys and a lighter amber shade for grocery store honeys.

Results – cont'd

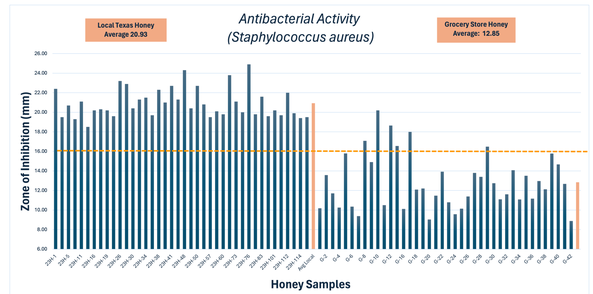

Figure 4. Antibacterial Activity against *Staphylococcus aureus* comparing Local TX honey vs. Grocery Store Honey through zone of inhibition. Orange column represents the average of each group. Dotted bar represents the standard for high antimicrobial activity according to CLSI.

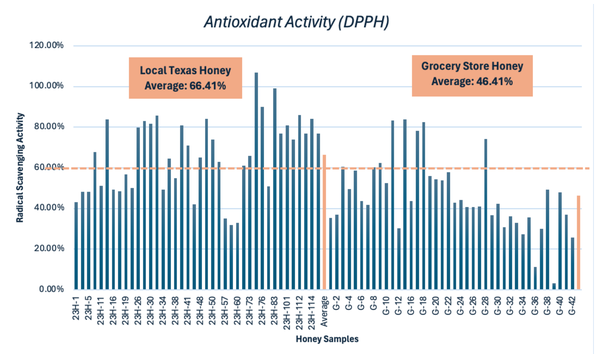

Figure 5. Antioxidant Activity of Local Texas Honey vs. Grocery Store Honey using DPPH Radical Scavenging Activity (RSA) Method. Orange bar represents the average of each group.

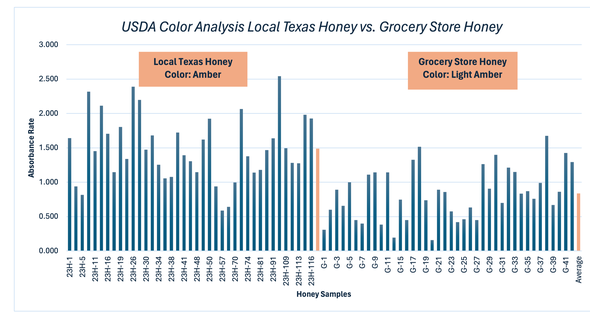

Figure 6. Average Color Absorbance Results (Abs560) of Local Texas Honeys vs. Grocery Store Honeys. Orange bar represents the average of each group.

Conclusions

- **Overall, local beekeeper honey samples showed higher biological activity potential compared to grocery store honeys**.
- The inhibitory effect of local TX honeys (21mm) was significantly higher than grocery store honeys (13mm) against *S. aureus*
- Local beekeeper honeys exhibited 20% stronger antioxidant activity compared to grocery store honeys.
- The average color of local honeys was amber, while the color of grocery store honey was light amber.
- Our results suggest that ***honey from local TX beekeepers are stronger candidates to be classified as medical-grade honey; thus, to be used in medicinal applications.***
- Grocery store honeys presented very limited antimicrobial and antioxidant activity, which can help the consumers making informed decisions when purchasing honey for therapeutic purposes.

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Acknowledgements

The funding for this research was provided by the **Sophomore Biology Research Initiative (SBRI)** of **Department of Integrative Biology** at UTSA, which provides course-based undergraduate research experiences (CURE).
We want to thank **Dr. Ferhat Ozturk** for his incredible support towards us and our research this year! He has given us great feedback and guided us during the experimental process, data analysis, and finalizing our research. We also want to thank **Dr. Mariah Hopkins**, Director of Integrative Biology CURE Labs, and **Donna Degen**, our CURE Lab Coordinator for providing students with the opportunity to grow and expand our research skills.

All honey sample donors and beekeeper associations