The Effects of Frankincense on Pathogenic Bacteria in the Oral Microbiome

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SUMMARY OF PROJECT

Frankincense oil, originating from *Boswellia* trees in the Middle East, Africa, and parts of Asia, has a rich history as a valuable remedy for various diseases. Recent scientific research has revealed its potential therapeutic effects on oral health, contributing to oral disease prevention and maintenance. As interest in natural remedies grows and concerns regarding side effects of synthetic drugs persist, frankincense serves as a promising candidate for adjunctive therapy. This study examines the impact of frankincense on the oral microbiome, focusing on its antimicrobial properties against pathogenic oral bacteria –*S. mutans, P. gingivalis,* and *F. nucleatum* – that contribute to dental caries and periodontal disease.

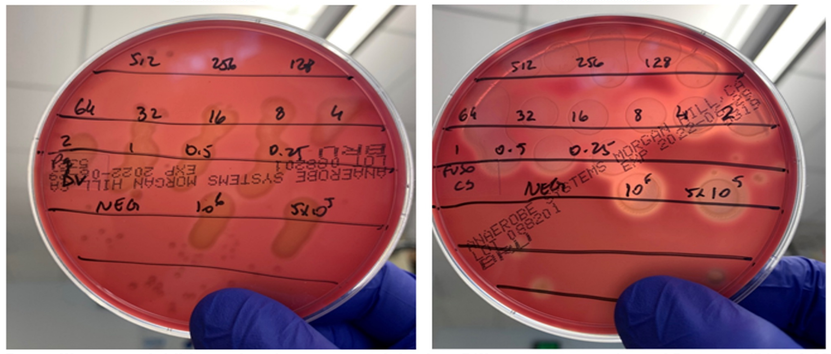
INTRODUCTION

The therapeutic effects of frankincense presents a compelling area for research for several reasons. Firstly, oral diseases such as caries and periodontal disease are prevalent amongst millions of individuals worldwide, posing significant health and economic problems. Investigating natural remedies like frankincense can offer a promising alternative to conventional treatments. The findings of this research could have profound implications for oral health management, such as offering a safe, accessible, and cost-effective solution for preventing and managing common oral diseases. Additionally, this research can have the potential to inform public health policies related to oral care. If frankincense oil demonstrates significant antimicrobial properties against pathogenic oral bacteria, policymakers can consider integrating it into oral health promotion and disease prevention programs, contributing to the promotion of natural approaches to dental care.

Figure 1. *Boswellia sacra* in Wadi Dawkah, a natural park of frankincense-producing trees in Oman. *Boswellia sacra* photo from Wikimedia.org.

METHODS

To measure the effects of frankincense on these bacteria, saliva samples will be collected with a RNA/DNA stabilizing solution from volunteers prior to and after using a frankincense mouthwash solution. Volunteers will be divided into two separate groups, one group with a frankincense solution and one group without. After seven days of treatment, a PCR assay with control and experimental saliva samples will be performed to analyze the quantity of oral pathogens. Preliminary results will be shown. PCR amplification will be performed using primers specific for each bacterial strain, allowing for sample analysis.



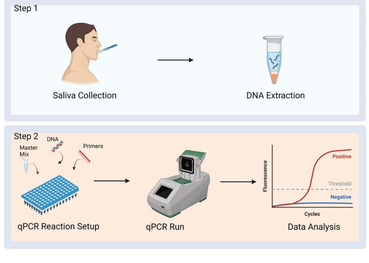
***Boswellia serrata* inhibits oral pathogens growth *in vitro*.** Different concentrations of *B. serrata* (512 – 0.25 µg/mL) were tested against *P. gingivalis* (left) and *F. nucleatum* (right). The growth in blood agar plates represent bacterial growth in the presence of different B. serrata extracts tested.

PRELIMINARY DATA

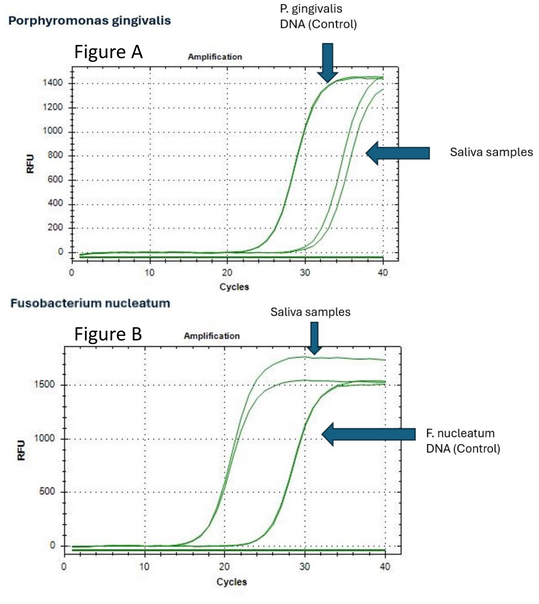
Boswellia serrata extract – frankincense oil - exhibits a range of medicinal properties, including anti-cancer, anti-inflammatory, and antimicrobial effects. In a recent study done in vitro, researchers investigated the antimicrobial effects of *B. serrata* extract on two oral pathogens associated with periodontitis, namely *Porphyromonas gingivalis* and *Fusobacterium nucleatum*. The results revealed that while the growth and biofilm formation of *P. gingivalis* were significantly impaired by treatment with *B. serrata* extracts, the effects *on F. nucleatum* were not as pronounced. Additionally, non-toxic concentrations of *B. serrata* were found to decrease intracellular *P. gingivalis* infection in human gingival epithelial cells. These findings underscore the potential of *B. serrata* in preventing and/or treating periodontal diseases.

In our preliminary data analysis, we have successfully demonstrated our ability to collect saliva samples, isolate nucleic acids, and detect and quantify specific oral pathogens, namely *P. gingivalis and F. nucleatum*, using PCR amplification techniques. This initial analysis indicates that our experimental setup and methodologies are sound, laying a foundation for the next step in our research. While we have yet to test the efficacy of the mouthwash solution containing frankincense extract against these pathogens, our ability to reliably detect and quantify them in saliva samples suggests that we are ready to proceed with the main experiment.

Pure *P. gingivalis, F. nucleatum* DNA and saliva sample concentration after PCR amplification. Figure A shows the amount of *P. gingivalis* in saliva sample compared to pure *P. gingivalis* DNA extract after PCR amplification. Figure B shows the amount of *F. nucleatum* in saliva sample compared to pure *F. nucleatum* DNA extract after PCR amplification. Primers specific for each bacteria strain were utilized. *P gingivalis* and *F. nucleatum* were both detected and successfully amplified using PCR.



Saliva collection and qPCR Schematic



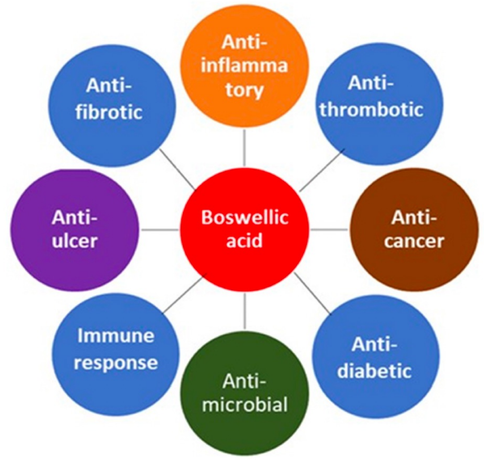


Figure 3. Modern medicinal uses of *Boswellia*.

NEXT STEPS

A mouthwash using dilute frankincense extract will be tested for the effect on the oral microbiome in human volunteers.

ACKNOWLEDGEMENTS

We would like to express our gratitude German Moncada and David Vang for excellent technical assistance.

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