Comparative Study of Antibacterial Effect of *Trigonella Foenum-Graecum, Boswellia Serrata*, and *Nigella Sativa* on Aggregatibacter Actinomycetemcomitans

Dr. Payal Jaiswal & Dr. Lalita Goyal

Department of Biochemistry, M.L.B. Govt. Girls P.G. College, Indore, M.P.

Abstract

Bacterial resistance to antibiotics has become a major concern, necessitating the exploration of alternative treatments. Herbal medicine offers a promising approach, as many plant species possess antimicrobial properties. *Aggregatibacter actinomycetemcomitans* (*A. a.*) is a Gram-negative coccobacillus responsible for aggressive forms of periodontal disease. This study evaluates the antibacterial efficacy of *Trigonella foenum-graecum* (fenugreek), *Boswellia serrata* (BS), and *Nigella sativa* (NS) against *A. a.* using the broth microdilution method. The minimum inhibitory concentrations (MIC) of fenugreek, BS, and NS were determined to be 374.33 µg/ml, 708.33 µg/ml, and 705 µg/ml, respectively, indicating that fenugreek exhibited the strongest antibacterial effect. These findings suggest that fenugreek could be a potential alternative treatment for periodontitis. Future research should focus on optimizing extraction methods and concentrations to enhance antibacterial potency.

Keywords: *Aggregatibacter actinomycetemcomitans,* microdilution, periodontitis, antibacterial potency.

Introduction

The development of bacterial resistance to antibiotics over time has become a significant concern. As an alternative, herbal medicines have gained attention due to their antibacterial properties. Approximately 70,000 plant species have been identified for their antimicrobial potential, showing efficacy against bacteria, fungi, and viruses. *Aggregatibacter actinomycetemcomitans* (*A. a.*) is a Gram-negative coccobacillus that plays a crucial role in aggressive forms of periodontal disease, particularly localized aggressive periodontitis.

Herbal extracts such as *Trigonella foenum-graecum* (fenugreek), *Boswellia serrata* (BS), and *Nigella sativa* (NS) have been traditionally used for various medicinal purposes (Al-Okbi, S. Y. et al. 2014) Fenugreek has demonstrated benefits in controlling diabetes, reducing cholesterol, aiding digestion, and acting as an antioxidant (Singh, D. et al. 2018). *Boswellia serrata* is well-known for its anti-inflammatory properties, primarily due to boswellic acid, which is effective against inflammatory diseases(Gupta, A,. et al. 2017) . *Nigella sativa* (black cumin) has been widely used in traditional medicine for its diuretic, antipyretic, and anti-inflammatory properties. This study aims to compare the antibacterial effects of fenugreek, BS, and NS against *A. a.* to explore their potential in treating aggressive periodontitis using natural alternatives.\

Objective

This study investigates the antibacterial efficacy of Trigonella foenum-graecum, Boswellia serrata, and Nigella sativa against A. actinomycetemcomitans, aiming to explore traditional herbal therapies for the treatment of aggressive periodontitis.

Materials & Methods

Fenugreek, BS, and NS seeds were procured from Jevik Setu Market, Indore, specializing in organic seeds and vegetables. The seeds were finely ground using a mortar and pestle and soaked in dimethyl sulfoxide (DMSO) for one week. The extract was then filtered and centrifuged at 4000 rpm for 30 minutes at 4°C, followed by storage at 4°C for further analysis.

The pathogenic bacterial strain was obtained from the Periodontology Department of the College of Dental Science and Hospital, Rau, Indore, M.P. The minimum inhibitory concentration (MIC) of fenugreek, BS, and NS against A. a. was determined using the broth Microdilution method.

Results & Discussion

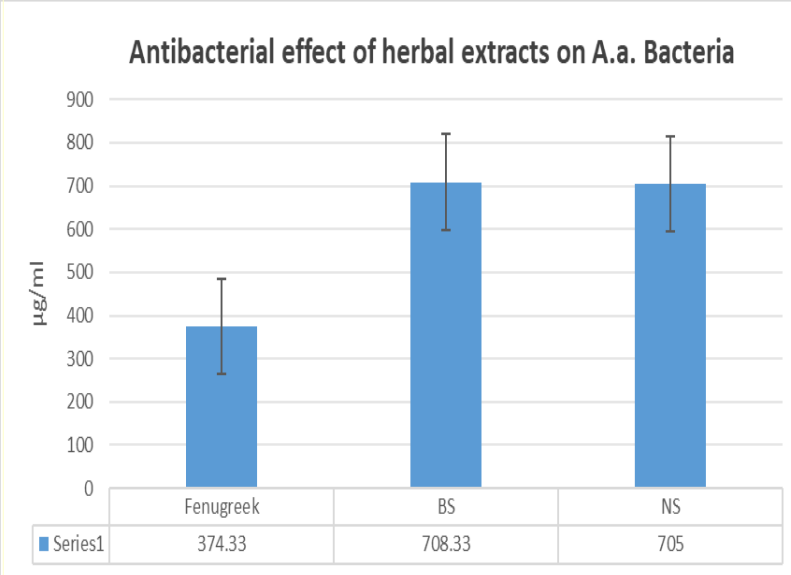
The MIC values obtained were as follows:

- Fenugreek: 374.33 µg/ml
- Boswellia serrata: 708.33 µg/ml
- Nigella sativa: 705 µg/ml

No turbidity was observed in the negative control group, confirming the antimicrobial activity of the tested extracts.

Table: Showing the Antibacterial effect of herbal extracts on A.a. Bacteria-

S.No.	Herbal Extract	Mean±SD
1	Fenugreek	374.33±4.04
2	B.S.	708.33±7.63
3	N.S.	705±5



Graph: Showing the Antibacterial effect of herbal extracts on A.a. Bacteria

The results indicate that fenugreek exhibited the strongest antibacterial effect (Gupta, R. et al. 2014) against *A. a.* compared to BS and NS. Currently, the standard treatment for periodontal disease focuses on biofilm removal through mechanical procedures and systemic antibiotic therapy (Deas, D.E. et al.2010). Alternative approaches such as photodynamic therapy with herbal photosensitizers (Moslemi, et al. 2015) and adjunctive use of systemic antibiotics (Dakic, A. et al.2016) have also been explored. Previous studies have evaluated the antimicrobial properties of other natural extracts against *A. a.*. For instance, Kapadia,S.P.et al 2015. investigated the antimicrobial activity of banana peel extract using the agar well diffusion method. *Ocimum sanctum* (Tulsi) has also been widely studied for its antibacterial properties (Mondal, S. et al. 2011). However, limited studies exist on the antibacterial activity of fenugreek, BS, and NS specifically against *A. a.*. Our study is among the first to examine fenugreek's antibacterial effect on *A. a.*.

One challenge in comparing results with previous studies was the variation in extraction methods and bacterial strains. Future studies should focus on evaluating different extraction techniques, including aqueous and alcoholic extracts, to optimize antibacterial efficacy.

Conclusion

Our comparative study demonstrates that ***Trigonella*** *foenum-graecum* exhibits the strongest antibacterial activity against ***A. actinomycetemcomitans*** compared to ***Boswellia serrata*** and ***Nigella*** *sativa*. Given fenugreek's well-documented medicinal properties, it has the potential to be explored further as an alternative treatment for periodontitis. Future research should aim to refine extraction methods and optimize concentrations for enhanced antibacterial potency.

****

Reference

1. Al-Okbi, S. Y., Mohamed, D. A., & Hamed, T. E. (2014). Potential protective effect of Nigella sativa crude oils on fatty liver in rats. Journal of Medicinal Food, 17(3), 285-291.
2. Dakic, A., Boillot, A., Colliot, C., Carra, M. C., Czernichow, S., & Bouchard, P. (2016). Detection of Porphyromonas gingivalis and Aggregatibacter actinomycetemcomitans after systemic administration of amoxicillin plus metronidazole as an adjunct to non-surgical periodontal therapy: a systematic review and meta-analysis. Frontiers in microbiology, 7, 1277.
3. Deas, D. E., & Mealey, B. L. (2010). Response of chronic and aggressive periodontitis to treatment. Periodontology 2000, 53(1).
4. Gupta, A., & Upadhyay, N. K. (2017). Boswellia serrata: An effective anti- inflammatory agent. Journal of Ethnopharmacology, 208, 204-211.
5. Gupta, R., Singh, N., & Nishteswar, K. (2014). Therapeutic efficacy of Trigonella foenum-graecum in metabolic disorders: A review. Ancient Science of Life, 33(4), 245-250.
6. Kapadia, S. P., Pudakalkatti, P. S., & Shivanaikar, S. (2015). Detection of antimicrobial activity of banana peel (Musa paradisiaca L.) on Porphyromonas gingivalis and Aggregatibacter actinomycetemcomitans: An: in vitro: study. Contemporary clinical dentistry, 6(4), 496-499.
7. Khan, M. A., & Afzal, M. (2016). Chemical composition and medicinal properties of Nigella sativa Linn. Asian Pacific Journal of Tropical Biomedicine, 6(5), 398-405.
8. Mondal, S., Varma, S., Bamola, V. D., Naik, S. N., Mirdha, B. R., Padhi, M. M.,and Mahapatra, S. C. (2011). Double-blinded randomized controlled trial for immunomodulatory effects of Tulsi (Ocimum sanctum Linn.) leaf extract on healthy volunteers. Journal of ethnopharmacology, 136(3), 452-456.
9. Moslemi, N., Soleiman-zadeh Azar, P., Bahador, A., Rouzmeh, N., Chiniforush, N., Paknejad, M., & Fekrazad, R. (2015). Inactivation of Aggregatibacter actinomycetemcomitans by two different modalities of photodynamic therapy using Toluidine blue O or Radachlorin as photosensitizers: an in vitro study. Lasers in medical science, 30, 89-94.
10. Raja, A. F., Ali, F., Khan, I. A., Shawl, A. S., Arora, D. S., Shah, B. A., & Taneja, S. C. (2011). Antistaphylococcal and biofilm inhibitory activities of acetyl-11-keto-β-boswellic acid from Boswellia serrata. BMC microbiology, 11, 1-9.
11. Safayhi, H., Sailer, E. R., & Ammon, H. P. (1995). Mechanism of 5-lipoxygenase inhibition by acetyl-11-keto-beta-boswellic acid. Molecular pharmacology, 47(6), 1212-1216.
12. Schneider, C., & Segre, T. (2009). Green tea: potential health benefits. American family physician, 79(7), 591-594.
13. Singh, D., Kumar, T. R., & Kumar, S. (2018). Medicinal properties of Trigonella foenum-graecum: A review. International Journal of Pharmaceutical Sciences and Research, 9(6), 2155-2161.