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Introduction

Gingivitis is associated with an increase in dental plaque mass and an increase in the proportion of Gram-negative anaerobes. Prebiotics have the potential to modify plaque composition¹.

Dietary nitrate supplementation has been shown to modify oral microbiome composition by increasing the relative abundance of the health-associated and aerobic genera *Neisseria* and *Rothia*².

This study investigated the effect of nitrate and nitrite on the composition of in-vitro biofilms derived from human saliva.

Methods

- Pooled saliva from 6 volunteers as inoculum
- Biofilms grown using the Calgary Biofilm Device in a mucin-containing complex medium
- Medium was supplemented with 0.5 mM, 5 mM and 10 mM sodium nitrate or nitrite
- Biofilms were harvested after 7 days treatment
- 16S rRNA gene community profiling using the Illumina MiSeq platform for the V1-V2 region
- Data analysed in mothur

References

¹Jockel-Schneider Y, Schlagenhaut U, Stolzel P, Gossner S, Carle R, Ehmke B, Prior K, Hagenfeld D. 2021. Nitrate-rich diet alters the composition of the oral microbiota in periodontal recall patients. J Periodontol doi:10.1002/JPER.20-0778
²Velmurugan S, Gan JM, Rathod KS, Khambata RS, Ghosh SM, Hartley A, Van Eijl S, Sagi-Kiss V, Chowdhury TA, Curtis M, Kuhnle GG, Wade WG, Ahluwalia A. 2016. Dietary nitrate improves vascular function in patients with hypercholesterolemia: a randomized, double-blind, placebo-controlled study. Am J Clin Nutr 103:25-38.

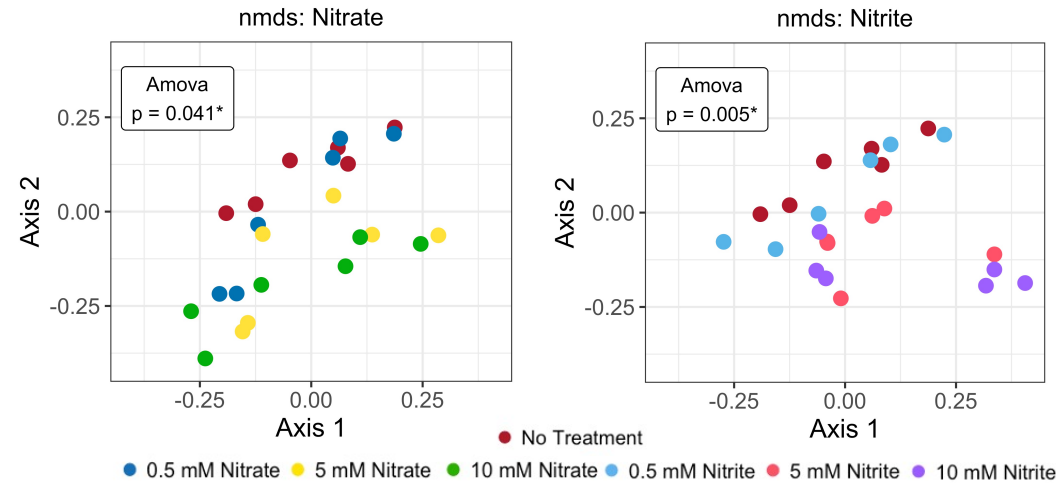


Figure 1 Shifts in bacterial community structure of in-vitro biofilms after supplementation.

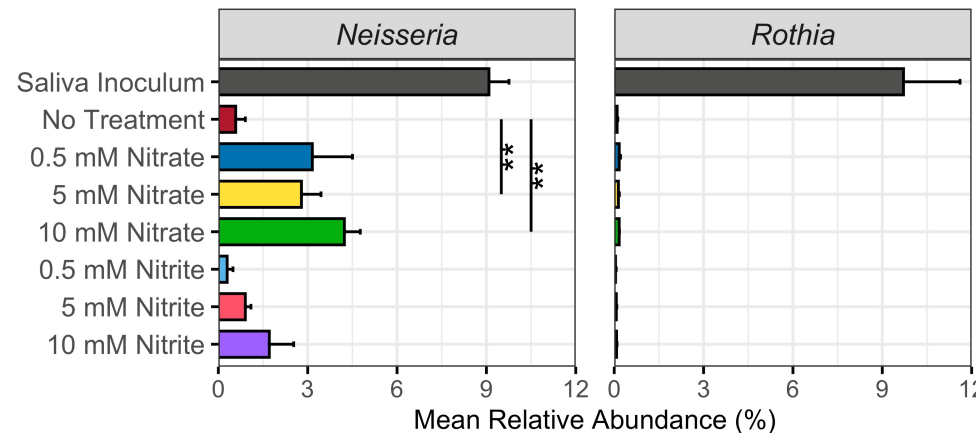


Figure 2 Relative abundance of health-associated and aerobic genera after supplementation.

Results

- Treatment with 5 mM and 10 mM nitrate (p = 0.021 and p = 0.015) or nitrite (p = 0.01 and p = 0.004) led to significant changes in the bacterial community composition compared to no treatment (Figure 1)
- Health-associated genus *Neisseria* was significantly increased in biofilms treated with 5 mM or 10 mM nitrate (Figure 2)
- *Rothia* grew poorly in the biofilm model, although present in the saliva inoculum, and no treatment effects were seen (Figure 2)

Conclusions

Supplementation with nitrate and nitrite can modify the composition of the bacterial biofilm community by increasing relative abundance of *Neisseria* spp. This supports the hypothesis that electron acceptors such as nitrate could be used as prebiotics to maintain oral health by encouraging growth of health-associated species.

Conflict of Interest

This project is supported by GlaxoSmithKline.

Acknowledgement
Study funded by:

