

EFFECT OF PROBIOTICS ON CARIES-RELATED VARIABLES

Akademisk avhandling

Som för avläggande av odontologie doktorsexamen vid Sahlgrenska akademien, Göteborgs universitet kommer att offentlig försvaras i hörsal Arvid Carlsson, Medicinaregatan 3, den 21 oktober 2021, klockan 9.00

Sahal Ahmad Alforaidi

Fakultetsopponent:

Docent Pernilla Lif Holgersson

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Avhandlingen baseras på följande delarbeten

- I. Alforaidi S, Bresin A, Almosa N, Lehrkinder A, Lingström P. Oral colonisation after the administration of drops containing *Lactobacillus reuteri*. *Oral Health Prev Dent* 2020; 18 :1017-1023.
- II. Lehrkinder A, Alforaidi S, Simark-Mattsson C, Almosa N, Lingström P. *Lactobacillus reuteri* treatment induces a genetic response in *Streptococcus mutans* and interference in endogenous *lactobacilli sp.* 2021 Submitted for publication.
- III. Alforaidi S, Bresin A, Almosa N, Lehrkinder A, Lingström P. Effect of drops containing *Lactobacillus reuteri* (DSM 17938 and ATCC PTA 5289) on plaque acidogenicity and other caries-related variables in orthodontic patients. *BMC Microbiology* 2021: accepted.
- IV. Alforaidi S, Almosa N, Zafar H, Ashi H, Lingström P. Administrative mode and dose-related effect of probiotics on caries-related variables: A systematic review. 2021 Submitted for publication

**SAHLGRENKA AKADEMIN
INSTITUTIONEN FÖR ODONTOLOGI**



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ABSTRACT

In relation to the caries disease, the aims of this thesis were to investigate the effect of probiotic drops on different caries-related variables *in vivo* (Papers I & III), on interference capability and genetic response to different metabolites *in vitro* (II) and systematically to review the best mode and dose of administration based on the examined oral outcomes (IV). The effects on colonisation and cariogenic bacteria were studied in plaque and saliva via plating and qPCR-analyses in teenagers and orthodontic patients after short-term exposure. Moreover, the changes in plaque acidogenicity were evaluated in orthodontic subjects using the “pH strip method”. The interference capability of the endogenous lactobacilli on a panel of 13 *Streptococci* strains after probiotic intervention was examined *in vitro*. Further, *S. mutans* strains from both active and inactive caries subjects were used for genetic evaluation to probiotic exposure using qRT-PCR expression tests. The optimal mode and dose for using probiotics were studied in a systematic review following the PRISMA checklist. The probiotics had the ability to colonise saliva and dental biofilm after short-term use. Temporary colonisation was seen in young adults up to five weeks following use. They had the opportunity to reduce the number of salivary *S. mutans* in young adults, while no such effect was found during orthodontic treatment. Using probiotics during orthodontic treatment also increased the pH of the dental biofilm in comparison to the placebo group. The behaviour of the endogenous lactobacilli changed after *L. reuteri* administration and was shown to produce an antibacterial effect against oral *streptococci*. A variation in susceptibility to probiotic bacteria and endogenous lactobacilli was found among the tested panel. The various metabolites induced different genetic responses on *S. mutans* in relation to caries activity. No clear optimal vehicle or dose was identified via the systematic review. Probiotics in the form of drops have the ability to colonise the oral cavity after short-time exposure and to be an additional tool in caries prevention in order to reduce plaque pH and change the oral ecosystem. Further studies are needed to identify the optimal mode and dose required.

Keywords: Bacterial interference, Caries, Caries prevention, Dental biofilm, Dental plaque, Lactobacilli, Lactobacillus reuteri, *Streptococcus mutans*, Plaque acidogenicity, Probiotics, qPCR, Saliva, Virulence.