

Probiotics in oral health and disease: a systematic review

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Table S7 - Characteristics of clinical trials of probiotics in cariology

Reference Oral condition	Parameters evaluated - Evaluation time	Study design - Groups of study	Sample size (at the end of the study)- Age or age group	Vehicle - Administration time	Probiotic strain(s) used (Dose)
Pahumunto <i>et al.</i>, 2018 Dental carie	Clinical: caries/ Microbiological: SM, LB (saliva samples) - baseline, 3, 4, 6 months	RCT placebo-controlled, double-blind, parallel groups - Test group: milk with probiotic / Control group: standard milk	103 children - 1.5-5 years	Milk 5g with 50mL water - 3 months (once a day)	<i>Lactobacillus paracasei</i> SD1 (10 ⁷ CFU/g)
Rodriguez <i>et al.</i>, 2016 Dental carie	Clinical: ICDAS - baseline and 10 months	RCT placebo-controlled, triple blind - Test group: milk with probiotic / Control group: standard milk	243 children - 2-3 years	150mL milk - 10 months (once a day) -	<i>Lactobacillus rhamnosus</i> SP1 (10 ⁷ CFU/mL)
Di Pierro <i>et al.</i>, 2015 Dental carie	Cariogramme - baseline, day 90	RCT, placebo controlled - Probiotic group and Placebo group	76 children with high dental decay risk - 6-17 years	Tablet - 90 days (once a day)	<i>Streptococcus salivarius</i> M18 (1 x 10 ⁹ CFU)
Teanpaisan <i>et al.</i>, 2015 Dental carie	Clinical: caries/Microbiological: SM, LB (unstimulated saliva samples)/ Biochemical (pH) - baseline, 3, 6, 9, 12 months	RCT placebo-controlled, double-blind - Test group: milk with probiotic / Control group: standard milk	122 children - 12-14 years	Milk 5g with 50 mL water- 6 months (once a day)	<i>Lactobacillus paracasei</i> SD1 (10 ⁷ CFU/mg)
Hedayati-Hajikand <i>et al.</i>, 2015 Dental carie	Clinical: caries, PI, gingival health	RCT placebo-controlled, double-blind - Probiotic group and Placebo group	110 children - 2-3 years	Tablet - 3 months (once a day)	<i>Streptococcus uberis</i> KJ2TM, <i>Streptococcus oralis</i> KJ3TM, <i>Streptococcus rattus</i> JH145TM (10 ⁸ CFU)
Stensson <i>et al.</i>, 2014 Dental carie	Clinical: caries, PI, GI/ Microbiological SM, LB (plaque and saliva samples)/ Immunological: levels of sIgA - baseline and at 9 years old	RCT placebo-controlled, simple blind - Test group: oil containing live probiotic derived from breast milk / Placebo group	113 babies (and their mothers) - 9 years	Drops - 4 weeks before birth to 1 year of age (5 drops per day)	<i>Lactobacillus reuteri</i> (10 ⁸ CFU)
Taipale <i>et al.</i>, 2013 Dental carie	Clinical: ICDAS, PI/Microbiological: SM (plaque samples) - 1, 8, 24 months and 4 years old	RCT - Probiotic group + xylitol 100-300mg/Xylitol group (100-300mg)/Sorbitol group (100-300mg)	106 children - 1-2 months	Slow release or tablet - From 1-2 months of age to 2 years (twice a day)	<i>Bifidobacterium animalis subsp. lactis</i> BB-12 (5 x 10 ⁹ CFU)
Hasslöf <i>et al.</i>, 2013 Dental carie	Clinical: caries/Microbiological SM, LB (saliva samples), probiotic colonization - 3, 6 and 9 years old	RCT placebo-controlled, double-blind - Probiotic group and Placebo group	118 babies - 4 months	Supplementary cereals - 9 months (once a day)	<i>Lactobacillus paracasei</i> F19 (10 ⁸ CFU)
Ferrer <i>et al.</i>, 2019 Salivary pH, colonization of probiotic <i>S.dentisani</i> , level of <i>S.mutans</i> , acid production	Microbiological: SM, colonization of <i>S.dentisani</i> /Biochemical: pH salivary, acid production (dental plaque and saliva samples) - baseline, 14, 28 days	Study pilot phase 1, prospective, parallels groups Scalling 1 st and confection of dental gutter - Groups: unique dose or multi-dose (1 by the dentist and 6 at home)	11 healthy patients - 25-35 years	Topical adhesive gel 5min - 1 week (once a day) or unique dose	<i>Streptococcus dentisani</i> CECT7746 (+ guar gum + hydroxyethyl cellulose) (monodose 4 x 10 ¹⁰ CFUs multi-dose 5.5 x 10 ⁹ CFUs)
Manmontri <i>et al.</i>, 2019 Levels of <i>S. mutans</i>	Clinical: caries / Microbiological: SM (salivary, dental plaque samples), LB, total bacteria/ - baseline, 6, 12 months	RCT placebo-controlled, double-blind - Group I: placebo group/Group II: once a day/Group III: 3 days/week probiotics (fortnightly) and 4 days/week placebo	268 children - 1-5 years	Milk 50mL - 6 months (once a day)	<i>Lactobacillus paracasei</i> SD1 (1.8 x 10 ⁷ CFU/mL in 20% skimmed milk)
Villavicencio <i>et al.</i>, 2018 Salivary cariogenic microflora, salivary pH	Clinical: ICDAS, PI/ Microbiological: SM, LB/ Biochemical: pH, buffer capacity - baseline, 9 months	RCT placebo-controlled, triple blind - Probiotic group (probiotic milk) / Control group (standard milk)	321 children - 3-4 years	Milk 200mL - 9 months (once a day for 5 days per week)	<i>Lactobacillus rhamnosus</i> (5 x 10 ⁶ CFU/g) and <i>Bifidobacterium longum</i> (3 x 10 ⁶ CFU/g)
Alamoudi <i>et al.</i>, 2018 Salivary cariogenic microflora, salivary pH	Clinical: PI/Microbiological: LB, SM/ Biochemical: salivary pH, buffer capacity - baseline, 28 days	RCT controlled, double-blind - Probiotic group and Control group	178 children - 3-6 years	Lozenges - 28 days (twice a day)	<i>Lactobacillus reuteri</i> DSM 17938 and ATCC PTA 5289
Bafna <i>et al.</i>, 2018 Salivary cariogenic microflora	Microbiological: LB, SM (saliva samples) - baseline, 2 and 4 weeks	RCT controlled, double-blind - Probiotic group and Control group	70 adults with high risk of caries and with salivary SM count > 10 ⁶ CFU/mL - > 18 years	Yogurt 100g - 2 weeks (once a day)	<i>Lactobacillus acidophilus</i> LA5 and <i>Bifidobacterium lactis</i> BB12
Nagarajappa <i>et al.</i>, 2015 Salivary cariogenic microflora	Microbiological: LB, SM (saliva samples) - baseline, 1h, 18 days	RCT controlled, double-blind - Probiotic group and Control group	30 adults - 18-22 years	Ice cream 42g to 60mL - 18 days (once a day)	<i>Bifidobacterium infantis</i> 35624 (10 ⁶ CFU/mL)

Ashwin <i>et al.</i>, 2015 Salivary cariogenic microflora	Microbiological: SM (saliva samples)- baseline, 7, 30 days, 6months	RCT placebo-controlled, double-blind - Probiotic group and Placebo group	60 children with 0 DMFT - 6-12 years	Ice cream 54g - 7 days (once a day)	<i>Lactobacillus acidophilus</i> LA5 and <i>Bifidobacterium lactis</i> BB12 (10 ⁶ CFU each)
Nozari <i>et al.</i>, 2015 Salivary cariogenic microflora	Microbiological: LB, SM (saliva samples) – N/A	RCT placebo-controlled, double-blind, parallel 4 periods: 1 st and 3 rd : washout 1-2week respectively; 2 nd and 4 th : intervention 2weeks - Test group: probiotic yogurt / Control group: placebo yogurt	49 children - 6-12 years	Yogurt 200g - 2 weeks (once a day)	<i>Bifidobacterium lactis</i> (10 ⁶ CFU/g)
Javid <i>et al.</i>, 2015 Salivary cariogenic microflora	Microbiological: LB, SM (saliva samples) - baseline, 2 weeks	RCT, single blind - Probiotic group and Control group (yogurt 300g/d)	66 adults with early caries - 18-30 years	Yogurt 300g - 2 weeks (twice a day)	<i>Bifidobacterium lactis</i> (10 ⁶ CFU/mL)
Bhalla <i>et al.</i>, 2015 Levels of <i>S. mutans</i>	Microbiological: SM (saliva samples) - baseline, 1h, 7 days	RCT controlled - Probiotic group and Control group (curd)	30 caries free children - 12-14 years	Curd 200g - 7 days (once a day)	<i>Bifidobacterium animalis subsp. lactis</i> BB-12
Teanpaisan & Piwat 2014 Levels of <i>S. mutans</i>	Microbiological: LB, SM, salivary yeasts and probiotic colonization (PCR) - baseline, 1, 2, 3, 4, 8 weeks	RCT prospective, controlled-placebo, double-blind - Group A: probiotic and group B: placebo (standard powdered milk)	37 adults with caries in less than 2 teeth, absence of active untreated cariou lesions and absence of gingivitis or periodontal disease - 18-25 years	Milk powder 10g with 50mL water - 4 weeks (once a day)	<i>Lactobacillus paracasei</i> SD1
Campus <i>et al.</i>, 2014 Cariogenic microflora, salivary pH, gingival health	Clinical: BOP/Microbiological: SM/ Biochemical: salivary pH - baseline, 3, 6, 8 weeks	RCT controlled-placebo, double-blind - Probiotic group and Placebo group	181 children with 2 to 3 carious lesions and salivary concentration of SM $\geq 10^5$ CFU / mL - 6-8 years	Lozenges - 6 weeks (twice a day)	<i>Lactobacillus brevis</i> CD2
Mortazavi & Akhlaghi 2012 Salivary cariogenic microflora	Microbiological: LB, SM (saliva samples) - baseline, 2 weeks	RCT - Probiotic group and Placebo group	60 healthy adults with active untreated carious lesions and signs of gingivitis or periodontal disease - 18-37 years	White cheese 50g - 2 weeks (twice a day)	<i>Lactobacillus casei</i> LAFTI L26 (10 ⁶ CFU/g)
Cildir <i>et al.</i>, 2012 Salivary cariogenic microflora in children with cleft palate	Microbiological: LB, SM (saliva samples: CRT test) - baseline, 25 days	RCT, cross-over, double-blind 4 periods: 2 nd and 4 th of 25 days each (intervention)/1 st and 3 rd of 1 and 3 weeks respectively (washout) - Probiotic group and Placebo group	19 children operated on with cleft lip and palate without lesions of untreated caries - 4-12 years	Drop - 25 days (5 drops per day)	<i>Lactobacillus reuteri</i> DSM 17938 and ATCC PTA 5289 (1.3 x 10 ⁸ CFU/5drops)
Sudhir <i>et al.</i>, 2012 Levels of <i>S. mutans</i> and salivary pH	Microbiological: SM (saliva samples)/ Biochemical: salivary pH - baseline, 30 days	RCT - Probiotic group (curd with probiotic) / Placebo group (200mL curd)	40 caries free children - 10-12 years	200mL curd - 30 days (once a day)	<i>Lactobacillus acidophilus</i>