

Antimicrobial Effect of Hidro-carbon-oxo-borate on a Multispecies Subgingival Periodontal Biofilm

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ABSTRACT

Purpose

This study evaluated the effect of hydro-carbon-oxo-borate complex (HCOBc) on a multispecies subgingival biofilm

Methods

The subgingival biofilm with 32 species related to periodontitis was formed in the Calgary Biofilm Device (CBD) for 7 days. Two different therapeutic schemes were adopted: 1) treatment with HCOBc, 0.12% chlorhexidine (CHX) and negative control group (without treatment) from day 3 until day 6, two times a day for 1 min each time, totaling 8 treatments, and 2) a 24-hour treatment on a biofilm grown for 6 days. After 7 days of formation, biofilm metabolic activity was determined by colorimetry assay, and bacterial counts and proportions of complexes were determined by DNA-DNA hybridization..

Results

The first treatment scheme resulted in a significant reduction in metabolic activity of biofilm by means of 77% by HCOBc and CHX treatments versus negative control. The total count of 11 and 25 species were decreased by treatment with hydro-carbon-oxo-borate complex and CHX respectively when compared with the group without treatment ($p < 0.05$), highlighting a reduction in the levels of *P. gingivalis*, *T. forsythia*, *P. intermedia* and *F. periodonticum*. CHX significantly reduced the count of 10 microorganisms in comparison with the group treated with HCOBc ($p < 0.05$). HCOBc and CHX significantly decreased the proportion of the pathogenic red complex when compared with control-treated biofilm, and HCOBc had even a greater effect on the red complex than CHX had ($p \leq 0.05$). For the 2nd treatment scheme, HCOBc complex and CHX significantly decreased 61 and 72 % of metabolic activity of control biofilms and the counts of 27 and 26 species, respectively. HCOBc complex did not significantly affect the proportions of formed biofilms while CHX significantly reduced proportions of red, orange and yellow complexes

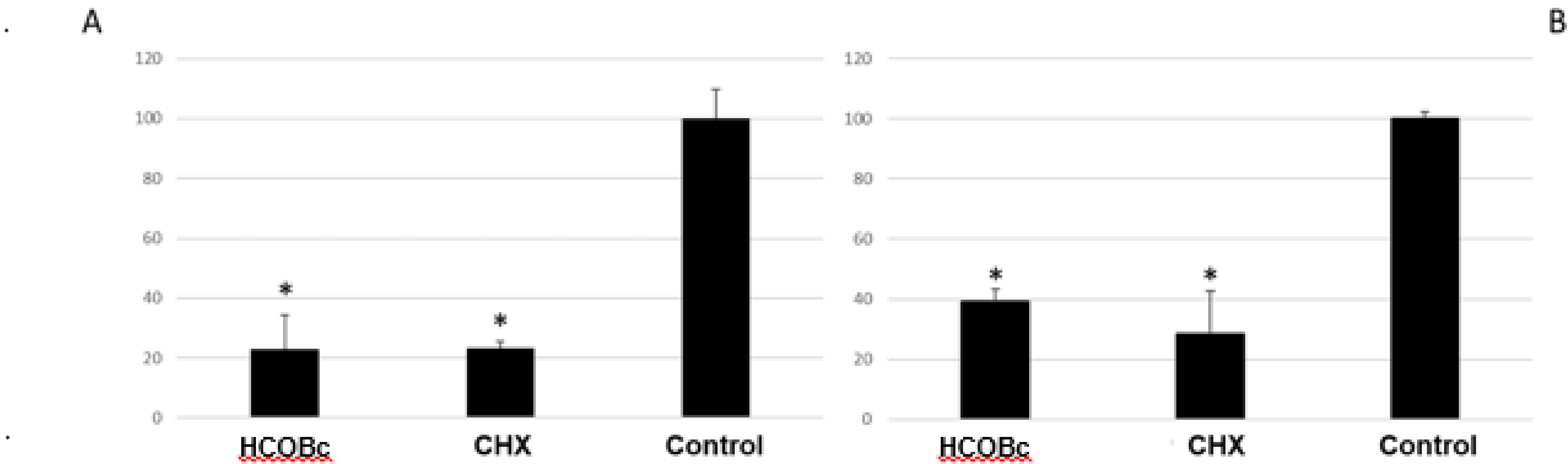


Figure 1: Results (mean and standard deviation) of metabolic activity of multispecies biofilms treated with hydro-carbon-oxo-borate complex gel (), Chlorhexidine 0.12% (CHX) and culture medium (control). Control biofilms were considered 100% metabolic activity. A: Twice daily scheme and B: 24-hour treatment on formed biofilms. * indicate statistical significance by ANOVA followed by Tukey post-hoc test for control group ($p \leq 0.05$).

Conclusion

These data suggested that HCOBc complex was as effective as chlorhexidine in reducing overall subgingival biofilm formation, and better than chlorhexidine in reducing red-complex bacterial proportions. Although HCOBc reduced the mature 6-day-old subgingival multispecies biofilms, it did not modify the proportions of bacterial complexes of the above-mentioned biofilms. Future *in vivo* studies are needed to validate these results.

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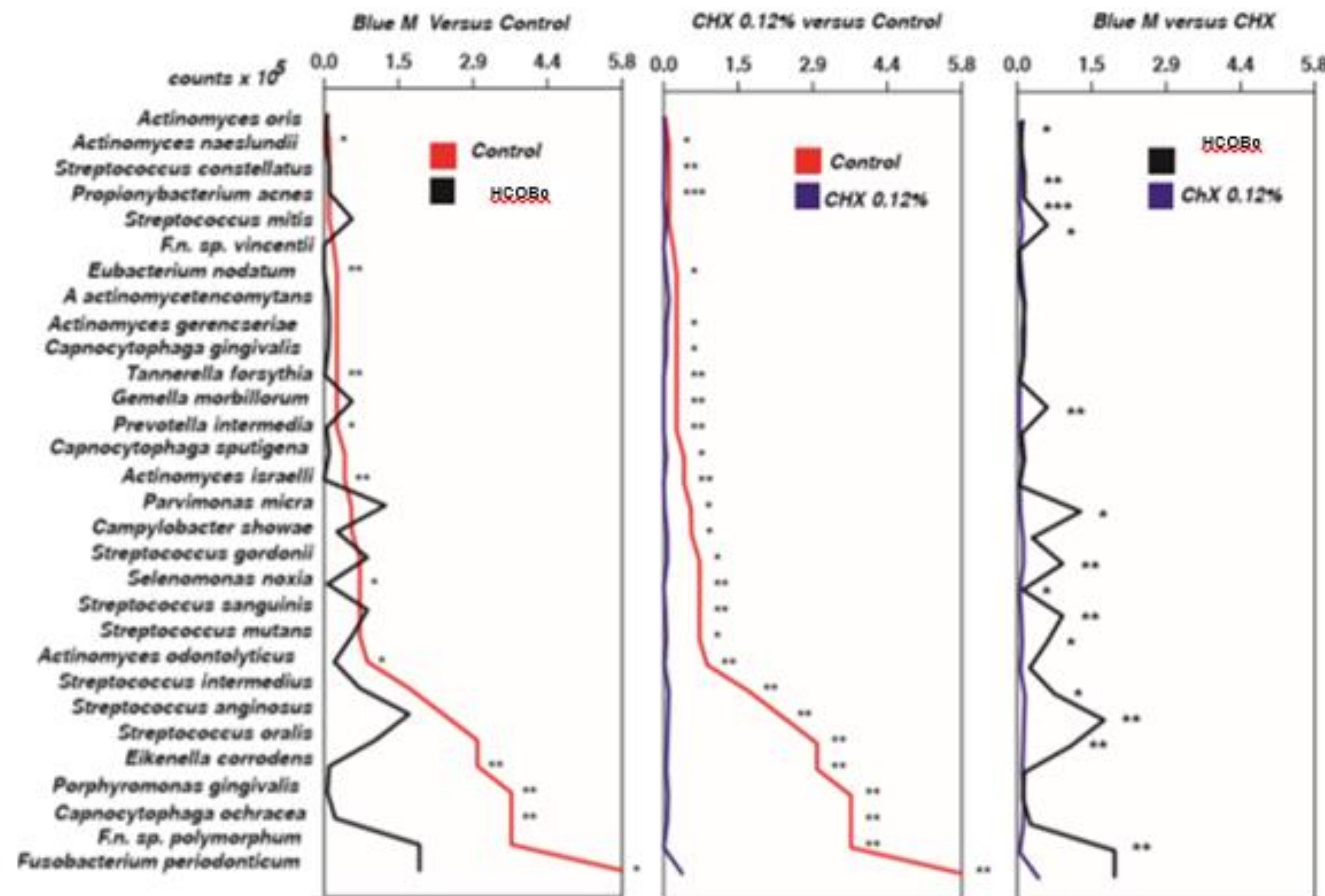


Figure 2: Mean bacterial count (×10⁵) of biofilms treated twice daily with hydro-carbon-oxo-borate gel, Chlorhexidine 0.12% (CHX) and culture medium (control). Data were analyzed using the Mann-Whitney test (* p<0.05; ** p<0.01, ***p<0.001).

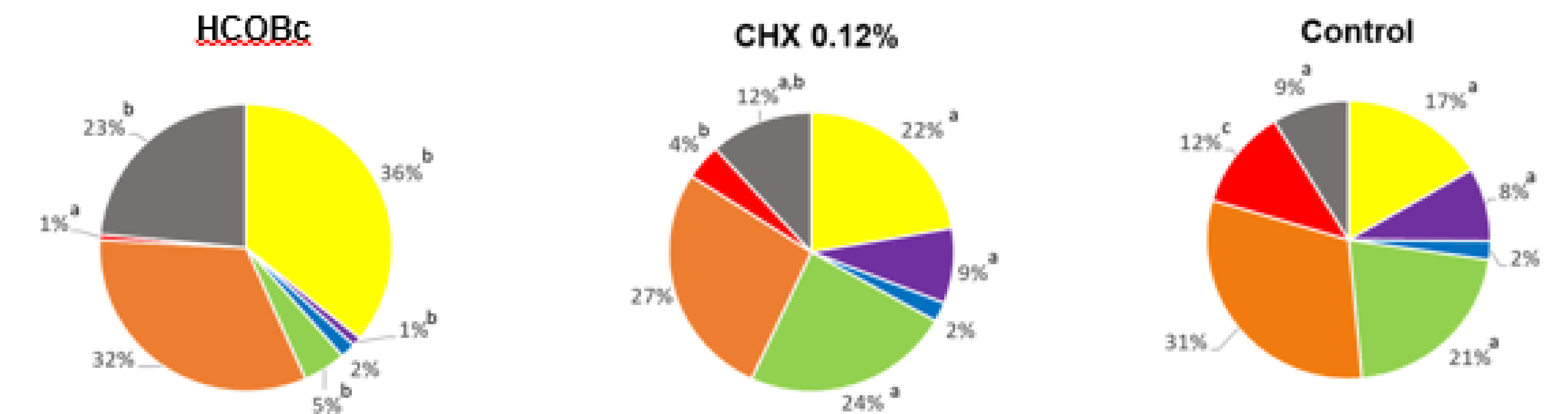


Figure 3: Mean proportions of 7-day biofilms treated with hydro-carbon-oxo-borate gel (BlueM), Chlorhexidine 0.12% (CHX 0.12%) and culture medium (control) twice daily from day 03 until day 06. Different letters mean statistical significance determined by Kruskal-Wallis followed by Dunnnett post-hoc tests (p ≤ 0.05).

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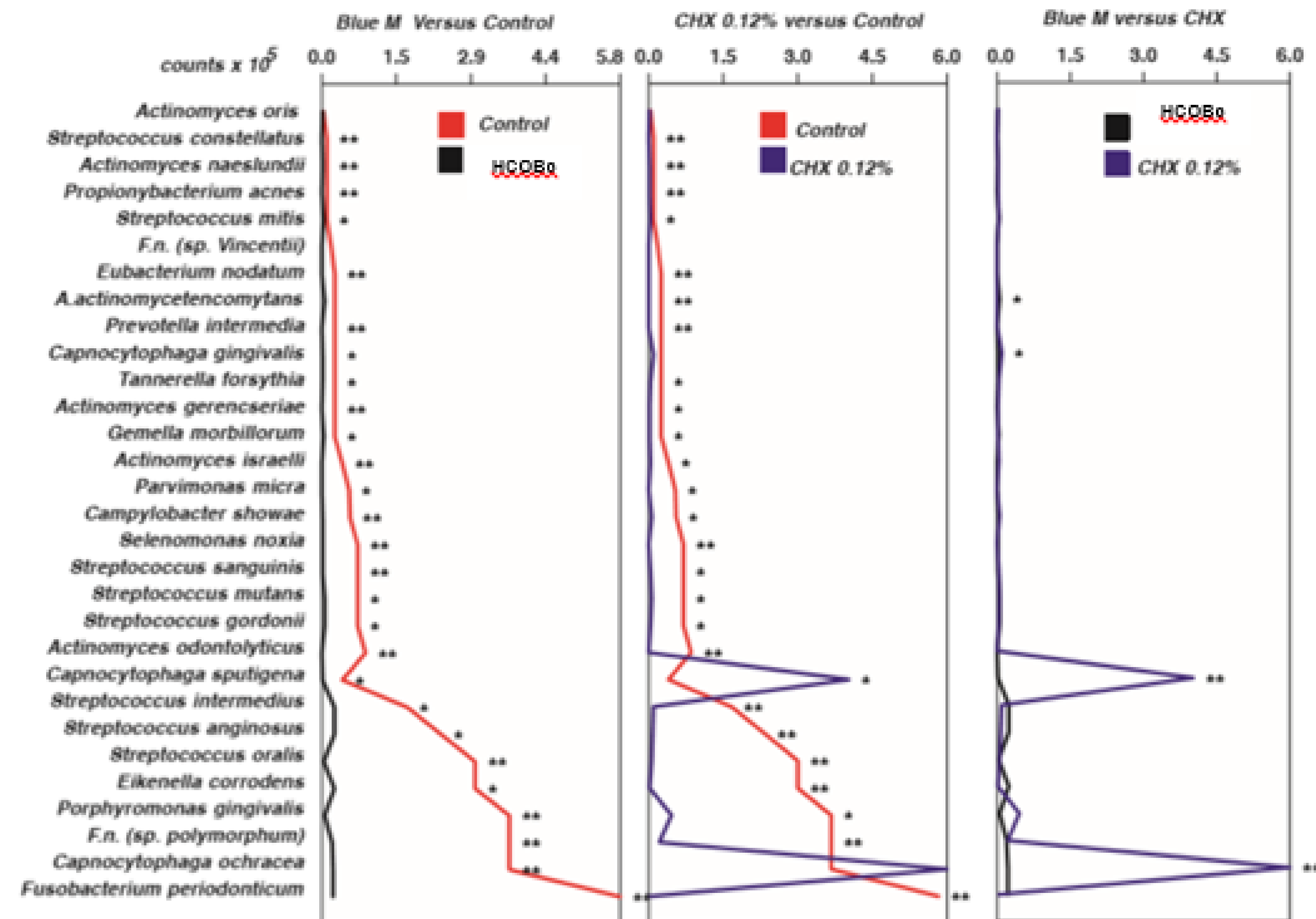


Figure 4: Mean bacterial count ($\times 10^5$) of 6-day biofilms treated during the next 24 hours with hydro-carbon-oxo-borate gel, Chlorhexidine 0,12% (CHX) and culture medium (control). Data were analyzed using the Mann-Whitney test (* p < 0.05; ** p < 0.01, *** p < 0.001).

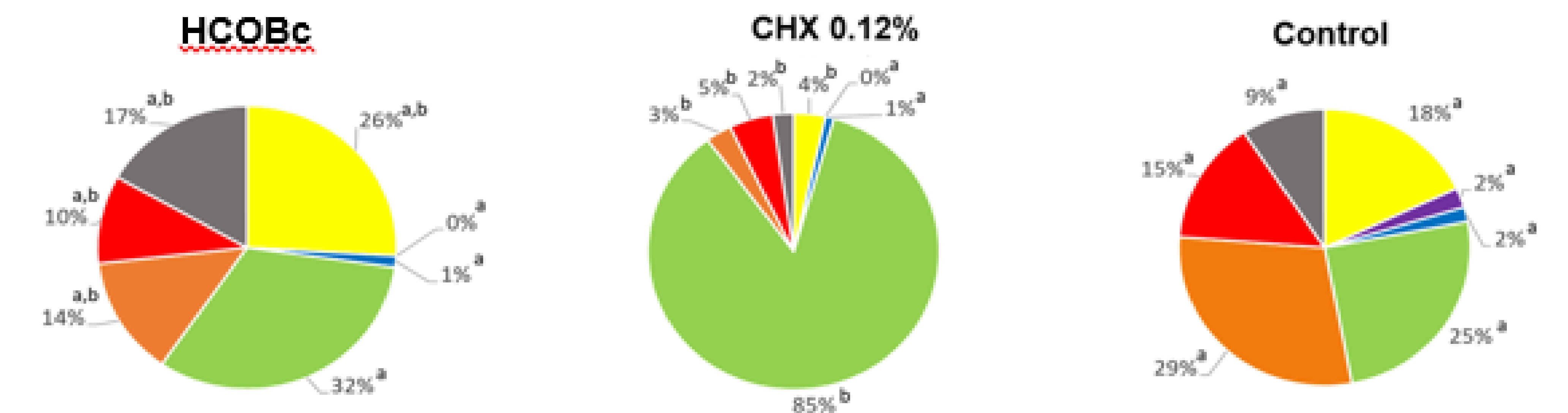


Figure 5: Mean proportions of 6-day biofilms treated for an additional 24 hours with hydro-carbon-oxo-borate (HCOBc) gel, Chlorhexidine 0,12% (CHX 0.12%) and culture medium (control). Different letters mean statistical significance determined by Kruskal-Wallis followed by Dunnnett post-hoc (p ≤ 0.05).