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pH-sensitive Tertiary Amine Monomer for the Prevention of Dental Caries

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Abstract

Previous researches indicated that there is an aggregate of microorganism in dental caries which takes part in promoting the occurrence of dental caries, but few studies on anti-caries materials for these 'core microbiome' were developed. In order to explore the effect of pH-sensitive tertiary amine monomer (DMAEM) on the core microbiota of dental caries and further study its anti-caries effect, we co-cultured the core microbiome of caries anaerobically (including Veillonella parvula, Fusobacterium nucleatum, Prevotella denticola, Leptotrichia wadei, Streptococcus mutans), and then treated with DMAEM (6.25mg/ml) and PBS for 10 minutes every 24 hours under acidic and neutral conditions, and repeated 3 times. We conducted methylthiazolyl tetrazolium colorimetry (MTT), lactic acid detection, transverse microradiography (TMR), confocal laser scanning microscopy (CLSM), quantitative polymerase chain reaction (qPCR) and rat model test to study the cariogenic ability changes of the flora.

Results

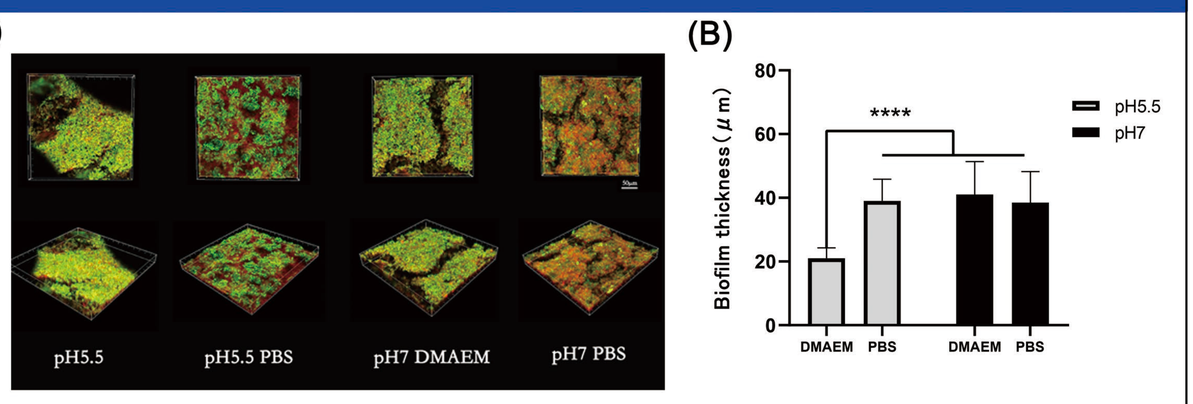
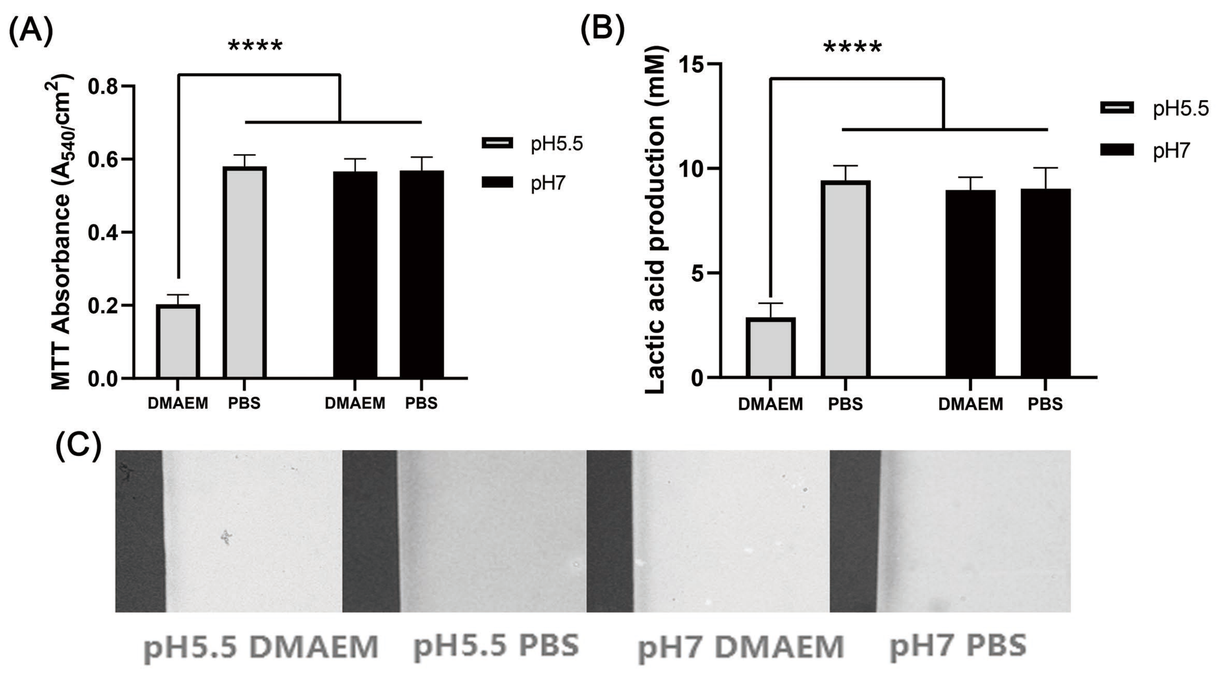


Figure 1 Growth change of the biofilms. CLSM three-dimensional structure (A), the fluorescence intensity of live bacteria and extracellular polysaccharides(B), the thickness of the biofilm(C). Total viable bacterial count(D), the number of each bacterium(E) and composition ratio of the microbiome(F).****P < 0.0001; ns, not significant.



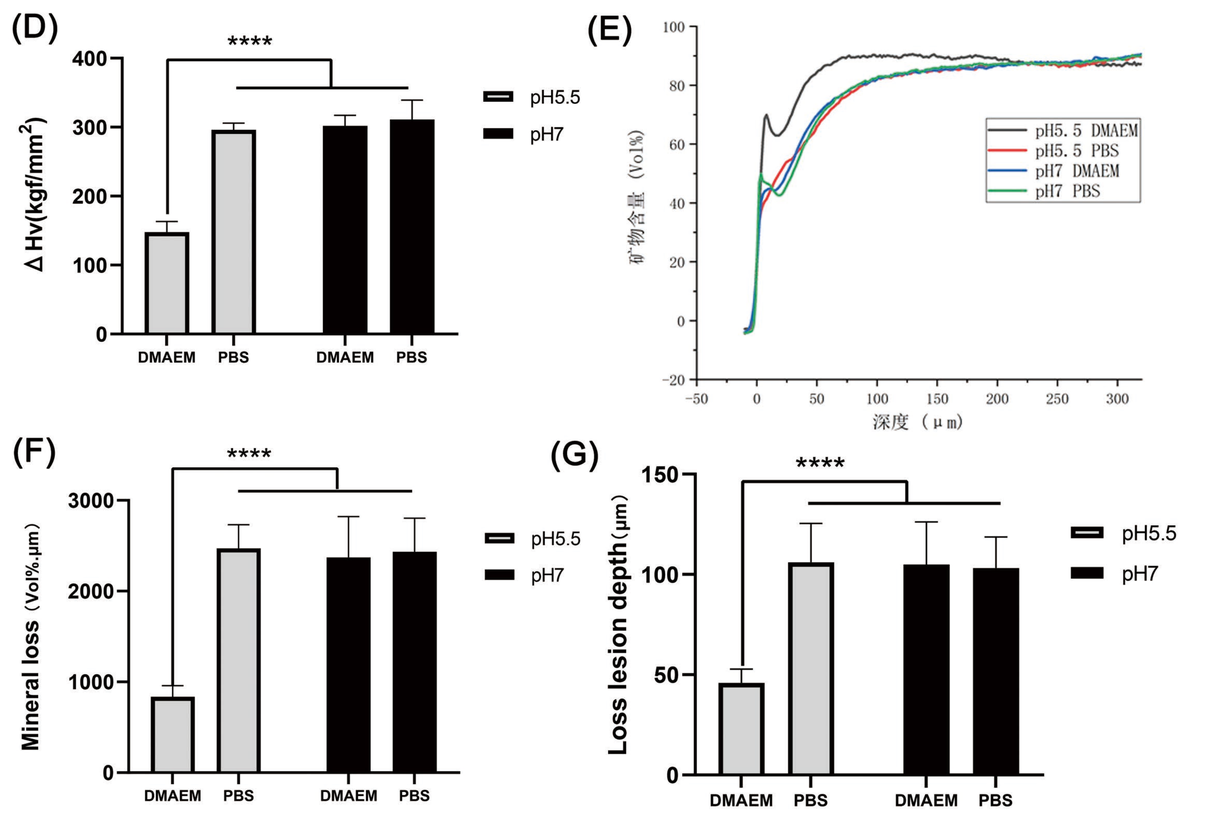


Figure 2 Metabolic activity and demineralization capacity of the flora. MTT assay(A) and lactic acid production(B). Image captured by transverse microradiography(C), surface microhardness change(D), mineral volume curve(E), mineral loss(F) and lesion depth(G) of the enamel specimens.****P < 0.0001.

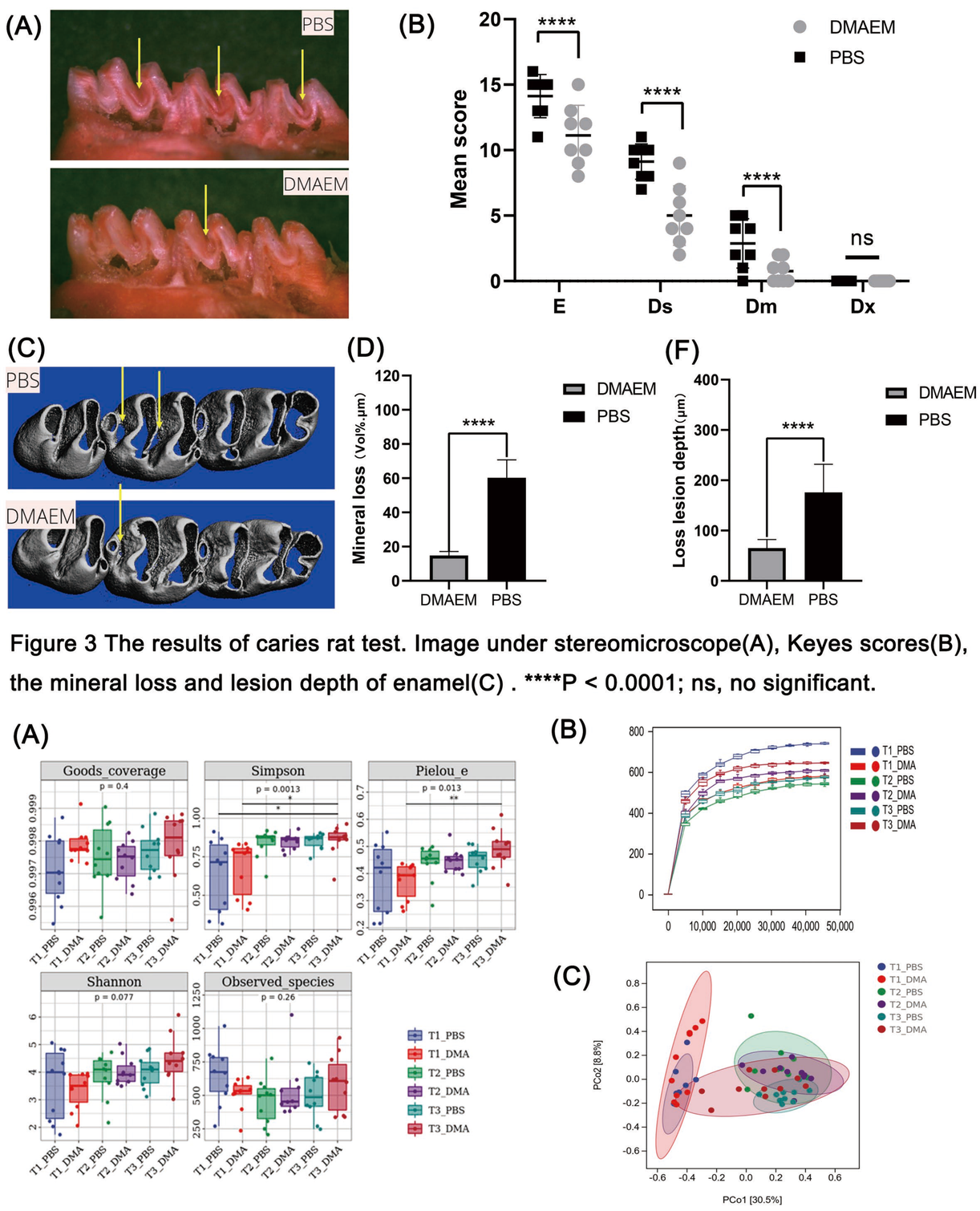


Figure 3 The results of caries rat test. Image under stereomicroscope(A), Keyes scores(B), the mineral loss and lesion depth of enamel(C) . ****P < 0.0001; ns, no significant.

Figure 4 High-throughput analysis of rat saliva biofilm. α diversity analysis(A), rarefaction curve(B) and β diversity analysis(C).

Conclusion

DMAEM can respond to acidic conditions, effectively inhibit the growth of the core microbiota of caries and its cariogenic ability while maintaining the microecological balance. It is a promising pH-sensitive materials for caries prevention and treatment.

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