BAR-Encapsulated Nanoparticles against *P. gingivalis* Biofilm Formation

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Abstract

Periodontal diseases are globally prevalent chronic inflammatory diseases that affect ~46% of U.S. adults. *Porphyromonas gingivalis* (*P. g.*) adherence to oral streptococci is a key event in the initiation and pathogenesis of periodontal diseases. Previous work in our groups has shown that a region of the streptococcal antigen denoted BAR (SspB Adherence Region) can inhibit *P. g.*/*S. gordonii* (*S. g.*) interaction and biofilm formation both *in vitro* and in a mouse model of periodontitis. While efficacious, BAR provided transient inhibition and required higher concentrations of BAR to disrupt established biofilms. To address these challenges, we fabricated BAR-ecapsulated poly(lactic-co-glycolic acid) (PLGA) nanoparticles (NPs) using an adapted double-emulsion technique, then assessed their activity to inhibit or disrupt *in vitro* biofilm formation relative to free BAR. Moreover, the kinetics of BAR-encapsulated NPs were compared to free BAR after different durations of exposure in a two-species biofilm model. Our results indicate that BAR-encapsulated PLGA NPs potently inhibit biofilm formation (IC50 = 0.7 µM) and disrupt established biofilms (IC50 = 1.3 µM) in a dose-dependent manner. In addition, functional activity of BAR released during the first two hours of administration potently inhibit biofilm formation, while a longer duration of 3 hr is required to disrupt pre-existing biofilms. In conclusion, these results suggest that BAR-encapsulated provides a potent platform to inhibit and disrupt *P. g.*/*S. g.* biofilms, relative to free BAR. The incorporation of BAR peptide within NPs provided relevant and timely release of BAR peptide, suggesting potential application for delivery to the oral cavity.

Biography of Presenter

Mohamed Y. Mahmoud is a Ph.D. Candidate at University of Louisville in the Department of Pharmacology & Toxicology. Mohamed obtained his undergraduate degree in Veterinary Medicine at Cairo University. He earned his Master's in Toxicology at Cairo University. Mohamed worked as an Assistant Lecturer of Toxicology and Forensic Medicine, Cairo University since 2015. Mohamed submitted his first *in vitro* manuscript, which will be followed by his *in vivo* manuscript, a review paper (in progress), and a co-authored manuscript with a Master's dental student in the area of fibers against oral biofilms. His current focus is creating novel biomaterials that deliver BAR peptide to specifically target oral niches against biofilm formation.