Effect of Genistein in the growth of *Fusobacterium nucleatum*

Bryan Cruz

Mentor: Dr. Shane Gold

Bio 494

Fall 2013
Abstract

*Fusobacterium nucleatum* is an early colonizing bacteria that adheres to teeth and gums and plays a direct role in the development of periodontal diseases. Genistein is an antimicrobial phytoestrogen produced by soybeans. This study investigated the antimicrobial effect of genistein on *F. nucleatum* and was found to inhibit growth *in vitro*, suggesting that consumption of soy products may be protective against periodontal disease.

**Key Words:** *Fusobacterium nucleatum*, genistein, periodontal diseases, gingivitis, isoflavones, phytoestrogen, periodontitis, biofilm

Introduction:

Gum infections are initiated by the metabolic activities of early colonizing bacteria such as *Streptococcus mutans*, a bacterial species that hydrolyzes sucrose to form dextran and other sticky polysaccharides. Bacterial strains such as *Fusobacterium nucleatum* adhere to these biofilms and promote colonization by additional pathogenic strains such as *Treponema denticola*, *Aggregatibacter actinomycetemcomitans*, *Porphyromonas gingivalis*, *Tannerella forsythia*, and *Campylobacter rectus* (Cho et al. 2012, Kolenbrader 2000). The metabolic activities of the resulting bacterial communities produce acids and irritants that can erode tooth enamel, promote inflammation, and create opportunities for further infection, many of which are associated with effects on bone health, heart, skin and other regions beyond the mouth (Jensen, 1998).

Recent studies have suggested that soy proteins and isoflavones, may help control periodontal infections (Tanaka et al. 2008). Genistein (5,7-dihydroxy-3-[4-hydroxyphenyl]chromen-4-one), a structural analog of estrogen, is one of the most abundant isoflavones in soy (Martínez-Montemayor et al. 2010) and is known to have antifungal properties that may help reduce the risk of infections (Birk et al. 1974). Genistein is also reported to help enhance the immune response against infections (Jenkins et al. 2002). There are no reports of an antimicrobial effect of genistein against *F. nucleatum*. The purpose of this study was to investigate the ability of genistein to inhibit the growth of *F. nucleatum*. 
Material and Methods

*Fusobacterium nucleatum* (ATCC 25586) was grown in chopped meat broth (Atlas & Synder 2006), and incubated at 37°C for 48 hours under anaerobic conditions. Genistein stock solutions were resuspended in DMSO to 100 mM. A two-fold dilution series was set up in chopped meat broth to obtain genistein concentrations ranging from 0.0012 mM to 0.61 mM. Each culture tube was inoculated from an overnight culture of *F. nucleatum* at a 1 % (w/v) inoculation level, and incubated for 48 hours at 37°C under anaerobic conditions, whereupon the absorbance was measured at 600 nm to gauge the density of bacterial growth. Each assay was performed in duplicate.

Results and Discussion

Bacterial growth was observed at all genistein concentrations among the entire tested range but cell density exhibited a clear dose-dependent inhibitory effect (Figure 1). As *F. nucleatum* is an important early colonizer of the human oral cavity, the inhibition of this one species is key in preventing the development of periodontal disease. The results obtained herein suggest that the consumption of soy products, or the use of dental care products containing genistein, coupled with proper dental hygiene, may be able to help inhibit the growth of *F. nucleatum*, and thereby help prevent the development of gum diseases.

![Graph](image)

Figure 1. The average absorbance measurements for *F. nucleatum* cultures at concentrations of genistein up to 0.62 mM.
Work Cited


