Effects of polyphenols on Periodontitis

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Research Question

Can the use of polyphenols treat and/or prevent periodontal disease?

Abstract

Pharmacological agents have been used for centuries to treat or cure diseases. Foods, herbs, and extracts can produce similar pharmacological effects, one being polyphenols. This extract in particular exhibits anti-inflammatory and antioxidant effects.[4] One cellular study stated the biofilm forming capacity and viability of periodontitis pathogens can be significantly altered by dietary polyphenols.[3]

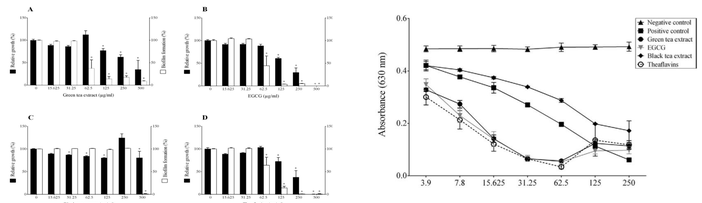
Each year 2.8 million people in the United States are diagnosed with an antibiotic resistant bacterial or fungal pathogen[3]. Due to the increasing occurrence of antibiotic resistance, importance of finding new molecules capable of expanding treatment modalities is fundamental in maintaining an acceptable standard of care.

Introduction

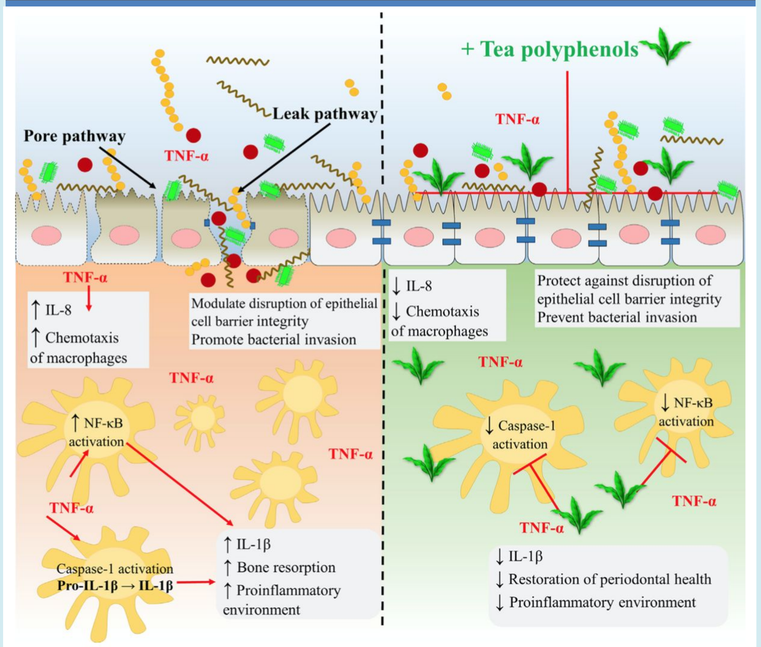
- Polyphenols found in green tea enhanced the integrity of gingival keratocytes by the increase in trans-epithelial resistance.[1]
- Dietary polyphenols are found in a variety of sources like curcumin in the commonly consumed turmeric and catechins in fruits, green tea, and vegetables.[4]
- Polyphenols are natural products, produced by plants as secondary metabolites with different functions ranging from defense to growth regulation.[5]
- During gingival health, biofilms are composed of gram-positive facultative aerobic bacteria. If left undisturbed, the biofilm eventually becomes colonized with gram-negative facultative anaerobic bacteria, which then begin to proliferate.
- Bacterial agents identified in causing Periodontitis*: Porphyromonas gingivalis, Prevotella intermedia, Tannerella forsythia* or *Treponema denticola*, as well as *Aggregatibacter actinomycetemcomitans.*
- According to the CDC, roughly 47% of adults, aged 30 years and older have some form of periodontal disease[3].
- Periodontal disease increases with age, approximately, 70% of adults 65 years and older have periodontal disease.
- Pro-inflammatory cytokines involved in periodontitis: TNF-α, IL-1, IL-6 & IL-8

Review of Literature

- Polyphenols possess the capacity to chelate iron, an essential nutrient, which may contribute to their antibacterial activity which may be responsible for possible bactericidal properties.[1]
- A clinical study on humans used a gel containing 1% curcumin, which is found in turmeric, and was applied to affected areas in the periodontal pockets and resulted in bactericidal effects on *P. gingivalis*, *P. intermedia, F. nucleatum, and Capnocytophaga*.[3]
- Compared with other polyphenolic compounds, EGCG shows the highest inhibitory effect on the growth and adherence to human epithelial cells of *P. gingivalis*.[5]
- EGCG and theaflavins significantly and dose-dependently reduce IL-1 secretion by TNF-α-treated macrophage.[2]

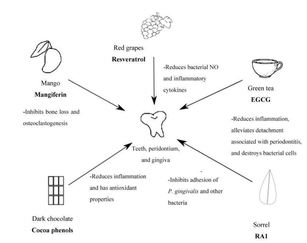


Role in maintaining gingival tissue



Discussion

Findings from the research examined the effectiveness of plant polyphenols in maintaining keratinocyte tight junctions (TJ) as well as limiting the inflammatory response of IL-1 secretion by TNF-α-treated macrophage. IL-1 & TNF-α play significant roles in the cascade effect of other interleukins which elucidate the effects inflammation have on collagen modeling of the periodontium. Plants rich in Polyphenols such as the ones found in green tea may attenuate host inflammatory responses while also expressing a potential in inhibiting bacterial growth by disrupting membrane proteins found on bacterial cell surfaces. The chelation of iron by polyphenols should also not be overlooked. One of the many reasons why bacteria perform hemolysis is to metabolize iron which me be the key to their bactericidal effects. Most of the work so far in this area focuses on treatments of biofilms grown in a lab or on rodent species. There is not enough data performed on humans *in situ* or *in vivo.* There exist numerous opportunities for future research regarding this area and should be followed up extensively. Also polyphenols are rich in their diversity and although some do not express desired outcomes there are many more individual molecules of polyphenols which may prove to be beneficial for possible treatments.



Conclusion

From the research examined, it appears that certain polyphenols express bactericidal properties as well as anti-inflammatory properties which may be beneficial to elucidating better treatment modalities for periodontitis and perhaps other diseases. Similar effects have been shown on other autoimmune inflammatory diseases such as rheumatoid arthritis.

References

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