

A Review on the Role of *Porphyromonas gingivalis* for Periodontitis

Insyirah Raudah Ismail^a & Faezah Sabirin^{ab*}

Structured Abstract

Background: Millions of people worldwide suffer from periodontitis, a chronic inflammatory disease of the oral cavity that remains to be a major public health concern. In Malaysia alone, more than 12 million adults are affected. Periodontitis can lead to the breakdown of the tooth's supporting structures shortly after starting with bacterial buildup known as biofilm and inflammation. *Porphyromonas gingivalis* (*P. gingivalis*) has been recognised as a major contributor among the several pathogens associated due to its capacity to disrupt the balance of oral microbes, cause inflammation, and evade host immune responses. This critical review focuses on the role of *P. gingivalis* on the development of periodontitis including the factors for the development of periodontitis, the role of *P. gingivalis* in oral dysbiosis, the mechanism used by *P. gingivalis* to thrive in oral microbiome, the importance of subgingival biofilm and how *P. gingivalis* impact the host immune system.

Methodology: This critical review was completed through analysing relevant peer-reviewed articles published between 2010 and 2025 and retrieved from scientific databases such as PubMed, Scopus, ScienceDirect, Web of Science, SpringerLink as well as BioMed Central (BMC). Articles were chosen based on their relevance to *P. gingivalis*, oral dysbiosis, dental biofilm production, virulence mechanisms, host immunological interaction, and systemic implications.

Key Findings: *P. gingivalis* plays an important role in oral dysbiosis by disrupting the equilibrium of oral bacteria and allowing other pathogenic bacteria to thrive. Subgingival biofilms create an immune-evasive niche that supports the persistence and proliferation of *P. gingivalis*. Its virulence components, including fimbriae, gingipains, LPS, and OMVs, contribute in its ability to adhere to tissues, evade immune responses, and induce inflammation. Chronic tissue degradation is driven by the disruption of host signalling pathways, including NF- κ B, MAPK, and PI3K/Akt, by these virulence factors. Due to its ability to spread beyond the oral cavity and trigger systemic immune responses, *P. gingivalis* has been linked to several systemic diseases, including diabetes, cardiovascular disease, and Alzheimer.

Conclusion: In conclusion, *P. gingivalis* is the main pathogen responsible for periodontitis as it disrupts the balance between good and bad bacteria in the mouth, which results in inflammation and oral dysbiosis. It thrives in the subgingival biofilm, where it is protected from the immune system and can worsen the condition by interacting with other pathogenic microorganisms. *P. gingivalis* may attach to tissues, evade immune reactions, and harm the gum tissue in response to its virulence factors, which include fimbriae, gingipains, LPS, and OMVs. These behaviours can result in cardiovascular disease, diabetes, and other health issues in alongside oral disease.

Keywords: *Porphyromonas gingivalis*, periodontitis

*Correspondence: drfaezah@uitm.edu.my

^a School of Biology, Faculty of Applied Sciences, Universiti Teknologi MARA, Shah Alam, Malaysia

^b School of Dental, Faculty of Dentistry, Universiti Teknologi MARA, Sungai Buloh, Malaysia