

## Betel nut chewing effects on the incidence of periodontitis

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### Abstract

**Background:** Betel quid chewing, a common cultural practice in various parts of Asia, has been associated with numerous oral health issues, including periodontitis. Betel quid chewing, which involves the consumption of a mixture of areca nut, lime, betel leaf, and sometimes tobacco, is a common practice in several Asian countries, including Indonesia. Several studies have indicated a connection between this habit and various oral health problems, including periodontitis, a chronic inflammatory condition affecting the supporting tissues of the teeth. This systematic literature review aims to explore the relationship between betel quid chewing and the incidence of periodontitis.

**Method:** The method used is a systematic review which is done by searching articles through Google Scholar, PubMed, and ScienceDirect.

**Discussion:** The review's findings indicate that betel quid chewing significantly increases the risk of periodontitis. The pathophysiological mechanisms involve chronic irritation and alterations in oral microflora induced by the components of betel quid, ultimately leading to inflammation of periodontal tissues. Some studies also suggest that the duration and frequency of betel quid chewing are positively associated with the severity of periodontitis.

**Conclusion:** There is strong evidence supporting the hypothesis that betel quid chewing is an important risk factor for the development of periodontitis.

**Keywords:** Betel nut; Betel nut chewing; Periodontitis; Oral Cancer

### 1. Introduction

Chewing betel nuts is a popular practice in South and Southeast Asian countries and carries a significant risk for oral disorders, including periodontal disease, cancer, and precancerous lesions<sup>[1]</sup>. The province in Indonesia with the highest betel nut consumption, at 17.7%, is East Nusa Tenggara, where betel chewing is valued as a means of initiating conversations and strengthening social bonds. This practice is considered a form of appreciation for visiting guests<sup>[2]</sup>.

Betel has been widely used as a drug in Southeast Asia and the Asia Pacific. According to anthropological studies, betel can cause euphoria and antidepressant effects. It can also strengthen gums and teeth, improve digestion, eliminate nausea, stop diarrhea, deworm, improve cognitive abilities, and stimulate appetite or suppress hunger. It also functions as an analgesic and sedative. Some of these effects have been validated by scientific evidence<sup>[3]</sup>, the psychoactive effects of betel quid have been recognized in previous research<sup>[4]</sup>, and the issue of betel addiction, or dependence, has also been discussed<sup>[5]</sup> [6].

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This tradition of chewing betel nut has been carried out by teenagers and adults for 3,000 years, to be precise in the Neolithic era in the hope of cleaning and strengthening teeth. Therefore, it is not surprising that in rural areas there are still many elderly and elderly people who still practice this tradition<sup>[7]</sup>. In the past, this tradition was usually carried out by someone who liked to snacking, but currently this tradition is only carried out by elderly parents<sup>[8]</sup>.

2018 RISKESDAS data shows that the percentage of periodontitis cases in Indonesia is 74.1%<sup>[9]</sup>. The habit of betel nut has adverse effects on the health of the teeth, gingiva and oral mucosa. On the one hand, betel chewing can inhibit the formation of dental caries, but on the other hand, the negative effects of betel nut can cause stains on the teeth and gingiva. In addition, betel nut can increase the risk of periodontal disease and cause lesions on the oral mucosa<sup>[10]</sup>.

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## 2. Methods

This research is a systematic literature review obtained from 3 academic databases, namely Google Scholar, Pubmed and ScienceDirect. Data search was carried out by looking for information from relevant journals with publication criteria for the last 10 years, namely 2014-2024. The data obtained was based on the keywords "chewing betel nut", "periodontitis" and "oral cancer".

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## 3. Discussion

The term "betel nut chewing" refers to the act of chewing a mixture of ingredients such as betel nut, areca nut, lime, gambier, and tobacco. Betel nut chewing is used in important events such as weddings and traditional ceremonies. It is also used in daily activities<sup>[11]</sup>. According to Sutana et al.<sup>[8]</sup>, hosts usually have a healthy mouth, strong teeth, and rarely have cavities or loss. However, they may have slightly yellow or reddish teeth. This is related to the advantages of the materials used for the host. The natural antiseptic properties of areca nut and betel leaves prevent the growth of germs that cause toothache and bad breath thanks to the phytochemical compounds in them. In addition, the mixture of lime deposits contained in the host material contains calcium, which is considered good for healthy bones and teeth. The alkaloid, saponin, flavonoid and polyphenol content in tobacco can also be used as a wound medicine<sup>[8]</sup>.

Betel quid consists of a mixture of areca nut, slaked lime from seashells, betel leaf, and slightly dried tobacco<sup>[1]</sup>. The Areca nut, also known as betel nut, is the fruit of the areca palm (*Areca catechu*), which is found over much of the tropical Pacific (Melanesia and Micronesia), South Asia, Southeast Asia, and parts of east Africa. The main component in areca nut is arecoline, which is also the primary carcinogen and the cause of the majority of malignancies<sup>[12]</sup>.

Arecoline is known to stop the growth of gingival keratinocytes, which increases the risk of severe periodontal disease, gingival tissue destruction, and chronic periodontitis. Arecoline has been shown to induce carcinogenicity (CP) by impairing the genotoxicity and cytotoxicity of mammalian cells both in vivo and in vitro. As a result, this impact increases. Inflammatory diseases caused by infections of the tissues supporting the teeth, especially cementum, periodontal ligament, and alveolar bone, are called carcinogenesis. The disease causes sequelae, which make buccal appearance and function more difficult. Additionally, disease development, exposure to disease, and rate of progression are influenced by genetics, environmental variables, and behavior. Insecurity, emotional responsibility, and increased body defense mechanisms that can worsen infections and illnesses are some of the effects that CP can cause<sup>[13]</sup>.

Areca nut contains main components including polyphenol compounds, tannins (11-26%), alkaloids (0.15-0.67%)<sup>[14]</sup><sup>[15]</sup>, and calcium hydroxide (slaked slime). In the betel leaves, we can found components such as polyphenols, alkaloids, and sterols. Previous research has proven that arecoline in areca nut impacts the growth of fibroblasts, gingival keratinocytes, human epithelial cell lines<sup>[16]</sup>, and cementoblasts<sup>[17]</sup>. Arecoline alters the shape of fibroblasts and collagen, which makes betel chewers more susceptible to periodontal tissue destruction and unresponsive to periodontal regenerative procedures. In addition, arecoline increases the expression of transglutaminase-2 mRNA and causes damage to intracellular vacuoles. The dose of arecoline affects gingival fibro explosions<sup>[16]</sup>. Previous studies regarding the relationship between betel quid chewers and periodontal disease found that chewers had worse OHIS than non-chewers<sup>[18]</sup>. Additionally, betel quid has been shown to exacerbate gingival irritation<sup>[19]</sup>. Betel quid chewers had worse gingival inflammation, plaque index, bleeding on probing (BOP), recession, periodontal pocket depth (PPD), and clinical attachment loss (CAL) compared to non-chewers<sup>[18]</sup><sup>[19]</sup>.

The arecoline content in betel nuts which is cytotoxic with a cytotoxicity threshold of 10 g/ml causes periodontal cell damage due to BQC (betel quid chewer). Arecoline also inhibits cellular mitochondrial activity and intracellular thiol depletion. In addition, gingival fibroblasts, which play a role in biological toxicological pathways, are subject to gene suppression. Arecoline increases salivation and increases the amount of calcium salts deposited in the calculus. In

addition, excessive occlusal forces caused by BQC cause severe attrition of the occlusal surfaces of the mandible and maxilla<sup>[16]</sup>.

Slaked lime component plays an important role in the initiation and progression of periodontal inflammation. They also participate in the formation of ROS, which causes oxidative stress in periodontal tissues. Increased ROS causes periodontal and gingival fibroblast proliferation to decrease, resulting in greater PPD (periodontal pocket depth)<sup>[20]</sup>.

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#### 4. Conclusion

There is strong evidence supporting the hypothesis that betel quid chewing is an important risk factor for the development of periodontitis. These findings underscore the need for public health interventions aimed at reducing the practice of betel quid chewing to prevent the rising incidence of periodontitis in at-risk populations. Further research is recommended to explore deeper biological mechanisms and assess the effectiveness of interventions designed to reduce this habit.

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#### Compliance with ethical standards

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##### *Disclosure of conflict of interest*

The authors declare that there is no conflict of interest regarding the publication of this document.

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#### References

- [1] Uehara O, Hiraki D, Kuramitsu Y, Matsuoka H, Takai R, Fujita M, Harada F, Paudel D, Takahashi S, Yoshida K, Muthumala M, Nagayasu H, Chiba I, Abiko Y. Alteration of oral flora in betel quid chewers in Sri Lanka. *Journal of Microbiology, Immunology and Infection*. 2021; 54(6):1159-1166.
- [2] Javed F, Al-Hezaimi K, Tenenbaum HC, Nogueira-Filho G, Qayyum F, Correa FOB, Samaranyake LP. Severity of periodontal disease in individuals chewing betel quid with and without tobacco. *The American journal of the medical sciences*. 2013; 346(4):273-278.
- [3] Strickland SS. Anthropological perspectives on use of the areca nut. *Addiction biology*. 2002; 7(1):85-97.
- [4] Chu NS. Neurological aspects of areca and betel chewing. *Addiction biology*. 2002; 7(1):111-114.
- [5] Winstock A. Areca nut-abuse liability, dependence and public health. *Addiction biology*. 2002; 7(1):133-138.
- [6] Lee CY, Chang YY. Betel quid chewing and cessation in the sociocultural context of Paiwan people from Taiwan: a qualitative study. *Journal of ethnicity in substance abuse*. 2021; 20(3):395-414.
- [7] Saraswati RA, Safitri M, Rahmah DNH, Camalin CMS, Putri CS, Setyaningsih E. Potensi Senyawa Antimikrobia Dari Organ Tanaman Ramuan Ngingang. *Prosiding SNPBS (Seminar Nasional Pendidikan Biologi dan Saintek) Ke-4*. 2019.
- [8] Sutana IG, Sinarsari NM, Dwipayana AP. Ngingang: Kebiasaan Masyarakat Tradisional Dalam Memelihara Kesehatan Gigi Dan Mulut. *Jurnal Yoga Dan Kesehatan*. 2021; 4(2):123-135.
- [9] Kementerian Kesehatan RI. *Pokok-Pokok Hasil Riskesdas (Riset Kesehatan Dasar) 2018*. Jakarta : Kementerian Kesehatan RI. 2019.
- [10] A'yun Q, Purwati DE. Bad Habits of Betel Chewing on Periodontal Status: A Cross-Sectional Study. *International Journal Of Drug Research And Dental Science*. 2022; 4(1):1-6.
- [11] Koesbardiati T, Murti DB. Konsumsi sirih pinang dan patologi gigi pada masyarakat prasejarah Lewoleba Dan Liang Bua, di Nusa Tenggara Timur, Indonesia. *Berkala Arkeologi*. 2019; 39(02):121-138.
- [12] Papke RL, Horenstein NA, Stokes C. Nicotinic activity of arecoline, the psychoactive element of " Betel Nuts", suggests a basis for habitual use and anti-inflammatory activity. *PloS one*. 2015; 10(10):e0140907.

- [13] Berniyanti T, Jamaludin MB, Eky YE, Bramantoro T, Palupi R. Duration and frequency of betel quid chewing affects periodontitis severity and life quality of people in Tanini Village, Kupang, Indonesia. *International journal of dental hygiene*. 2024; 22(1):229-235.
- [14] Jain V, Garg A, Parascandola M, Chaturvedi P, Khariwala SS, Stepanov I. Analysis of alkaloids in areca nut-containing products by liquid chromatography-tandem mass spectrometry. *J Agric Food Chem*. 2017;65(9):1977–83.
- [15] Kozlakidis Z, Cheong IH, Wang H. Betel nut and arecoline: past, present, and future trends. *IDDB*. 2022;2(2022):64–72.
- [16] Sari R, Aji NRAS, Seong CFJ, Amany TY, Dewi RS. Betel Quid and Oral Phenomenon: Current Review. *Current Oral Health Reports*. 2023; 10(3):88-98.
- [17] Chen YJ, Lee SS, Huang FM, Yu HC, Tsai CC, Chang YC. Effects of arecoline on cell growth, migration, and differentiation in cementoblasts. *J Dent Sci*. 2015; 10(4):388–93.
- [18] Parmar G, Sangwan P, Vashi P, Kulkarni P, Kumar S. Effect of chewing a mixture of areca nut and tobacco on periodontal tissues and oral hygiene status. *J Oral Sci*. 2008; 50(1):57–62.
- [19] Hsiao CN, Ko EC, Shieh TY, Chen HS. Relationship between areca nut chewing and periodontal status of people in a typical aboriginal community in Southern Taiwan. *J Dent Sci*. 2015; 10(3):300–8.
- [20] Kang SW, Park HJ, Ban JY, Chung JH, Chun GS, Cho JO. Effects of nicotine on apoptosis in human gingival fibroblasts. *Arch Oral Biol*. 2011; 56(10):1091–7.