

The Effect Of Betel Chewing Duration On Salivary Calcium Level

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ABSTRACT

Background: Betel chewing remains a common practice in many regions of Indonesia and is claimed to improve dental health. Calcium is a key component of saliva and plays a crucial role in maintaining oral health and facilitating enamel remineralization. Its concentration may be influenced by betel chewing habits. The effects of prolonged betel chewing on salivary calcium levels continues to be controversial. The purpose of this study was to analyze the influence of betel chewing duration on salivary calcium levels.

Method: Thirty respondents were selected using a non-probability sampling method and divided into three groups based on their duration of betel chewing: five to ten years, ten to fifteen years, and more than fifteen years. UV-Vis spectrophotometry was used to measure calcium levels in unstimulated saliva samples obtained by spitting.

Result: The results showed that the average calcium level in saliva increased significantly with increasing duration of betel chewing. The group with a betel chewing history exceeding 15 years demonstrated the highest average salivary calcium concentration (117.85 mg/L), while the other group showed lower salivary calcium concentration. Statistic analysis showed that the three groups differed significantly ($p < 0.00$).

Conclusion: Longer duration of betel chewing habit has been linked to elevated calcium concentrations in saliva.

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INTRODUCTION

Indonesia is a country with a variety of cultural diversity in each region.^{1,2} One of the traditions that became a daily habit for ancient people was the tradition of raising betel using natural ingredients.³ The habit of betel quid chewing has been an integral part of Indonesian culture and daily life since the 6th century, particularly in the regions of Nusa Tenggara, Java, Kalimantan, Sumatra, and Papua.⁴

Betel chewing is the activity of mixing various ingredients, namely betel nut, lime, green betel, and gambir which are crushed together.⁵ This betel chewing activity is done with the aim of cleaning and strengthening teeth, because they believe that the ingredients contained in betel can strengthen and clean teeth, proven by the teeth of people in ancient times which were strong and resistant to disease.⁶ In addition, a study conducted in England on immigrants from South Asia who crushed betel, it was found that crushing betel can provide a refreshing sensation in the oral cavity and is believed to strengthen teeth and gums.⁵

The ingredients contained in betel chewing are natural. Betel leaves are the main natural ingredient in betel chewing, used to wrap other ingredients containing essential oils that act as antimicrobials against *Streptococcus mutans* bacteria in saliva. Betel lime which is usually used in betel chewing also has antibacterial properties because betel lime can create OH⁻ ions which cause DNA damage, protein denaturation, and the cytoplasmic membrane of bacteria.⁷ Betel lime contained calcium hydroxide (Ca(OH)₂) which plays a role in increasing the concentration of calcium ions in saliva.² *Uncaria gambir roxb* or known as gambir can also be used as a mouth antiseptic due to the catechin content contained in gambir.⁸

Saliva is a body fluid released by the salivary glands that keeps the oral cavity moist.⁹ One of the

components of saliva is calcium, which is very important in the enamel remineralization process.¹⁰ The habit of betel chewing involves chewing a mixture of betel leaves, areca nuts, lime and other ingredients can affect the composition of saliva, especially calcium levels.² However, betel lime also increases the pH of saliva, which causes the oral cavity to become alkaline. This condition can damage the DNA oxidation system of mucosal cells in betel chewers and shorten the buildup of plaque on the teeth.¹¹

RESEARCH METHOD

The research population was the community of RT 07 Manis Mata Village, Ketapang Regency, West Kalimantan, who have the habit of chewing betel. The total sample size total is 30 respondents, selected using the non-probability sampling method. Samples were grouped into three categories based on the duration of betel chewing habit, namely short term (5–10 years), medium term (10–15 years), and long term (>15 years). Inclusion criteria included betel nut chewers residing in Manis Mata Village, aged 20–60 years, who chewed betel nut more than twice a day, and were willing to participate as respondents. Exclusion criteria included respondents with systemic diseases such as diabetes mellitus and autoimmune disorders, those who chewed betel less than two times a day, and those currently taking medications that affect saliva production, such as anticholinergics, anticonvulsants, and cytotoxic drugs.

This study received ethical approval from the Ethics Committee of the Faculty of Dentistry, Sultan Agung Islamic University, Semarang, number 748/B.1-KEPK/SA-FKG/V/2025. After the study was explained to the participants and informed consent forms were signed, unstimulated saliva samples were collected using the spitting method at 8:00 a.m. Participants were asked to

rinse their mouths with water, wait for 1–2 minutes, then collect saliva at the base of the mouth for 30 seconds and spit it into a container until 5 ml of saliva was obtained. Saliva samples were stored in a cooler box at a temperature of $\pm 4^{\circ}\text{C}$, then centrifuged at 3000 rpm for 10 minutes. Salivary calcium levels were analyzed using UV-Vis spectrophotometry at a wavelength of 817 nm.

The study was conducted at the Integrated Laboratory of Diponegoro University. The data were analyzed using the Shapiro–Wilk normality test and Levene’s test of homogeneity. Data that were normally distributed and homogeneous were analyzed using one-way ANOVA, and followed by a Bonferroni post-hoc test. All data were analyzed using SPSS version 27.

RESULT

Saliva samples collected from betel nut chewers showed color variations ranging from clear to yellowish, with some samples appearing cloudy and others clear. Most saliva samples were non-foamy, with a generally thin consistency, although some appeared thicker. The samples in this study consisted of saliva from 30 individuals who practice betel nut chewing, comprising 16 women and 14 men. Table 1 below shows the categorization of samples based on the duration of betel nut chewing in years and gender.

Table 1. Respondent Characteristics by Gender

Group	Male	Female	Total (N)
5-10 years	7	3	10
10-15 years	5	5	10
>15 years	2	8	10

Table 2. Mean and Standard Deviation of Calcium Levels by Group

Group	N	Mean (mg/L)	SD
5-10 years	10	64,90	2,80
10-15 years	10	92,90	3,68
>15 years	10	117,85	4,13

Table 2 shows that the average salivary calcium concentration in individuals who have been living in the area for 5–10 years is 64,900 mg/L, while for those who have lived there for 10–15 years it is 92,900 mg/L, and for those who have lived >15 years is 117,850 mg/L.

A normality test was conducted using the Shapiro-Wilk test. Homogeneity test conducted using Levene Test. The results are shown in Table 3.

Table 3. Results of the Normality and Homogeneity Tests

Group	Normality test (Sig.)	Homogeneity test (Sig.)
5-10 years	0,74	0,48
10-15 years	0,44	
>15 years	0,97	

Based on the test results above, the significant values for both the Shapiro-Wilk and Levene’s tests are $P > 0.05$. These results indicate that the data is normally distributed and the variance is homogeneous. Statistical testing was performed using a parametric test using the one-way ANOVA method (Table 4).

Table 4. Result of One-Way Anova test

Group	Sig.	Keterangan
5-10 years		
10-15 years	0,00	significant difference
>15 years		

Based on the data in Table 4, $p = 0.000$ ($p < 0.05$) was obtained, indicating that the duration of betel nut chewing has a significant effect on salivary calcium levels in betel nut chewers. A Bonferroni post-hoc test was then conducted to understand the differences between the two groups. The results of the calculations are presented in Table 5.

Table 5. Bonferroni Post-hoc Test between groups

Group	Sig. (P)
5-10 years and 10-15 years	0,00
10-15 years and >15 years	0,00
>15 years and 5-10 years	0,00

The results of the Bonferroni post-hoc test between groups indicate differences significantly among groups.

DISCUSSION

The research results and statistical tests revealed a significant difference ($p = 0.00$) in salivary calcium content among the groups of respondents with different betel chewing habits: 5-10 years, 10-15 years, and >15 years. This suggests that the duration of betel chewing affects salivary calcium concentration in betel chewers.

The results of the Bonferroni post-hoc test showed that there were significant differences in salivary calcium levels between each pair of groups, namely between the 5-10 years and 10-15 years

groups, between the 5-10 years and >15 years groups, and between the 10-15 years and >15 years groups ($p < 0.05$). This indicates a change in salivary calcium composition related to the duration of betel chewing.

The longer a person practices betel chewing, the more frequent and prolonged the exposure of saliva to betel nut and other ingredients—such as gambir and areca nut—which possess antibacterial activity and other compounds that can affect the composition of saliva. This leads to an increase in salivary calcium levels as the body's adaptive response to this habit.¹² This aligns with the theory supporting this study, which suggests that chronic exposure to betel-chewing ingredients can increase salivary calcium levels in the oral cavity.¹³ The primary mechanism behind the increase in salivary calcium levels in long-term betel chewers involves mechanical and chemical stimulation from betel-chewing ingredients, such as betel lime (calcium hydroxide), which increases the rate of salivary flow and the secretion of calcium ions from the salivary glands. This process triggers the release of more Ca^{2+} ions into the saliva, causing calcium levels to rise above the normal average in betel chewers.¹⁴

These differences in salivary calcium levels can be explained by the ingredients used in the betel-chewing tradition, particularly betel lime, which contains calcium hydroxide. Betel lime, one of the main components of the betel-chewing mixture, is believed to increase the concentration of calcium ions in saliva through the release of calcium hydroxide. The high pH of calcium hydroxide makes the oral cavity alkaline and creates a type of reactive oxygen species known as the hydroxyl radical, which can damage the DNA oxidation system of betel-chewing mucosal cells and accelerate plaque buildup on the teeth.¹⁵

Excessively high levels of calcium in saliva can also potentially cause rapid hardening of dental plaque, which can negatively impact oral health, as the use of lime in betel nut mixtures creates an alkaline environment, leading to the accumulation of calculus.¹⁶ The results of this study on the relationship between the habit of chewing betel nut and the incidence of dental caries, based on the duration of the habit, indicate that the longer the duration of betel nut chewing, the greater the number of dental caries experienced. The findings indicate that respondents who had chewed betel nut for more than ten years and did so more than five

times daily were classified as having severe dental caries. Conversely, respondents who chewed betel nut 1–3 times per day were classified as having mild dental caries. These results suggest a significant association between the duration of betel nut chewing and the incidence of dental caries.¹⁷

The results of this study are consistent with previous research findings indicating that the saliva profiles of betel chewers show differences in inorganic components such as calcium compared to non-chewers.¹³ In addition, other studies have also shown that consumption of substances containing betel lime can affect calcium levels in saliva.

Limitation of this study was the limited knowledge of oral and dental health among the community of Manis Mata Village, West Kalimantan, particularly among betel quid chewers. This condition resulted in less cooperative responses and participation from respondents during the data collection process. Furthermore, an uncontrolled factor that may have influenced the increase in salivary calcium levels was the respondents' oral hygiene status. Poor oral hygiene, may contribute to elevated calcium concentrations in saliva.

CONCLUSION

Based on the results of the study, it can be concluded that the habit of chewing betel is associated with increased calcium levels in saliva. This increase in calcium levels tends to be in line with the duration of betel chewing, where individuals who have chewed betel for more than 15 years showed higher salivary calcium levels compared to the group who chewed for a shorter period.

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