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## Estimation and Comparison of Salivary Calcium Levels in Smokers and Non-Smokers with or Without Periodontitis.

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### ABSTRACT

An elevated level of salivary calcium in smokers is related to a greater degree of bone loss and lower mineral density of bones than in non-smokers. However, the available literature does not reveal any comprehensive study that determines and compares the salivary composition of smokers and non-smokers in periodontally healthy and compromised subjects. To compare salivary calcium levels in individuals with chronic periodontitis, smokers without periodontitis, smokers with chronic periodontitis and healthy individuals. The study comprised of 60 male subjects equally divided into four groups of non-smokers with clinically healthy periodontium, smokers with clinically healthy periodontium, non-smokers with chronic periodontitis and smokers with chronic periodontitis. Clinical indices (plaque index, gingival index and calculus index) and non-stimulated whole saliva were obtained. Biochemical analysis of salivary calcium was done. Patient's salivary calcium and clinical parameters were analyzed using Student's t-test. Gingival index were significantly higher in smokers with periodontitis ( $P < 0.05$ ) as compared to non-smokers with periodontitis. On biochemical analysis of whole saliva, salivary calcium levels were  $7.32 \pm 1.70$  mg/dl,  $8.69 \pm 1.68$  mg/dl,  $8.65 \pm 2.69$  mg/dl and  $8.87 \pm 1.70$  mg/dl in non-smoker healthy, smoker healthy, non-smokers with periodontitis and smokers with periodontitis respectively. The present study exhibited increased concentration of salivary calcium levels in smokers with chronic periodontitis. It may thus be concluded that the analysis of salivary composition could be used as an auxiliary means in diagnosis of periodontal condition of an individual.

**Keywords:** Periodontal condition, salivary composition, calculus index, gingival index

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## INTRODUCTION

Saliva exerts a major influence on plaque initiation, maturation and metabolism. Salivary flow and composition influences calculus formation and periodontal disease [1-4]. Plaque accumulation is found more in smokers. Smoking is a significant risk factor for periodontal disease [5]. An elevated level of salivary calcium in smokers is related to a greater degree of bone loss and lower mineral density of bones than in non-smokers [6,7]. However, literature does not reveal any comprehensive study that determines and compares the salivary composition of smokers and non-smokers in periodontally healthy and diseased subjects.

With the above background, present study was conducted to estimate the salivary calcium levels in individuals with chronic periodontitis, smokers without periodontitis, smokers with chronic periodontitis and healthy individuals and to determine whether the calcium levels in saliva of individuals could be used as a diagnostic aid.

## MATERIAL AND METHODS

The study population comprised of 60 male subjects ranging in age from 25 to 55 years, equally divided into four groups visiting the Department of Periodontology. Four groups formed were as follows: A) Group I: Individuals with clinically healthy periodontium and were non-smokers, B) Group II: Individuals with clinically healthy periodontium who were smokers, C) Group III: Patients with chronic periodontitis who were non-smokers, and D) Group IV: Patients with chronic periodontitis who were smokers.

The purpose and design of the study were explained to all subjects and an informed consent was taken from them.

### Inclusion criteria:

- (i) Clinical with radiographic (Figure1) diagnosis of periodontitis,
- (ii) No history of periodontal therapy in last 6 months,
- (iii) Individuals who are currently smokers, and
- (iv) Subjects with at least 20 permanent teeth present.

### Exclusion criteria:

- (i) Presence of any systemic disease that could influence the course of periodontal disease,
- (ii) Individuals taking antibiotics or any other anti-inflammatory drugs since last 1 month just before the study, and
- (iii) Individuals suffering from xerostomia due to any systemic or local conditions or as a result of any therapy like radiation therapy or drug therapy.

### Clinical measurements

Plaque Index (PI) [8], Gingival Index (GI) [9], Calculus Index (CI) [10], clinical diagnosis of periodontitis by Periodontal Screening and Recording (PSR) [11] were made.

### Biochemical analysis:

Calcium level assessment was performed using O-cresolphthalein complexone (OCPC) method [12] in a semi-automated Erba Mannheim CHEM-5 Plus v2 machine.

**Sample collection:** Participants were asked not to eat or drink and to restrain from tooth brushing and smoking for 1 hour before the clinical examination and saliva collection. Non-stimulated whole saliva samples were collected. Following a brief rinsing of the mouth with water, the saliva secreted during the first 60 seconds swallowed, whereas that secreted during the next 10 minutes to be expectorated, and collected into sterile plastic bottles. 2 ml of saliva was collected from each individual for analysis.

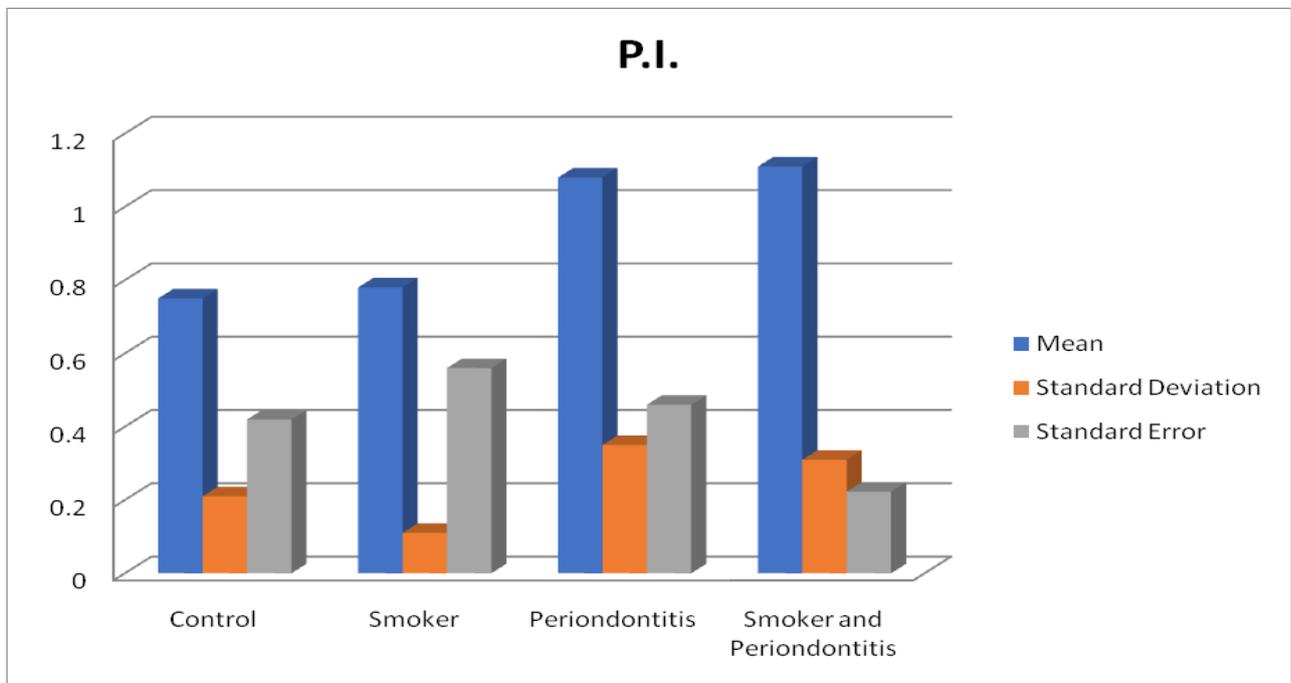
**Statistical analysis:** Data obtained was analyzed using Statistical Package for Social Science (SPSS) version 11.5. The P-value was taken as significant when less than 0.05 (confidence interval of 95% was taken). Patient’s salivary calcium and clinical parameters (Plaque Index, Gingival Index and Calculus Index) were analyzed using Student’s t-test.

**RESULTS**

When the clinical parameters, i.e., plaque index, gingival index and calculus index were compared between groups, mean PI for non-smokers healthy, smokers healthy, non-smokers with periodontitis and smokers with periodontitis were  $0.75 \pm 0.21$ ,  $0.78 \pm 0.11$ ,  $1.08 \pm 0.35$  and  $1.11 \pm 0.31$ , respectively. The differences between non-smokers healthy and smoker healthy and between non-smokers with periodontitis and smokers with periodontitis were not found to be statistically significant ( $P > 0.05$ ) (Table 1, Graph1).

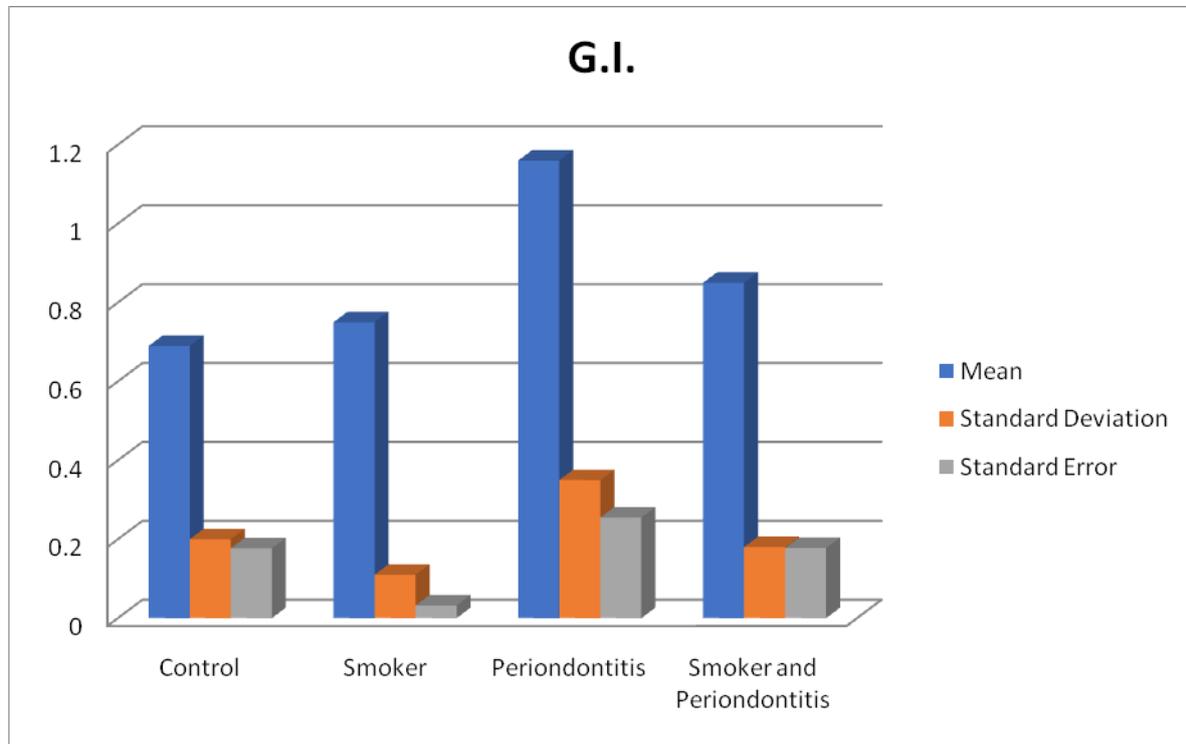
**Table 1: Mean and standard deviation of plaque and gingival Index among the study groups**

Study Groups	Mean±SD of Plaque Index	P-value	Mean±SD of Gingival Index	P-value
Control	0.75±0.21	0.08 (NS)	0.69±0.20	0.012 (S)
Smokers	0.78±0.11		0.75±0.11	
Control	0.75±0.21	0.007 (S)	0.69±0.20	0.0003 (S)
Periodontitis	1.08±0.35		1.16±0.35	
Control	0.75±0.21	0.006 (S)	0.69±0.20	0.011 (S)
Smokers with Periodontitis	1.11±0.31		0.85±0.18	
Smokers	0.78±0.11	0.004 (S)	0.75±0.11	0.0001 (S)
Periodontitis	1.08±0.35		1.16±0.35	
Smokers	0.78±0.11	0.006 (S)	0.75±0.11	0.121 (NS)
Smokers with Periodontitis	1.11±0.31		0.85±0.18	
Periodontitis	1.08±0.35	0.067 (NS)	1.16±0.35	0.004 (S)
Smokers with Periodontitis	1.11±0.31		0.85±0.18	



**Graph1: Comparison of mean plaque Index between study groups.**

Similarly, mean GI in non-smokers healthy, smokers healthy, non-smokers with periodontitis, and smokers with periodontitis were  $0.69 \pm 0.20$ ,  $0.75 \pm 0.11$ ,  $1.16 \pm 0.35$  and  $0.85 \pm 0.18$  respectively. This indicated a much higher GI score in diseased patients, while the difference between smokers without periodontitis and smokers with periodontitis were not found to be statistically significant ( $P > 0.05$ ) (Table 1, Graph2).

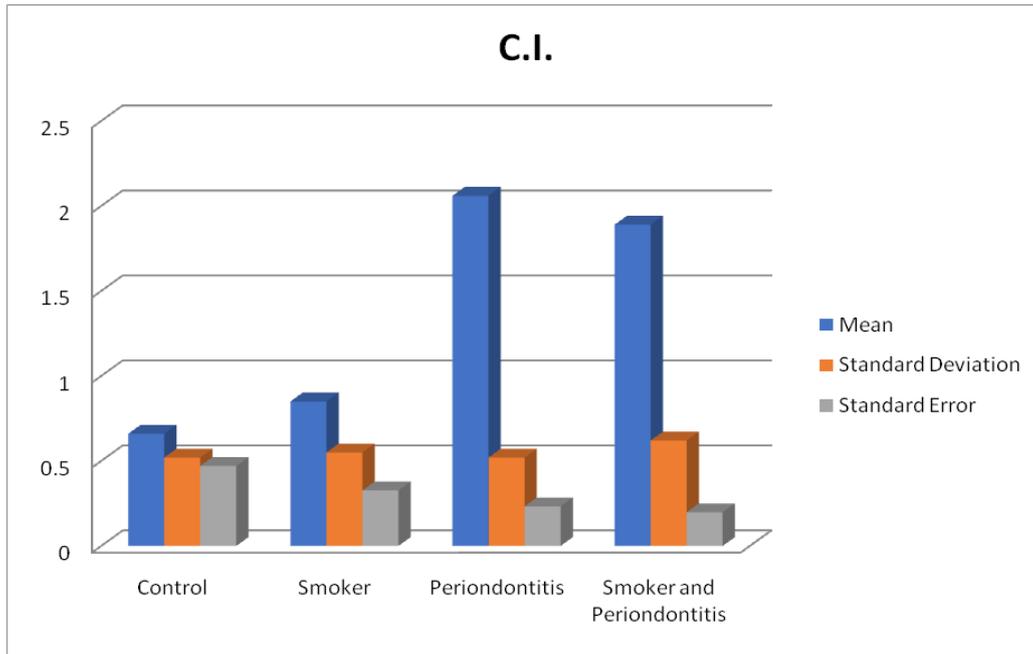


**Graph2: Comparison of mean gingival Index between study groups.**

Also, mean CI in non-smokers healthy, smokers healthy, non-smokers with periodontitis and smokers with periodontitis were  $0.66 \pm 0.52$ ,  $0.85 \pm 0.55$ ,  $2.06 \pm 0.52$  and  $1.89 \pm 0.62$ , respectively. These scores indicated a much higher CI score in diseased patients, while the difference between non-smokers with periodontitis and smokers with periodontitis was not found to be statistically significant ( $P > 0.05$ ) (Table 2, Graph3).

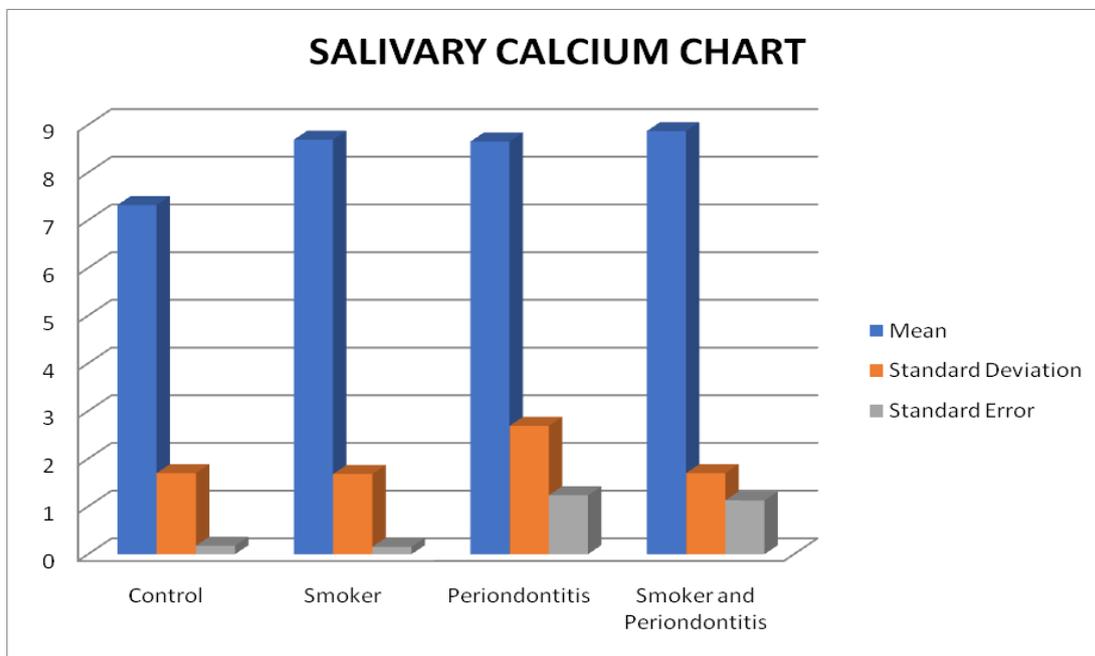
**Table 2: Mean and standard deviation of calculus index and salivary calcium among the study groups.**

Study Groups	Mean±SD of Calculus Index	P-value	Mean±SD of Salivary Calcium	P-value
Control	0.66±0.52	0.004 (S)	7.32±1.70	0.001 (S)
Smokers	0.85±0.55		8.69±1.68	
Control	0.66±0.52	0.00001 (S)	7.32±1.70	0.002 (S)
Periodontitis	2.06±0.52		8.65±2.69	
Control	0.66±0.52	0.00036 (S)	7.32±1.70	0.008 (S)
Smokers with Periodontitis	1.89±0.62		8.87±1.70	
Smokers	0.85±0.55	0.00002 (S)	8.69±1.68	0.744 (NS)
Periodontitis	2.06±0.52		8.65±2.69	
Smokers	0.85±0.55	0.0005 (S)	8.69±1.68	0.811 (NS)
Smokers with Periodontitis	1.89±0.62		8.87±1.70	
Periodontitis	2.06±0.52	0.144 (NS)	8.65±2.69	0.691 (NS)
Smokers with Periodontitis	1.89±0.62		8.87±1.70	



**Graph 3: Comparison of mean calculus index-simplified between study groups.**

Analysis of the biochemical parameters revealed that salivary calcium levels increased consistently, and were  $7.32 \pm 1.70$  mg/dl,  $8.69 \pm 1.68$  mg/dl,  $8.65 \pm 2.69$  mg/dl and  $8.87 \pm 1.70$  mg/dl in non-smokers healthy, smokers healthy, non-smokers with periodontitis and smokers with periodontitis respectively (**Table 2, Graph4**). The differences between smokers without periodontitis, non-smokers with periodontitis and smokers with periodontitis subjects were not found to be statistically significant ( $P > 0.05$ ).



**Graph 4: Comparison of mean salivary calcium level between study groups.**



**Figure 1: OPG x-ray of a periodontitis patient showing severe interdental bone loss with calculus**

## DISCUSSION

### Salivary calcium in periodontitis patients:

In the present study, group III subjects, i.e. chronic generalised periodontitis had higher values of salivary calcium than group I subjects, i.e., healthy controls. These results were consistent with the findings of Sewon and Karjalainen [13]. They concluded that periodontitis affected subjects had a higher re-mineralization potential than individuals with no signs of periodontal disease. The results, however, were in contrast with those obtained by Sewon and Makela [14], who found that higher calcium levels were related to good dental health but there was no relation to periodontal bone destruction. This is likely to be due to the differences in the age group of the subjects evaluated.

### Salivary calcium in smokers:

Group IV subjects, i.e., smokers with chronic generalized periodontitis showed higher mean salivary calcium values than group III subjects. While group I subjects showed lower mean salivary calcium level as compared to group IV subjects with statistical significance ( $P < 0.001$ ). These results are consistent with the findings of Sewon, Sutej Ivana, Endre Kiss, Preeti Kambalyal and Megha Varghese who showed that salivary calcium level is higher in smokers having periodontitis as compared to non-smokers [15-19]. While the studies by Otman Zuabi and Ebru Olgan showed that there is no significant difference between mineral content of saliva in smokers and non-smokers [20,21]. Also Zuabi et al found that smokers exhibited distinct salivary composition characterised with significantly smaller calcium, magnesium and sodium concentration compared to non-smokers [20]. This can be due to the different techniques used for detection of salivary calcium. They had detected salivary calcium level by inductively coupled plasma atomic emission spectrophotometry.

When group II subjects (i.e. smokers with clinically healthy periodontium) were compared with group I subjects for mean salivary calcium level, group II subjects showed higher mean salivary calcium values than group I subjects which showed that salivary calcium level was higher in smokers as compared to non-smokers.

### Plaque index:

Group IV subjects which include smokers having chronic generalised periodontitis, showed highest mean plaque index value, followed by group III, group II, and then group I. This is due to differences in the quality of plaque between the groups. These results are consistent with the findings of Abhay P. Kolte [12].

**Gingival index:**

In our study mean gingival index was highest in group III, followed by group IV, group II and of group I. Here though smokers with periodontitis had more plaque values than periodontitis patients, they showed less gingival inflammation, this may be due to the effect of smoking on the gingival tissues.

**Calculus Index:**

In our study mean calculus index was higher in smokers than periodontally healthy non-smokers. It shows smokers have higher mineralization potential than non-smokers. These results are consistent with the findings of Endre Kiss [17].

**CONCLUSION**

Smokers have a higher plaque index and lower gingival index. The level of calcium in saliva is higher in chronic generalised periodontitis individuals compared to those in periodontally healthy individuals. This finding supports the view that higher salivary calcium could act as a risk factor for the development of periodontal diseases, possibly by raising the mineralisation potential of dental plaque. There is an increased level of salivary calcium in smokers suggesting a trend towards increased mineralizing potential in the saliva of smokers. Smokers having chronic periodontitis show higher salivary calcium level. Large-scale prospective studies including other salivary parameters are essential to further assess this relationship.

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