

Association of coffee with severity of periodontal disease - A comparative cross-sectional clinical study

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Abstract

Background: Coffee is commonly consumed in India on an everyday basis as it is considered to be psychoactive, mood elevator and provides relief from cold and headache. **Objectives:** To evaluate the association of coffee with severity of periodontal disease. **Materials and methods:** This study included 100 systemically healthy non-obese individuals aged 19-50 years, consuming coffee on an everyday basis for the past six months from the hostel mess of SDM College of Dental Sciences and Hospital (SDMCDSH), Dharwad, and were categorized into two groups, wherein 50 subjects in Group A (test group) comprised of individuals consuming only coffee and 50 subjects in Group B (control group) comprised of individuals not consuming coffee or tea. The consumption frequency for the test group was further divided into three categories: one cup/day; two to three cups/day and more than four cups/day. The clinical parameters recorded were: the Plaque Index, Gingival Index, Bleeding on Probing, Probing Pocket Depth and Clinical attachment levels. The results were subjected to statistical analysis. **Results:** The Spearman correlation co-efficient (r-value) between coffee consumption and severity of periodontal disease suggested that, as coffee consumption increased, there was an increase in the severity of gingivitis and periodontitis. **Conclusion:** With increase in coffee consumption, there is more gingivitis and periodontitis.

Key words: Caffeine, gingivitis, periodontitis

Introduction

Caffeine, a xanthine alkaloid found in tea leaves and coffee seeds contains carbohydrates, nitrogenous compounds, vitamins, minerals, phenolic compounds along with anti-cariogenic, chemo protective compounds, and is considered to be a psychoactive stimulant thus known to increase alertness, elevate mood, reduce fatigue, treat migraine, cluster headaches and is most widely used ever since Stone Age.^{1,2} Studies by Huang J³ and Tamaki N⁴

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have shown that phenolic compounds of coffee increases its anti-oxidative property, contributing to a reduction in the reactive oxygen species induced damage to the periodontium. However, Macedo R M⁵ suggested that excessive coffee consumption may lead to destructive periodontitis and reduction in bone healing after extraction. Although there are many studies 4,6,7,5 which shows the association of coffee consumption and severity of periodontitis, it still remains unclear whether coffee consumption improves periodontal health. Thus, this cross-sectional clinical study evaluates the association of coffee with the severity of periodontal disease.

Materials and method

This study was conducted in the Department of Periodontics, SDM College of Dental Sciences and Hospital, Dharwad, from July 2017 to October 2017. Hundred systemically healthy non-obese individuals in the age group of 19-50 years, consuming coffee

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on an everyday basis for the past six months, mainly from the hostel mess of SDM Dental College, Dharwad, with no history of smoking or alcohol consumption were sequentially enrolled in this study. Thus, the study participants were basically the dental students/hostellers from SDM Dental College, Dharwad. The study design was explained to all the participants, and a written informed consent was taken.

The inclusion criteria comprised of subjects between 19-50 years who consumed coffee regularly from the hostel mess of SDMCDSH for the past six months, subjects with a minimum complement of 20 teeth and subjects who had not undergone periodontal treatment in the last six months. The exclusion criteria comprised of patients with systemic diseases and conditions, pregnant and lactating mothers, patients who had already received periodontal therapy in the past six months, patients on medications: anti-inflammatory, antibiotics and immunosuppressant or oral contraceptive drugs, smokers and alcoholics, and patients with a history of tobacco or betel nut chewing.

The participants were divided into two groups, wherein 50 subjects in Group A (test group) comprised of individuals consuming only coffee and 50 subjects in Group B (control group) comprised of individuals not consuming coffee or tea. Subjects in the test group were further divided into individuals consuming one cup of coffee per day, two to three cups of coffee per day and more than four cups day.⁸ Clinical parameters like plaque index, gingival index and bleeding on probing were assessed. The severity of periodontitis was determined according to American Academy of Periodontology (1999)⁹ wherein, severe periodontitis cases had more than or equal to two interproximal sites with clinical attachment loss more than 6 mm not on the same tooth and more than one interproximal site with probing pocket depth more than 5 mm; moderate periodontitis cases had more than two interproximal sites with clinical attachment loss more than 4 mm or more than two interproximal sites with probing pocket depth more than 5 mm not on same tooth;

and mild periodontitis cases had more than two interproximal sites with clinical attachment loss more than 3 mm and more than 2 mm interproximal sites with probing pocket depth more than 4 mm not on same tooth or one site, with probing pocket depth more than 5 mm. Thus, the severity of periodontitis was assessed in all the three categories in both the groups. In this study, one investigator divided the subjects into test and control group, while the other randomly measured the clinical parameters. Thus, the severity of periodontal disease was assessed in all the three categories in both groups.

The standardization of caffeine measurements in instant coffee was made according to the United States Department of Agriculture (USDA)¹⁰ protocol which suggested that one teaspoon of instant coffee did contain 57 mg of caffeine, which remained the same irrespective of water, milk or cream added to the coffee. According to European Food Safety Authority (EFSA), a cup of filter coffee (200 ml) contained 86 mg of caffeine.¹¹ Thus, in the present study, one teaspoon of Bru Instant coffee was mixed in a cup containing 150 ml of water mixed with milk and sugar. Moreover, Barone and Roberts (1996)¹² did quote a value of 40-108 mg/150 ml which revealed that there is a variation in the amount of coffee powder used for the drink, and the flavour is greatly influenced by the amount of water mixed with coffee powder.

Statistical analysis

The results were subjected to statistical analysis, and a Spearman correlation test was performed so as to evaluate the association of coffee with the severity of periodontal disease.

Results

In the present study, 100 participants (20 male and 80 females) in the mean age group of 21.84 years were included, out of which 50 subjects consumed coffee and were categorized in Group A (test group). Out of these 50 participants, 18 subjects consumed one cup of coffee per day, 13 individuals consumed two to three cups of coffee every day and the remaining nineteen subjects consumed more than three cups of coffee every day. (Table 1)

Table 1: Descriptive statistics

Characteristics	Status	Number
Gender	Male	20
	Female	80
Coffee consumption	Nil	50
	1 cup	18
	2-3 cups	13
	More than three cups	19
Gingivitis status	Absent	33
	Mild	46
	Moderate	21
Periodontitis	Absent	62
	Mild	16
	Moderate	22
Mean age		21.84

Pertaining to the distribution of coffee consumption pattern and gingivitis, it was observed that in the Group B (control group) 84.8% subjects were without gingivitis, 45.7% subjects had mild form of gingivitis and 4.8% subjects had moderate form of gingivitis.

Table 2: Distribution of coffee consumption pattern among different levels of gingivitis

GINGIVAL STATUS	NUMBER OF COFFEE CONSUMPTION IN A DAY			
	No coffee	One cup of coffee	2-3 cups of coffee	More than 4 cups of coffee
NO GINGIVITIS	28 84.8%	3 9.1%	2 6.1%	0 0.0%
MILD GINGIVITIS	21 45.7%	12 26.1%	7 15.2%	6 13.0%
MODERATE GINGIVITIS	1 4.8%	3 14.3%	5 23.8%	12 57.1%

While in Group A (test group) in subjects who consumed one cup of coffee per day, 26.1% subjects had mild gingivitis, 14.3% subjects had moderate gingivitis and 9.1% subjects had no gingivitis. In subjects who consumed two to three cups of coffee every day, 23.8% subjects had moderate gingivitis, 15.2% subjects had mild gingivitis, while 6.1% subjects had no gingivitis. In subjects consuming more than four cups of coffee per day, all the subjects had gingivitis, of which 57.1% had the moderate form and 13% had the mild form of gingivitis,

thus suggesting that as the consumption of coffee increased, there was an increase in the severity of gingivitis. (Table 2)

Pertaining to the distribution of coffee consumption pattern and periodontitis, it was observed that in subjects who did not consume coffee, i.e., Group B (control group), 77.4% subjects had no periodontitis. While in the Group A (test group), subjects who consumed one cup of coffee per day, 50% patients had mild periodontitis. In subjects who consumed 2-3 cups of coffee on an everyday basis, 25% subjects had mild periodontitis and 27.3% patients had moderate form of periodontitis. In subjects consuming more than four cups of coffee per day, all of them had periodontitis, where 72.7% subjects had moderate periodontitis and 12.5% subjects had mild periodontitis, which suggested that as the consumption of coffee increased, there was an increase in the severity of periodontitis. (Table 3)

Table 3: Distribution of coffee consumption pattern among different levels of periodontitis

PERIODONTAL STATUS	NUMBER OF COFFEE CONSUMPTION IN A DAY			
	no coffee	one cup of coffee	2-3 cups of coffee	more than 4 cups of coffee
NO PERIODONTITIS	48 77.4%	10 16.1%	4 6.5%	0 0.0%
	2 12.5%	8 50.0%	4 25.0%	2 12.5%
MILD PERIODONTITIS	0 0.0%	0 0.0%	6 27.3%	16 72.7%

The Spearman correlation co-efficient (r-value) between the coffee consumption and severity of periodontal disease showed a statistically significant strong positive correlation (r=0.633) with severity of gingivitis and a very strong positive correlation (r=0.819) with severity of periodontitis with a strong association, thus suggesting that as the coffee consumption increased, there was an increase in the severity of gingivitis and periodontitis. (Table 4)

Table 4: Distribution of coffee consumption pattern among different levels of periodontitis

		SEVERITY OF ODONTITIS	SEVERITY OF GINGIVITIS
COFFEE CONSUMPTION	Spearman Correlation Coefficient (r value)	.819**	.633**
	Sig. (2-tailed)	<.0001	<.0001
	N	100	100

Discussion

The present study did evaluate the association of coffee with the severity of periodontal disease in hundred participants who were divided into Group A (test group) and Group B (control group), wherein the test group comprised of subjects who consumed coffee and the control group comprised of those not consuming tea or coffee. The subjects in the test group were further categorized into three groups: those who consumed one cup of coffee every day, two to three cups of coffee on a daily basis and more than four cups of coffee per day. The results showed that with the increase in the frequency of coffee consumption per day, there was an increase in the severity of periodontal disease.

Study conducted by Machida et al.⁸ suggested that consumption of coffee could be protective against periodontal bone loss. A study by Sakamoto et al.¹³ concluded that coffee consumption did not stimulate bone loss in rats. Furthermore, a 30 year longitudinal study between 1968 and 1998 by Ng N, Kaye and Garcia⁶ have reported that consumption of coffee is protective against periodontal bone loss which is contradictory to the results of the present study. The results obtained by Sakamoto¹³, Machida⁸ and Kaye, Garcia⁶ group of studies attribute the systemic increase in anti-oxidative property following coffee consumption, further contributing to the reduction in the damage at the local level by reactive oxygen species which is involved in the pathogenesis of periodontitis.

Conversely, a study conducted by Zuccarello et al.¹⁴ observed that consumption of coffee was the common risk factor for periodontitis. The Tanaka group of study¹⁵ showed that coffee consumption was

associated with an increased prevalence of tooth loss. Moreover, Macedo R M et al.⁵ observed that daily ingestion of heavy coffee showed a delay in alveolar bone reparative process after tooth extraction. Similarly, the findings of the present study showed that with the increase in the consumption of coffee, there was an increase in the severity of gingivitis and periodontitis. This could be attributed to the presence of caffeine in coffee, which is considered as the most psychoactive substance in the world.¹⁶ Caffeine is reported to exert multiple effects on the bone metabolism, thus attributing to the severity of periodontal disease.¹⁷ Kamagata-Kiyoura (1999)¹⁸ suggested that chronic caffeine intake is one of the risk factors in the pathogenesis of periodontitis. A study by Bezerra J P et al.¹⁹ showed that caffeine increased the bone loss and reduced bone healing after tooth extraction. In the present study, subjects who consumed more than four cups of coffee on an everyday basis had gingivitis, of which 57.1% had the moderate form and 13% had the mild form. Moreover, all the subjects had periodontitis of which 72.7% subjects had the moderate form and 12.5% subjects had mild periodontitis. This could be thus attributed to the caffeine content in the coffee, because in general, one cup of coffee contains 70 to 100 mg of caffeine, and considering the deleterious effects of caffeine on bone metabolism²⁰ and its risk factors associated with periodontitis, the findings of the present study could be consistent.

However, a cross-sectional study by Yamashita K et al.²¹ revealed that, with an increase in coffee consumption there was a significant positive association with the inflammatory parameters, cytokines IL-1, IL-8 and TNF- α . This can be justified with the similar clinical findings of the present study, wherein all the subjects in Group A (test group) who consumed more than four cups of coffee everyday had mild to moderate form of gingivitis. However, subjects in Group B (control group), 45.7% subjects had mild form of gingivitis and 12.5% subjects had mild form of periodontitis. This could be attributed to the residual plaque present in the gingival sulcus and interdental areas.

Caffeine is a xanthine alkaloid found abundantly in natural sources such as coffee seeds or tea leaves, and is considered to be psychoactive and an energy booster. Caffeine in coffee contains complex chemicals like carbohydrates, vitamins, minerals, phenolic compounds, anti-cariogenic and chemoprotective compounds.⁴ It is rapidly absorbed in the stomach and small intestine, metabolized primarily in the liver and excreted in 24 hour urine as dimethylxanthine, uric acid derivatives and 2.4% caffeine. The plasma half-life ranges from 2.3 to 12 hour with caffeine plasma concentrations reaching peak levels at 45 minutes to two hours after ingestion.⁴ It is used as a food additive regulated by Federal Food and Drug Administration (FDA), which regulates caffeine use as a stimulant in some over-the-counter and prescription medicines. Thus, caffeine is considered to be a pharmacologically active substance stimulating the central nervous system, providing cold and pain remedies.

However, excessive coffee consumption is considered to be a risk factors in the advancement of periodontitis. A systematic review by Wikoff D²² suggested that caffeine intake more than 400 mg/day would lead to potential adverse effects.

Although there are studies evaluating the association of coffee consumption on periodontal disease with mixed results, most of the studies are performed in subjects consuming black coffee or speciality coffees.^{17,20} Association of periodontitis in subjects consuming instant coffee remains the novelty of this study, and is therefore the first of its kind. However, considering the standardization of caffeine in instant coffee (Bru), the participants of this study were the dental students/hostellers who consumed coffee regularly from the hostel mess at least for the past six months. Further studies need to be performed on the general population so as to evaluate the association of coffee with the severity of periodontal destruction.

Conclusion

There is an association of coffee with the severity of periodontal destruction. Although the consumption of coffee is considered to be beneficial in various aspects, the increase in its frequency of consumption

is associated with more adverse effects. Therefore, with increase in coffee consumption, there is more gingivitis and periodontitis.

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Note

The authors declare no conflict of interest.

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