ISSN Print: 2394-7489
ISSN Online: 2394-7497
IJADS 2022; 8(3): 01-05

www.oraljournal.com
Received: 04-05-2022
Accepted: 03-06-2022

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Clinical evaluation of coffee based gel on gingivitis: A randomised controlled clinical trial

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DOI: https://doi.org/10.22271/oral.2022.v8.i2i.1571

Abstract
Introduction: Gingivitis is a non -destructive, plaque induced infection that causes inflammation of the gingiva. Coffee is considered to be the biggest source of dietary cancer prevention agents in industrialized countries. Caffeine, caffeic corrosive and chlorogenic corrosive are the dynamic components of coffee that have found to have anti-inflammatory and anti-oxidative impacts.
Objective: To evaluate the effectiveness of Coffee as an oral gel in the reduction of plaque and gingivitis.
Materials and Method: This single center, randomized controlled clinical trial was carried out among 30 participants with mild to moderate gingivitis. Group I, Scaling with application of coffee gel (Test) and Group II, Scaling only (Control) [n=15]. Group I subjects were instructed to use coffee gel twice daily following scaling. Clinical parameters (Turesky Gilmore Glickman Modification of Quigley Hein Plaque Index and Loe and Silness Gingival Index) were recorded at baseline,15 day and 1month post-operatively. Student's paired t-test and Independent t-test were used for intra and inter group comparison of clinical parameters.
Result: On intragroup comparison, both the groups showed a statistically significant difference at 1 month. But on intergroup comparison, there was no statistically significant difference between the test group and control group.

Keywords: Scaling, gingivitis, plaque, gel

Introduction
Gingivitis is caused by substances derived from microbial plaque accumulating at or near the gingival sulcus; all other suspected local and systemic etiologic factors either enhance plaque accumulation or retention, or enhance the susceptibility of the gingival tissue to microbial attack [1].
Various products like toothpaste, gels, paste to apply, mouthwash, pellets etc. have been on the markets for many years. Commercially available mouthwash containing synthetic and semi-synthethic products. Synthetic active ingredients have a number of drawbacks like the staining on the teeth, the irritation during use etc. The herbal medicines are normally considered safer than the non-herbal medicines because of the natural active ingredients present in herbal medicines, in combination with other components.
Coffee is considered one of the most widely used beverages worldwide. It has been regarded as 'the main source of food antioxidants in industrialized countries'. It is used as a food additive regulated by the Federal Food and Drug Administration (FDA), which regulates caffeine use as a stimulant in some over-the-counter and prescription medicines [2].
Horrigan L A *et al.* [3] reviewed the evidence of the immunomodulatory impacts of caffeine, finding that it modulates innate and adaptive immune responses. They reported that caffeine can supress human neutrophil and monocytes, chemotaxis and also suppress production of pro-inflammatory cytokine tumor necrosis factor (TNF)-alpha". Hence the present study was carried out to evaluate the effectiveness of Coffee as an oral gel in the reduction of plaque and gingivitis.

Materials and Method

This single centered, randomized controlled clinical trial was carried out among 30 participants with mild to moderate gingivitis, who were selected from the outpatient Department of Periodontics, Pacific Dental College and Hospital, Udaipur, Rajasthan. Subjects between 19-50yrs with a minimum complement of 20 teeth who had not undergone periodontal treatment in the last 6 months were included in the study. Patients with systemic conditions, pregnant and lactating mothers and on medications like anti-inflammatory, antibiotics and immuno-sup pressant or oral contraceptives were excluded from the study.

Preparation of coffee gel

50% concentration of coffee extract was used for the formation of gel. 1gm of Carbapol or CB 934 was dissolved in 50 mL phosphate buffer (pH 6.6) with vigorous mixing until it dissolved completely. After that, the coffee extract and preservatives were dissolved with each other. Coffee solution was slowly added into the CB 934 solution with continuous magnetic stirring at a speed of 100 rpm, until a homogenous mixture was obtained. The gelling agent (Na-CMC) was added slowly under continuous magnetic stirring. The volume was then increased to 100 mL with the addition of phosphate buffer. Finally, the prepared gel was kept for 24 hours at room temperature (25°C) for a complete polymer dissolution.

Procedure

30 patients satisfying the criteria are divided into two groups.

- Group I, Scaling with application of coffee gel (Test group) (n-15)
- Group II, Scaling only (Control group) (n-15)

After completion of phase I therapy i.e, ultrasonic scaling, all participants in the test group were instructed to apply coffee oral gel twice daily after brushing with gentle circular motion and to leave it for 10 min, and thereafter to rinse with water to clear any residual gel. Oral hygiene instructions were given and patients were recalled on day 15th day and 1 month. The clinical parameters assessed were Plaque index (PI) (Turesky-Gilmore-Glickman modification of the Quigley- Hein, 1970) [4], Gingival index (GI) (Loe and Silness, 1963) [5] which were recorded at baseline, 15 day and 1 month. For statistical analysis, Paired *t*-test and unpaired *t*-test were used to compare the pre- and post- intervention scores of intragroup and intergroup analysis respectively.

Fig 1: Prepared Coffee gel extract

Clinical photographs

Scaling with application of coffee gel (test group)

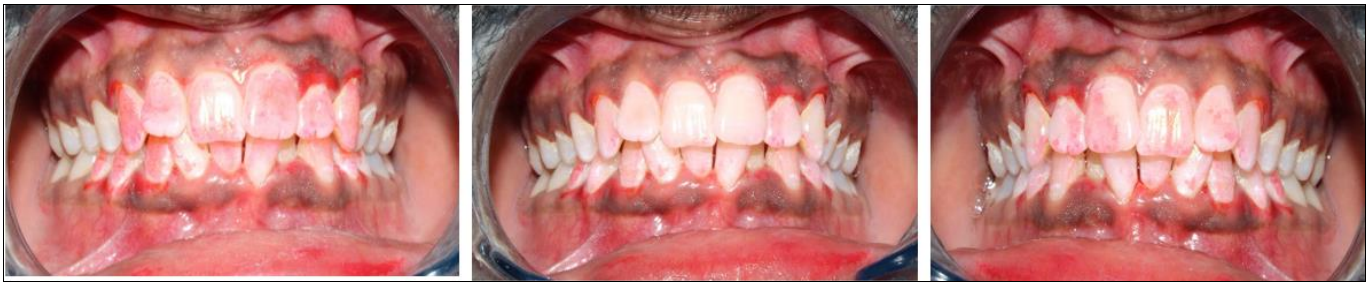


Fig 2a: Baseline **Fig 2b:** 15 day **Fig 2c:** 1 Month

Scaling (Control Group)

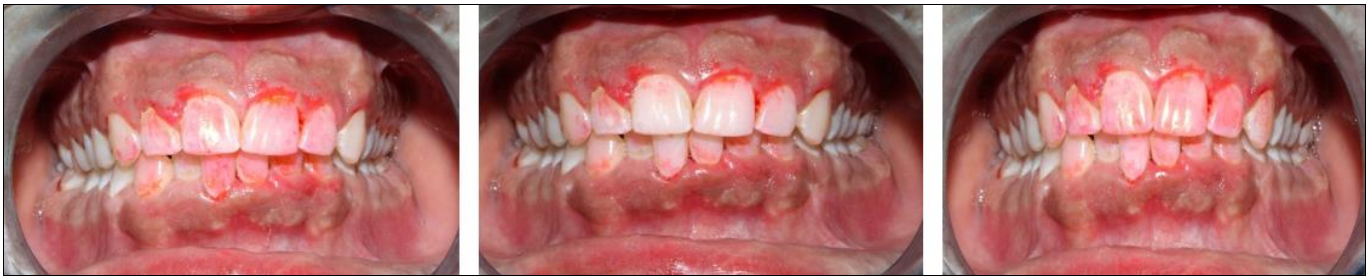


Fig 2a: Baseline **Fig 2b:** 15 day **Fig 2c:** 1 Month

Result

Table 1. All the clinical parameters i.e. plaque index and gingival index were assessed at baseline (after Scaling) 15th day and 1month post-Scaling. On intragroup comparison for plaque index, both test and control groups showed statistically highly significant difference at 15th day ($p<0.001$) and 1month post-scaling ($p<0.001$). Gingival index showed statistically highly significant difference in test group at 15th day

(p<0.001) and 1 month (p<0.001) but control group showed significant change at 15th day (p<0.001) and no significant difference was found at 1 month. (p=0.43)

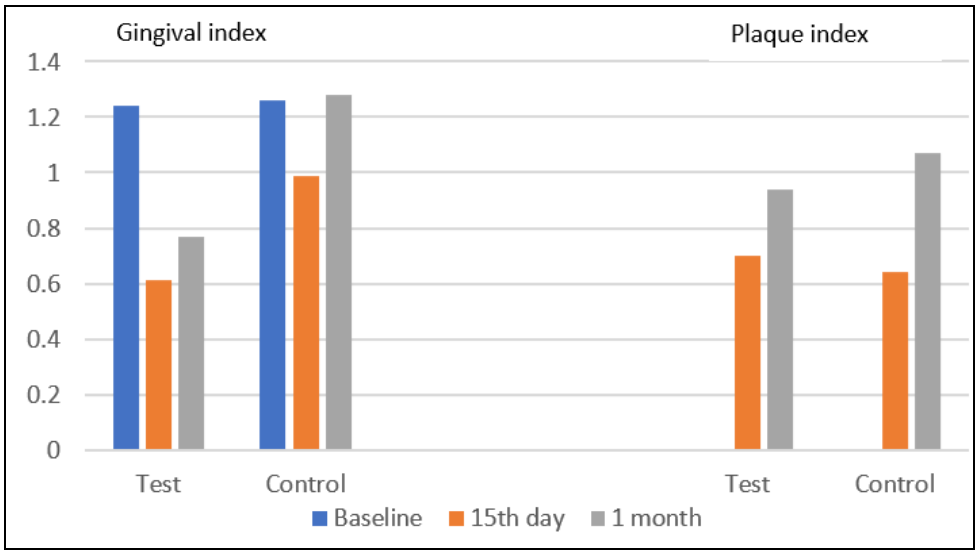
On intergroup comparison of plaque index was immediately after scaling even though coffee treated site (test group) showed less scores for new plaque formation, it was not statistically significant at both at 15th day (p= 0.665) and 1 month (p=0.109). Gingival index showed no significant difference at baseline and 15th day but at the end of 1month test group had better results which was statistically highly significant (p<0.001)

Table 1: Intragroup and intergroup comparison of gingival index and plaque index at baseline, 15th day and 1 month

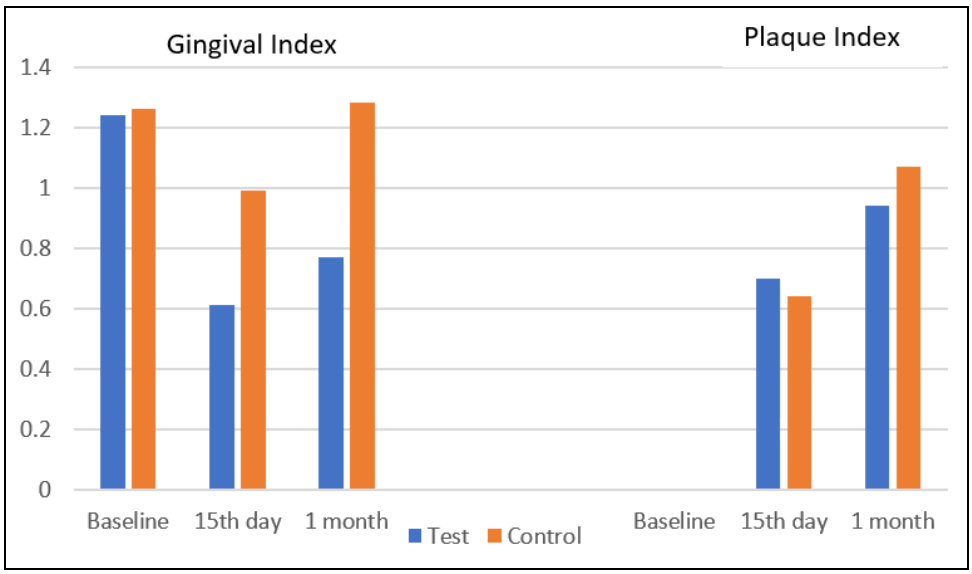
Gingival Index									
	Baseline			15TH Day			1 Month		
	Mean±*SD*	Mean Difference	P-Value	Mean±*SD*	Mean Difference	P- VALUE	Mean±*SD*	Mean Difference	P- Value
Test group	1.24±0.27	-	-	0.61±0.32	0.63	<0.001*	0.77±0.24	0.47	<0.001*
Control group	1.26±0.22	-	-	0.99±0.32	0.27	<0.001*	1.28±0.31	-0.02	0.43
Mean difference	0.02			0.38			0.51		
P-Value	0.807			0.008			<0.001*		
Plaque Index									
	Baseline			15TH Day			1 Month		
	Mean±SD	Mean difference	P-Value	Mean±*SD*	Mean Difference	P -Value	Mean±SD	Mean Difference	P-Value
Test group	0.00±0.00	NA	NA	0.70±0.30	-0.70	<0.001*	0.94±0.23	-0.94	<0.001*
Control group	0.00±0.00	NA	NA	0.64±0.34	-0.64	<0.001*	1.07±0.14	-1.07	<0.001*
Mean difference	NA			-0.006			0.13		
P-Value	NA			0.665			0.109		

p≤0.001*-Statistically highly significant ≠ NA-Not applicable

Graph



Graph 1: Intragroup comparison of gingival index and plaque index at baseline, 15th day and 1month



Graph 2: Intergroup comparison of gingival index and plaque index at baseline, 15th day and 1month

Discussion

Caffein (1, 3, 7 trimethylxanthane, CAF) is a naturally occurring alkaloid that is present not only in coffee but moreover in seeds, citrus natural products, olive oil, tea and cocoa beverages. Many studies have shown that CAF has antioxidant activity and so protects humans against health disorder related with oxidative stress [6].

A few components in coffee such as caffeine, unstable and non- volatile naturals acids, phenols and fragments compounds are detailed to have antimicrobial activity. Chlorogenic corrosive (CGA) and caffeic corrosive, which are non-volatile natural acids found in coffee, restrain the development of periodontal pathogens P. gingivalis and P. intermedia, as well as Candida albicans [7].

The present study evaluated the effectiveness of coffee as an oral gel in the reduction of gingivitis in 30 participants who were divided into Test group (Scaling with application of coffee gel) and group 2 (Scaling). In this study only commercially available coffee in the Indian market was investigated. (Nescafe®) Coffee treated site showed better resolution of gingival inflammation when compared to the control site that is scaling and root planning alone which was statistically significant. This results of the present study are in accordance with the study conducted by Laprise C *et al*. (2016) [8] suggested that increased intake of coffee had no deteriorating effect on the oral hygiene, but gingival health was found to be better among people who have coffee intake of more than 3cups per day.

Horrigan LA *et al*. (2006) [3] reported that caffeine can supress human ‘‘neutrophil and monocyte chemotaxis, it can also supress that pro-inflammatory cytokine tumor necrosis factor TNF-alpha. Caffeine was also found to supress human lymphocyte function as demonstrated by decreased T- cell expansion and impeded gene ration of Th1 ((interleukin [IL]-2 and intergalactic [IFN]-gamma), Th2 (IL-4, IL-5) and Th3 (IL-10) cytokines.

Huang J *et al*. (2004) [9] reported that dihydrocaffeic corrosive, which is identified in human plasma taking after coffee ingestion, scavenges intracellular reactive oxygen species (ROS). These findings suggested that the systemic increment in antioxidative property taking after coffee utilization contributes to a diminish in ROS-induced damage at the local level.

When the plaque scores were evaluated in the present study, both the groups were effective in controlling the new plaque formation through-out the study period but coffee treated site showed better result in reducing new plaque formation at the end of 1 month, though not statistically significant. This is in accordance to the study done by Signoretto C *et al*. [10] study has reported that individuals who regularly consume coffee have lower levels of cultivable bacteria in their saliva and dental plaque.

According to Stauder M *et al*. [11] the anti-biofilm action of barley coffee is due to Barley coffee fractions that content the same polyphenol content that is present in the coffee (catechins, and epigallocathechins). It may be attributed to interference with sucrose- dependent and sucrose-independent attachment components and/or inhibition the activity of key enzymes within the formation of oral biofilm (i.e Glucose transferase action and Fructosyltransferase), and /or impedances with bacterial majority detecting framework.

Antonio A G *et al*. (2011) [12] showed that the Coffee canephora aqueous extract at a concentration of 16% is bactericidal against S. mutans, one of the bacteria involved in the carious process [12]. The same group of authors (Antonio *et al*. 2012) [13] suggested that a higher concentration of the extract (20%) was competent of decreasing 15.2% mixed biofilm formed from pooled human saliva, proving that this substance contains a bactericidal impact, which leads us to believe that it would play a comparable role against the microbes utilized within the study as antibiotics would.

Martín MJ *et al*. [14] suggested that tannins in coffee have the capacity to restrain the movement of the glucotransferase enzyme which is the enzyme that can increase carbohydrate metabolism, particularly sucrose into extracellular polysaccharides known as glucans. The activity of the glucotransferase protein is inhibited, the synthesis of glucan will be inhibited as well, so that the connection of micro-organism to the tooth surface as initial process of micro-organism colonization on dental biofilm formation will not occur. Hence, it might be said that tannin in coffee contains a part in inhibiting biofilm.

Conclusion

Results of the present study confirmed that novel herbal coffee gel is an effective agent for treating plaque induced gingivitis in conjunction with scaling, compared to herbal gel application after scaling. Further long term studies are needed to confirm the effectiveness of this gel in the management of periodontal diseases.

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