EFFECT OF OMEGA 3 FATTY ACID SUPPLEMENTATION ON SALIVARY SIALIC ACID LEVEL IN SMOKERS WITH PERIODONTITIS AFTER NON SURGICAL PERIODONTAL THERAPY

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ABSTRACT

AIM: To evaluate and compare the effect of omega 3 fatty acid oral supplements as an adjunct to scaling and root planing on gingival and periodontal health and on salivary acid levels.

Materials & Methods: 30 smokers with chronic periodontitis randomly divided into test and control groups (15 in each) using a flip coin method. Subjects in the test group will be advised to take omega 3 fatty acid capsule once daily for 45 days after scaling & root planing and the subjects in the control group will not receive any supplementation after scaling & root planing . Subjects in both the groups will be asked not to take any other nutritional supplements or antiplaque agents other than regular tooth brushing during the study period. Clinical parameters assessed were simplified oral hygiene index (OHI), gingival index (GI), probing pocket depth will be measured before scaling and root planning, at baseline after 15 days and 45 days. Biochemical parameters salivary sialic acid will be measured at baseline,15 and 45 days.

Results: there is no significant effect of Omega-3 fatty acids oral supplementation as an adjunct to scaling and root planing on gingival health and salivary sialic acid levels in smokers. Both the groups showed significant reduction in oral hygiene index from base line to 15 days and from 15 days to 45 days also (p = 0.00). On intragroup comparison in both the groups at different time intervals there was no significant difference in both test and control group from 15 days to 45 days (p =0.33). Inter group comparison of gingival index scores between the test and control group showed statistically significant difference both after 15 days and 45 days with (p=0.006) and (p= 0.005) respectively. comparison of probing depth scores between the test and control group after 15 days and 45 days has no statistically significant difference with (p = 1.00) and (p =0.72) respectively. salivary sialic acid levels between the test and control group after 15 days and 45 days showed statistically significant difference (p =0.00).

Conclusion: Omega-3 fatty acid supplementation did not appear to enhance the therapeutic effects of NSPT in smokers with periodontitis with respect to probing depth, but resulted in significant reduction in gingival index that reflects gingival inflammation and salivary SA levels, a marker of systemic/oral inflammation

INTRODUCTION

Periodontitis is defined as an inflammatory disease of supporting tissues of teeth caused by specific microorganisms or groups of specific microorganisms, resulting in progressive destruction of the periodontal ligament and alveolar bone with periodontal pocket formation, gingival recession or both.[1]

Non-surgical periodontal therapy especially scaling and root planing has been gold standard therapeutic modality for treatment of periodontal diseases. It helps in reducing the bacterial load thereby reducing the inflammation around oral tissues.[5] The pocket depth reduction is less in smokers than nonsmokers after non-surgical periodontal therapy.[6] When the pockets persist in the smokers and non-smokers after the non-surgical periodontal therapy, adjunctive therapy can be used.

Omega-3 fatty acids include α-linolenic acid, eicosapentaenoic acid, and docosahexaenoic acid, which are found in abundance in fish oil and walnut oil. A low-carbohydrate diet high in fibre, omega-3 fatty acids, vitamins C and D has been shown to lower gingival and periodontal inflammation. With fewer adverse effects, omega-3 fatty acids can also be used as a supplement in many chronic inflammatory diseases. [7]

Sialic acid (SA) is a general term for acetylated derivative of neuraminic acid and forms a part of various glycoproteins and glycolipids by being one of the terminal residues. Salivary SA levels may be useful parameters to determine the severity of periodontal diseases.[8]
Therefore the aim of this study was to evaluate and compare the effect of omega 3 fatty acid oral supplements as an adjunct to scaling and root planing on gingival and periodontal health and on salivary sialic acid levels.

METHODOLOGY

To meet the primary objective of the study, a sample of 30 smokers with chronic periodontitis reported to the Department of Periodontics were selected. The informed consent of the patients was taken up for the study and patient consent forms were submitted to ethical committee of the institute.

Inclusion criteria

- Subjects between the age group of 50-60 years.
- Heavy smokers (smokes 20 cigarettes per day)[1].
- Should have a simplified oral hygiene index score of 1.3-3.0 (Greene JC 1967) and gingival inflammation with a gingival index score between 1.1-3.0 (Loe & Silness 1967)[1].

Exclusion criteria

For the study purpose, the following exclusion criteria will be considered.

- The patients with uncontrolled systemic diseases.
- Allergic to omega 3 fatty acids.
- Who underwent periodontal flap surgery in the past 6 months.

During the baseline visit, we measured the participant's simplified oral hygiene index, gingival index and probing pocket depth and salivary sialic acid levels were measured.

Study design

This study was a randomized control trial, thirty participants were randomly divided into test and control groups (15 in each) using a flip coin method. Subjects in the test group were advised to take omega 3 fatty acid capsule once daily for 45 days after scaling & root planing and the subjects in the control group did not receive any supplementation after scaling & root planning. Subjects in both the groups were asked not to take any other nutritional supplements or antiplaque agents other than regular tooth brushing during the study period.

The estimation of salivary sialic acid was done as:

Saliva was collected by the passive drool method. One technique for gathering complete saliva (also known as mixed saliva) is the passive drool method. This technique involves letting saliva gather at the back of the mouth, then asking participants to collect the saliva into a sterile container. Biochemical analysis of salivary sialic acid was done using the acidic ninhydrin method by Gaitonde[11]. When sialic acid and ninhydrin are present in an acidic media, they react to generate a coloured substance that can be detected spectrophotometrically at 470 nm. This approach involved adding 0.1 mL of acid ninhydrin reagent and 0.1 mL of glacial acetic acid to 0.1 mL of saliva. The reaction mixture was placed in a pan filled with boiling water for 10 minutes. After cooling the mixture under tap water, 1.0 mL of 99% of ethanol was added to the mixture. Absorbance was measured at 470 nm using a spectrophotometer.

Clinical Parameters

Clinical parameters were assessed by a clinician who is blind to the groups, simplified oral hygiene index (OHI), gingival index (GI), probing pocket depth and salivary sialic acid levels were measured at baseline before scaling and root planning after 15 days and 45 days after scaling and root planning.

OBSERVATIONS AND RESULTS

Statistical analysis:

The data is collected and entered in Microsoft excel,after calculating the mean oral hygiene index, gingival index, probing depth and salivary sialic acid level scores of the test and control sides using the above indices the data is subjected to statistical analysis using SPSS version 21.0. The data is checked for normality using the Shapiro–Wilk test and it showed the data is normally distributed. Descriptive statistics and inferential statistics such as independent t test are performed for intergroup comparisons and Paired t test are performed for intragroup comparisons at baseline, 15 days, and after 45 days.

The null hypothesis is set as there is no significant effect of Omega-3 fatty acids oral supplementation as an adjunct to scaling and root planing on gingival health and salivary sialic acid levels in smokers. Statistical significance level was set at $p < 0.05$[1] (95% confidence). Thus, values of $p < 0.05$were regarded as Statistically significant. Therefore, the null hypothesis will be rejected with 95% confidence.

Oral hygiene Index (OHI):

At baseline, in the test group OHI values were 2.43±0.23. After 15 days, there was a statistically highly significant decrease on the OHI values to 0.53 ± 0.21 and 0.82±0.21 after 45 days. Similarly, in the control group at base line the OHI values were 2.52 ± 0.21 and after 15 days and 45 days there was a significant decrease in OHI values to 0.55 ± 0.21and 0.82±0.21 respectively. Both the groups showed significant reduction in oral hygiene index from base line to 15 days and from 15 days to 45 days also (p = 0.00) [table 2] [chart 1].

Inter group comparison of OHI index scores showed no significant difference between the test and control group after 15 days (p = 0.863) and after 45 days (p =0.930) [table 2] [chart 1].

Gingival index (GI):

At baseline, in the test group and control groups mean GI values were 1.86 ± 0.26 and 1.91 ± 0.27 respectively. Control group showed significant decrease in gingival index scores after 15 days to 0.49 ± 0.23 and 45 days to 0.50 ± 0.21. Similarly the in the test group also there was a statistically significant decrease in gingival scores after 15 days to 0.27 ± 0.18 and after 45 days to 0.28 ±0.18 and with (p = 0.00) [table 3] [chart 2].

On intragroup comparison in both the groups at different time intervals there was no significant difference in both test and control group from 15 days to 45 days (p =0.33)

Inter group comparison of gingival index scores between the test and control group showed statistically significant difference both after 15 days and 45 days with (p=0.006) and (p= 0.005) respectively[table 3] [chart 2].

Probing depth:

At baseline, in the test group probing depth values were 6.33 ± 0.90. After 15 days, there was statistically significant decrease in probing depth to 4.40 ± 0.91. After 45 days, the values were 3.67 ± 0.49, there was a significant decrease. Similarly, probing depth values in the control group at base line were 6.33 ± 0.98. After 15 days, there was statistically significant decrease in probing depth to 4.73 ± 0.88. After 45 days, the values were 4.00 ±0.53 and there was significant difference.

On intragroup comparison in both the groups there was statistically significant difference at different time intervals from 15 to 45 days (p = 0.00) [table 4] [chart 3].

Inter group comparison of probing depth scores between the test and control group after 15 days and 45 days has no statistically significant difference with (p = 1.00) and (p =0.72) respectively [table 4] [chart 3].

Salivary Sialic acid levels:

At baseline, in the test group salivary sialic acid levels were 102.33 ± 3.29. After 15 days there was statistically significant difference in salivary sialic acid levels to 86.53 ±3.23. After 45 days, the values were 75.53 ±3.00, there was a significant decrease. Similarly, salivary sialic acid levels in the control group at base line were 102.13 ±2.61. After 15 days there was statistically significant difference in salivary sialic acid levels to 93.4 ± 2.40. After 45 days were 97.53 ± 7.18 with no significant difference.

On intragroup comparison in test group there was statistically significant difference from baseline

to 15 days with (p = 0.00) and there was statistically significant difference from 15 to 45 days with (p = 0.00). In control group there was statistically significant difference from baseline to 15 days with (p = 0.00) and there was no statistically significant difference from 15 to 45 days (p = 0.79) [table 5] [chart 4].
Inter group comparison of salivary sialic acid levels between the test and control group after 15 days and 45 days showed statistically significant difference (p =0.00) [table 5] [chart 4]

TABLES

Table 1 Demographic data baseline comparison between groups using unpaired T test

Demographic data baseline comparison between groups using unpaired T test			
Parameter	Control	Test	P value unpaired T test
Age in years	54 ± 2	55 ± 2	0.372
Oral hygiene index (OHI)	2.52 ± 0.21	2.43 ± 0.23	0.258
Gingival index (GI)	1.91 ± 0.27	1.86 ± 0.26	0.633
Probing Depth (PD)	6.33 ± 0.98	6.33 ±0.90	1.000
Salivary Sailic acid level	102.13 ± 2.61	102.33 ± 3.29	0.855

Table 2: Oral hygiene index intragroup and intergroup comparison using paired T test and unpaired T test.

Oral hygiene index paired T test and unpaired T test							
Groups	N	O day baseline	15 days	45 days	P value Paired T test 0 – 15 days	15 – 45 days	0 – 45 days
Control	15	2.52 ± 0.21	0.55 ± 0.21	0.83 ± 0.20	0.00**	0.00**	0.00**
Test	15	2.43 ± 0.23	0.53 ± 0.21	0.82 ± 0.21	0.00**	0.00**	0.00**
P value Unpaired T test		0.372	0.863	0.930			

Table 3: Gingival index intragroup and intergroup comparison using paired T test and unpaired T test.

Probing depth paired T test and unpaired T test							
Groups	N	O day baseline	15 days	45 days	P value Paired T test 0 – 15 days	15 – 45 days	0– 45 days
Control	15	6.33 ± 0.98	4.73 ± 0.88	4.00 ±0.53	0.00**	0.00**	0.00**
Test	15	6.33 ± 0.90	4.40 ± 0.91	3.67 ± 0.49	0.00**	0.00**	0.00**
P value Unpaired T test		1.00	1.00	0.72			

Table 4: Probing depth intragroup and intergroup comparison using paired T test and unpaired T test

Gingival index paired T test and unpaired T test							
Groups	N	O day baseline	15 days	45 days	P value Paired T test 0 – 15 days	15 – 45 days	0– 45 days
Control	15	1.91 ± 0.27	0.49 ± 0.23	0.50 ± 0.21	0.00**	0.33	0.00**
Test	15	1.86 ± 0.26	0.27 ± 0.18	0.28 ±0.18	0.00**	0.33	0.00**
P value Unpaired T test		0.63	0.006**	0.005**			

Table 5: Salivary Sialic acid levels intragroup and intergroup comparison using paired T test and unpaired T test

Salivary Sialic acid levels paired T test and unpaired T test							
Groups	N	O day baseline	15 days	45 days	P value Paired T test 0 – 15 days	15 – 45 days	0– 45 days
Control	15	102.13 ±2.61	93.4 ± 2.40	97.53 ± 7.18	0.00**	0.79	0.06
Test	15	102.33 ± 3.29	86.53 ±3.23	75.53 ±3.00	0.00**	0.00**	0.00**
P value Unpaired T test		0.85	0.00**	0.00**			

CHARTS

Chart 1: Mean values of Oral hygiene index in both test and control groups at baseline, 15 days and 45 days.

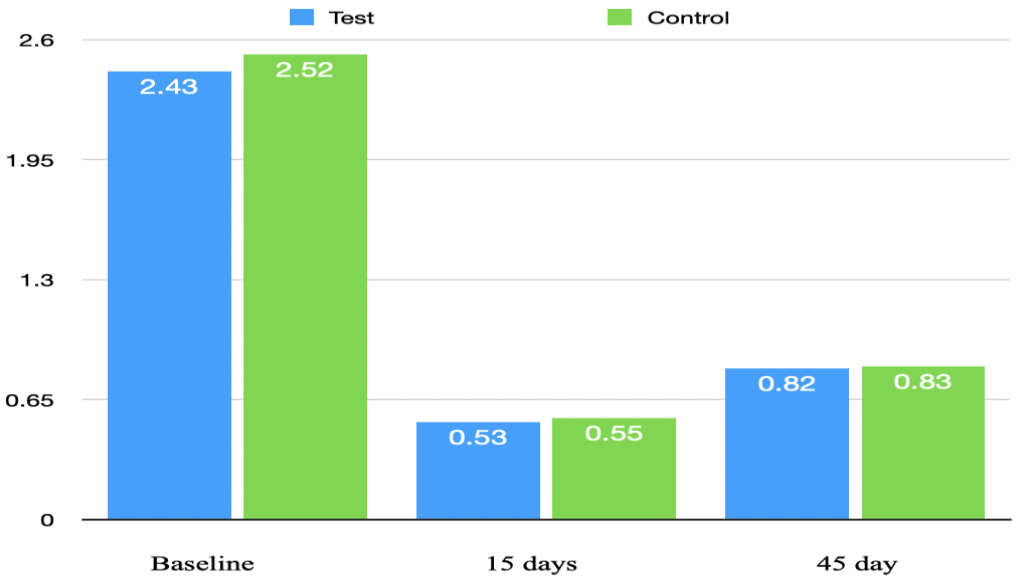


Chart 2: Mean values of gingival index in both test and control groups at baseline, 15 days and 45 days.

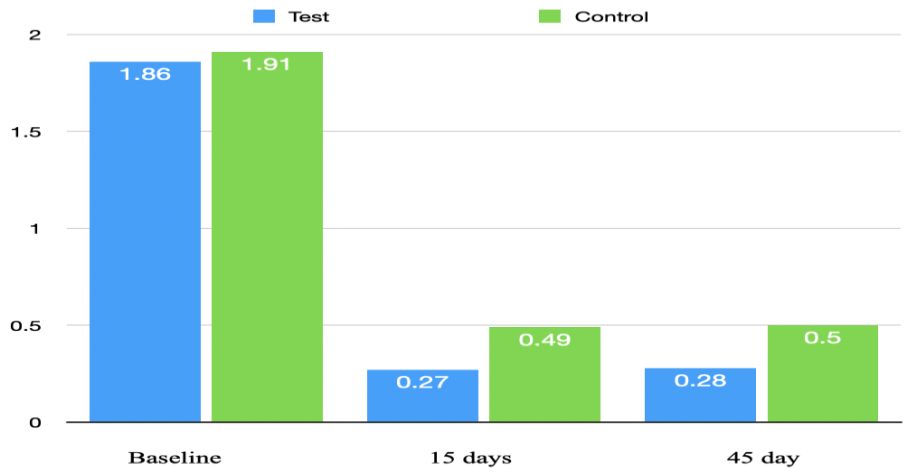


Chart 3: Mean values of probing depth in both test and control groups at baseline, 15 days and 45 days.

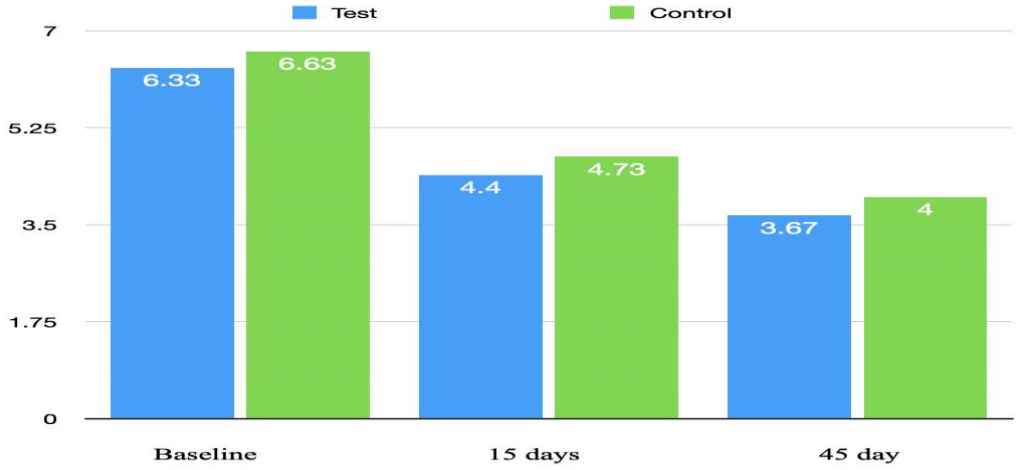
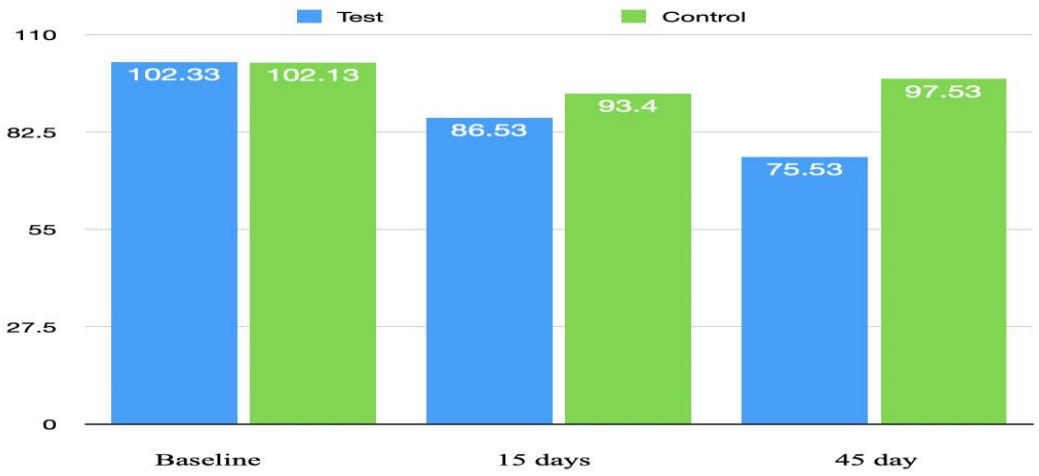


Chart 4: Mean values of salivary sialic acid levels in both test and control groups at baseline, 15 days and 45 days.



DISCUSSION

Periodontitis is a chronic inflammatory disease characterized by the destruction of supporting tissues of the teeth, primarily driven by the host's inflammatory response to microbial biofilm. Smokers with periodontitis present a unique challenge due to the deleterious effects of smoking on the immune system and the periodontal tissues. Smoking exacerbates oxidative stress and systemic inflammation, which further impairs periodontal healing post-therapy. Salivary sialic acid, a marker of inflammation and tissue turnover, has been implicated in the pathophysiology of periodontitis. Its elevated levels in smokers with periodontitis reflect ongoing inflammation and tissue damage. Thus, reducing salivary sialic acid levels can be considered a proxy for therapeutic success[8].

Omega-3 fatty acids (n-3 FAs), particularly eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA), have emerged as potent anti-inflammatory agents. Their mechanisms of action include downregulating pro-inflammatory cytokines (e.g., IL-1β, TNF-α) and promoting the resolution of inflammation via specialized pro-resolving lipid mediators, such as resolvins and protectins. This discussion evaluates the potential benefits of omega-3 supplementation in reducing salivary sialic acid levels in smokers with periodontitis following non-surgical periodontal therapy (NSPT).

Studies have demonstrated that omega-3 supplementation can significantly mitigate systemic inflammation. Calder (2017)[9] noted that n-3 FAs modulate the production of inflammatory eicosanoids derived from arachidonic acid, thereby shifting the balance towards anti-inflammatory mediators. This property is particularly relevant in smokers, whose systemic and local inflammatory burdens are heightened due to smoking-induced oxidative stress. In the context of periodontal disease, omega-3 fatty acids may enhance the outcomes of NSPT by attenuating the host's hyper-inflammatory response and promoting tissue repair.

In this randomized control trial we attempted to investigate whether oral supplementation of of omega 3 fatty acids after scaling has any positive effect on periodontal health and salivary sialic acid levels in smokers control in smokers with periodontitis. In our study we observed that individuals in both the groups i.e., those individuals that received omega 3 fatty acids oral supplements as an adjunct to NSPT and the ones that received only NSPT showed significant improvement in oral hygiene index and gingival index and probing pocket depth at 15 days and 45 days after NSPT. Oral supplementation of omega 3 fatty acids did not have an impact on probing pocket depth. Improvement in pocket depth reduction of the test group were similar to that of the control group that received NSPT alone. These results were in accordance with results obtained in a study by Martinez G etal (2014)[10].

In smokers with periodontitis, the inflammatory response is exacerbated due to increased oxidative stress and impaired immune function (Leite et al., 2018)[11]. This study's observation of reduced salivary SA levels post-NSPT in the O3FA group suggests that supplementation may have attenuated systemic and local inflammation, as elevated SA is a recognized marker of inflammation and tissue turnover (Guerrero-Flores et al.)[12].

Efficient root surface instrumentation and dislodgement of the subgingival biofilm after NSPT creates a root surface that is biologically compatible with the formation of a long junctional epithelium which adheres to the root surface cementum by a hemidesmosomal attachment. This reduction is largely a result of the resolution of gingival inflammation leading to shrinkage of the gingival tissues and the formation of a new, long junctional epithelium.[13]

The reduction in salivary sialic acid levels observed in the present study aligns with these findings. By curbing systemic and local inflammation, omega-3 fatty acids likely create a more favorable environment for periodontal healing, thereby reducing the inflammatory markers in saliva. Additionally, the resolution of inflammation may contribute to the stabilization of glycoproteins in the saliva, further lowering sialic acid levels.

CONCLUSION

Omega-3 fatty acid supplementation did not appear to enhance the therapeutic effects of NSPT in smokers with periodontitis with respect to probing depth, but resulted in significant reduction in gingival index that reflects gingival inflammation and salivary SA levels, a marker of systemic/oral inflammation. These findings underscore the potential of dietary interventions as adjuncts to conventional periodontal therapy, particularly in high-risk populations such as smokers. Further research is warranted to validate these findings and explore their translational potential in routine clinical practice.

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