

CORRELATION BETWEEN DIET PATTERN AND GINGIVITIS -A RETROSPECTIVE STUDY

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Abstract

Gingivitis is the inflammation of gingiva most commonly caused due to plaque accumulation. Dental plaque is a complex biofilm accumulation on teeth and oral tissues. Diet seems to have a profound impact on the gingival and periodontal inflammatory reaction. It is important to create awareness about better nutritional interventions among the general population to prevent further progression of gingival disease. The aim of this study was to assess the correlation between diet pattern and gingivitis. A retrospective study was conducted using the case records of patients visiting a private dental college in Chennai from June 2019 - March 2020. The study population included case records of patients between 18 and 25 years of age with recorded gingival index scores, selected by non-probability purposive sampling. Data was collected and then subjected to statistical analysis. Microsoft Excel 2016 (Microsoft office 10) data spreadsheet was used to collect data and later exported to SPSS IBM (version 20.0). Descriptive statistics and chi square test were employed with a level of significance set at $p < 0.05$. The age group of patients included in the study ranged between 18 and 25 years. 66.67% were males and 33.33% were females. 85.8% of gingivitis patients consumed a non-vegetarian diet and 14.2% were vegetarians. There was no statistically significant correlation between diet pattern and gingivitis ($p > 0.05$), though the prevalence and severity of gingival disease was increased among people with a non-vegetarian diet. There was a significant association between plaque index and gingival index scores ($p = 0.000$), with the severity of gingivitis increasing as the plaque index score increases.

Keywords: Dental plaque; Diet; Gingivitis; Plaque index

Introduction

Periodontium refers to the supporting structures around the tooth - namely gingiva, cementum, periodontal ligament and alveolar bone[6,7]. Gingivitis is the inflammation of gums most commonly caused due to plaque accumulation[8,9]. The signs and symptoms include pain, swelling, bleeding on brushing and bleeding on probing etc. If left untreated it can lead to periodontitis and ultimately loss of teeth[10,11].

Dental plaque is a complex biofilm accumulation on teeth and oral tissues[12]. Environmental and genetic factors are influential in the development of dental plaque biofilms. The role of dental plaque in gingivitis is well established[13]. Within 8 days of the beginning of plaque accumulation, an early lesion exhibiting many features characteristic of delayed hypersensitivity develops[14]. Individuals react differently regarding their inflammatory response to plaque accumulation, with some individuals showing only a mild expression of gingival inflammation[15].

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Diet seems to have a profound impact on the gingival and periodontal inflammatory reaction[16]. Examining the literature, several dietary recommendations for benefiting the health of periodontal tissues can be found, such as a reduction in carbohydrates, and an additional intake of Omega-3 fatty acids, vitamin C, vitamin D, antioxidants and fiber[17].

The health of the oral cavity can have wide-reaching effects on overall health[1,2]. Poor oral health may occur concomitantly with a more serious underlying disease process or may predispose an individual to other health conditions[3,4]. Protecting oral health is therefore critical in maintaining overall health[5].

Most importantly, the excessive intake of carbohydrates seems to promote dysbiosis and chronic inflammatory diseases[18]. The clinical reduction of carbohydrate intake seems to reduce gingival inflammation[19,20]. In-vitro studies showed that high levels of glucose promote apoptosis and inhibit proliferation of periodontal ligament cells[21,22].

Furthermore, the intake of vitamins C and D seem to play an important role in gingival and periodontal inflammation[23]. Several studies showed the positive impact of vitamin D on periodontal tissues both in clinical and in-vitro studies[24]. Vitamin C has been described as an important vitamin for periodontal health, both in clinical and in-vitro studies for some time[25]. The absence of vitamin C causes scurvy, which is accompanied by massive periodontal bone loss[26].

Last but not least, the role of dietary antioxidants seems to be important for several processes regarding an adequate systemic reaction to oxidative stress. Both clinical and *in-vitro* studies showed positive effects on periodontal tissues[27,28].

It is important to create awareness about better nutritional interventions among the general population to prevent further progression of gingival disease[29]. The aim of this study was to assess the correlation between diet pattern and gingivitis.

MATERIALS AND METHODS

Study design and setting

This retrospective study examined the records of patients who underwent treatment at a private dental college in Chennai from June 2019 - April 2020. Ethical approval was obtained from the Institutional Ethics Committee of the University (SDC/SIHEC/2020/DIASDATA/0619-0320). The study population included case records of patients between 18 and 25 years of age who had gingivitis, selected by non-probability purposive sampling. Pediatric patients, patients above 25 years of age, patients with healthy gingiva, medically compromised patients, completely edentulous patients and denture wearers, were excluded from the study.

Data collection

Case records of 3669 patients with recorded gingival index and plaque index scores were reviewed and analysed. Relevant data such as patient age, sex, gingival index score, diet pattern and plaque index score were recorded. Repeated patient records and incomplete records were excluded. The final dataset consisted of 162 patients of Indian origin between the age group of 18 to 25 years with recorded gingival Index and plaque Index scores. Data was verified by an external reviewer.

Statistical analysis

Data was recorded in Microsoft Excel 2016 (Microsoft office 10) and later exported to the Statistical Package for Social Science (SPSS IBM version 20.0) and subjected to statistical analysis. Descriptive statistics and chi square test were employed with a level of significance set at $p < 0.05$.

RESULTS

The data for this retrospective study was based on the patients seeking treatment in a private dental college. Currently there are very few studies investigating the correlation between diet pattern and gingivitis in the South Indian population. The results of the present study show that among the study population, about 6.17% were 18 years, 9.88% were 19 years, 9.26% were 20 years, 4.94% were 21 years, 12.35% were 22 years, 13.58% were 23 years, 23.46% were 24 years and 19.75% were 25 years of age. Majority of the patients were 24 years of age [Figure 1].

About 66.67% were males and 33.33% were females, showing a male predilection for gingivitis [Figure 2].

About 14.2% of gingivitis patients consumed a vegetarian diet and 85.8% were non-vegetarians, which showed that most of the patients consumed a non-vegetarian diet [Figure 3].

Among patients consuming a non-vegetarian diet, 41.36% had mild gingivitis, 41.98% had severe gingivitis and 2.47% had severe gingivitis. In patients with a vegetarian diet, 8.02% had mild gingivitis, 5.56% had moderate gingivitis and 0.62% had severe gingivitis. The prevalence and severity of gingivitis was higher in those who consumed a non-vegetarian diet. However, chi square test showed that there was no significant association [Figure 4, Table 1].

Among patients with good plaque index, 33.95% had mild gingivitis and 25.31% had moderate gingivitis. In patients with fair plaque index, 14.2% had mild gingivitis, 19.14% had moderate gingivitis and 1.23% had severe gingivitis. 1.23% of patients with poor plaque index had mild gingivitis, 3.09% had moderate gingivitis and 1.85% had severe gingivitis. Chi square test showed that there was a significant association between plaque index and gingival index, wherein the severity of gingivitis was higher in patients with fair and poor plaque index [Figure 5, Table 1].

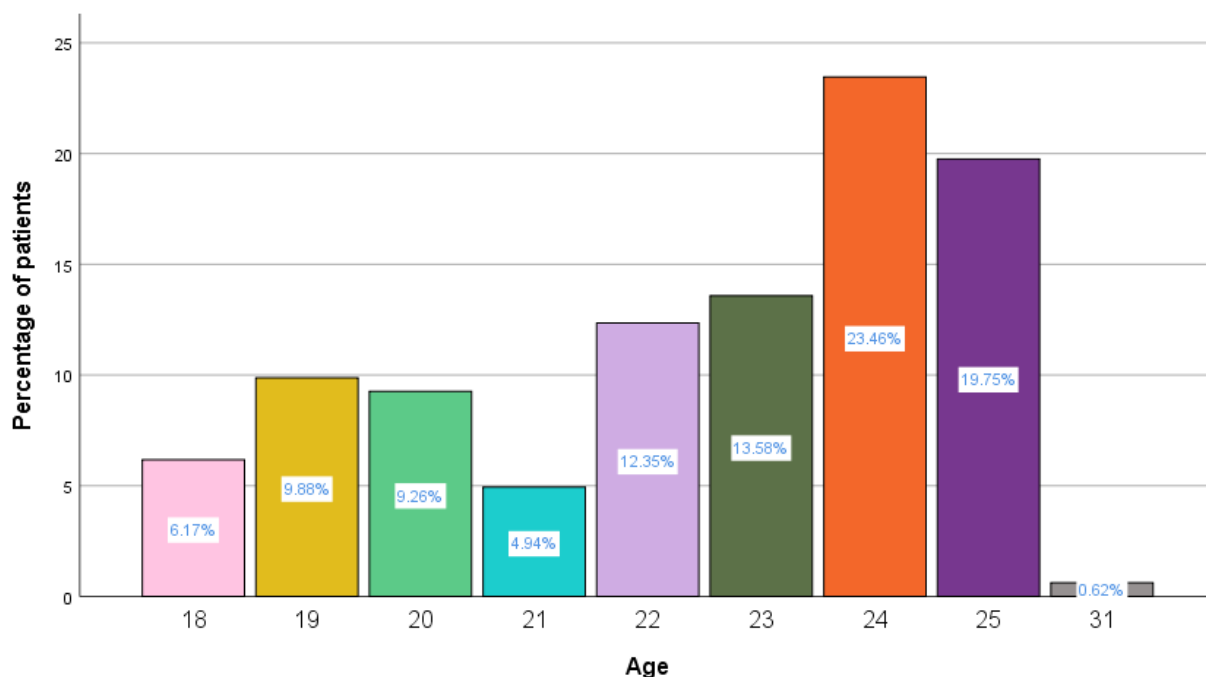


Figure 1 : Bar graph representing the age distribution of patients included in this study. X axis represents the age and Y axis represents the percentage of patients included in this study. The age group of patients included in the study ranged between 18 and 25 years. Majority of the patients were 24(orange) years of age.

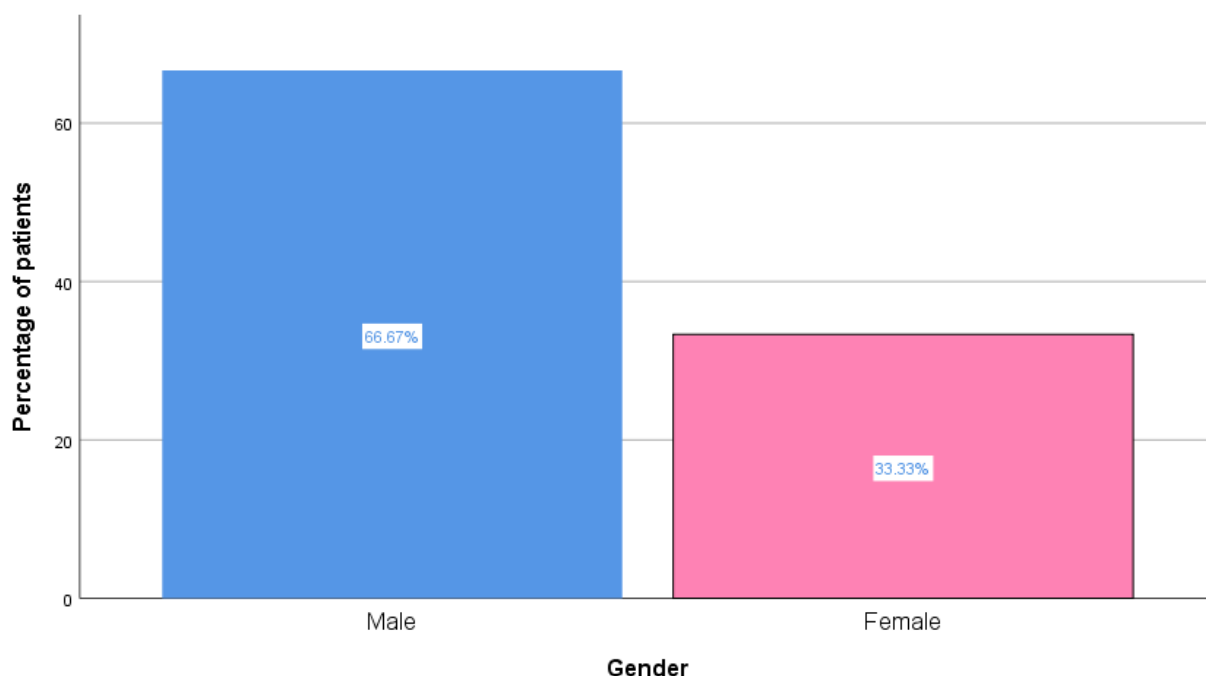


Figure 2 : Bar graph representing the gender distribution. X axis represents the gender and Y axis represents the percentage of patients included in this study. Majority of the patients who had gingivitis were males (blue) compared to females (pink).

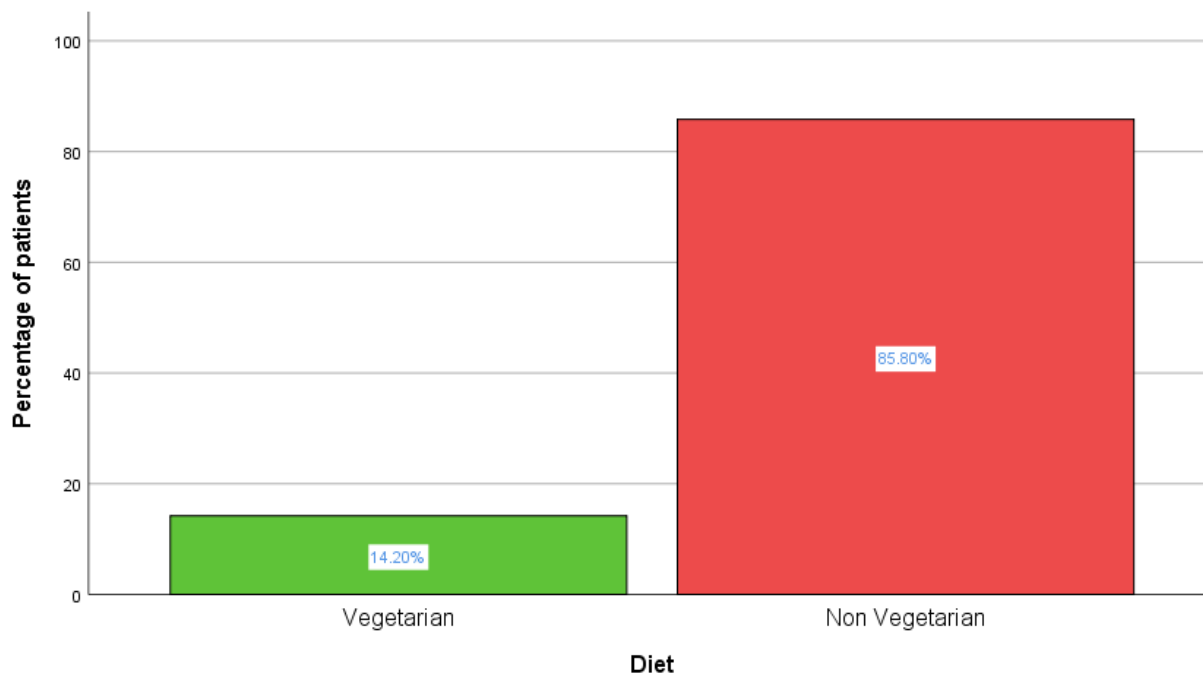


Figure 3 : Bar graph representing the diet pattern among patients. X axis represents the diet pattern and Y axis represents the patients included in this study. Majority of the patients in this study who had gingivitis were non-vegetarian (red) compared to vegetarians (green).

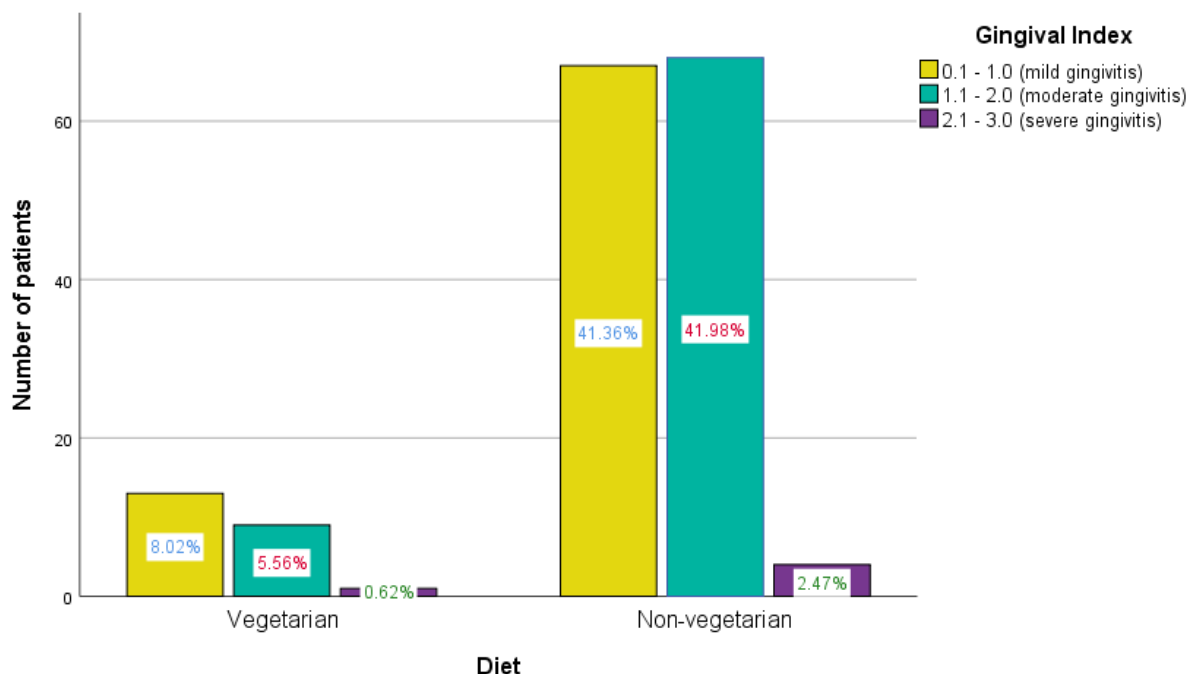


Figure 4 : Bar graph representing the association between diet pattern and gingivitis. X axis represents the diet pattern and Y axis represents the number of patients included in this study. The prevalence and severity of gingivitis was higher in those who consumed a non-vegetarian diet. Chi square test showed that there was no significant association between diet pattern and gingivitis. Pearson Chi square value = 0.813; p-value = 0.666 (p>0.05, statistically not significant).

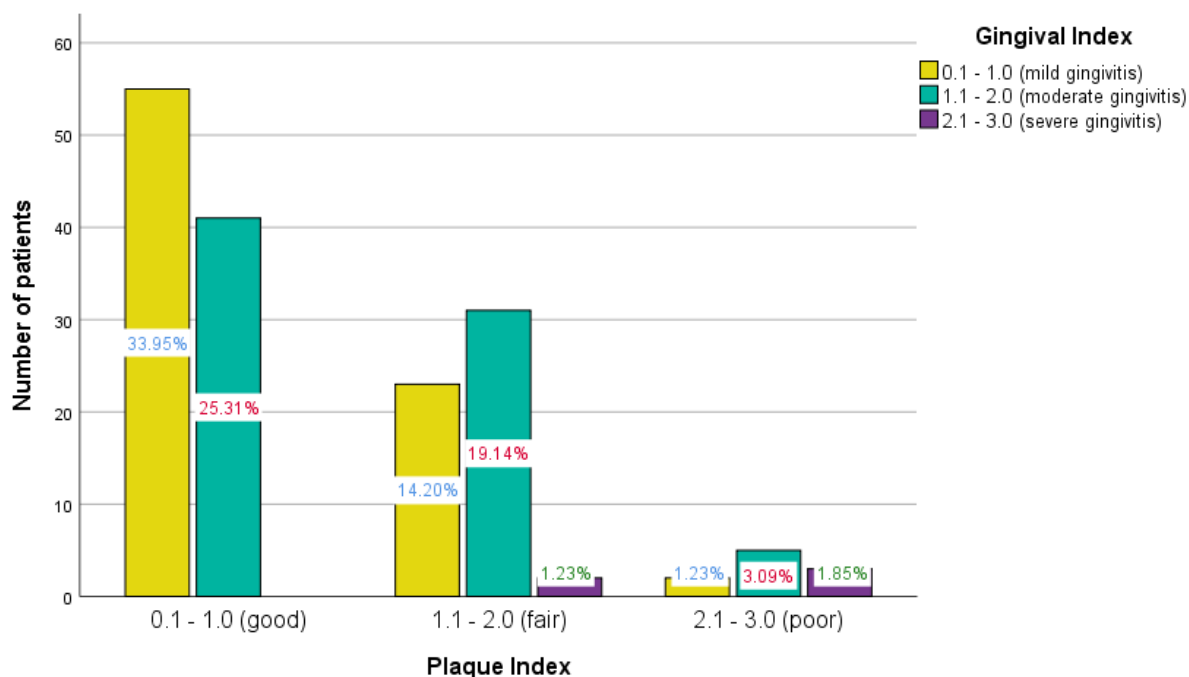


Figure 5 : Bar graph representing the association between plaque index and gingival index scores. X axis represents the plaque index scores and Y axis represents the number of patients included in this study. The severity of gingivitis was higher in patients with fair and poor plaque index. Chi square test showed that there was a significant association between plaque index and gingival index. Pearson Chi square value = 31.426; p-value = 0.000 ($p < 0.05$, statistically significant).

	Gingival Index			Chi square test
	0.1 - 1.0 (mild gingivitis)	1.1 - 2.0 (moderate gingivitis)	2.1 - 3.0 (severe gingivitis)	
Diet pattern :				Pearson Chi square value = 0.813; p-value = 0.666 ($p > 0.05$, *statistically insignificant).
Non-vegetarian	41.36%	41.98%	2.47%	
Vegetarian	8.02%	5.56%	0.62%	

Plaque index :				
0.1 - 1.0 (good)	33.95%	25.31%	0%	Pearson Chi square value = 31.426; p-value = 0.000 (p<0.05, *statistically significant).
1.1 - 2.0 (fair)	14.2%	19.14%	1.23%	
2.1 - 3.0 (poor)	1.23%	3.09%	1.85%	

Table 1 represents the severity of gingivitis among patients with various diet patterns and plaque index scores. Severe gingivitis was more common in patients with a non-vegetarian diet and poor plaque index. Chi square test showed that there was a significant association between plaque index and gingivitis (p<0.05). Though there was a higher prevalence of gingivitis among patients who consumed a non-vegetarian diet, there was no significant association (p>0.05).

DISCUSSION

The effect of diet on systemic diseases like cancer, type 2 diabetes and coronary heart diseases have been studied by various authors but studies correlating diet and oral health are rare .Most authors assessed dental parameters or performed saliva test[30,31,32,33].

Only a few studies investigating the influence of diet on periodontal conditions are available[34,35]. The present study evaluated 162 subjects for the correlation between diet and periodontal condition with a comprehensive periodontal examination.

First our data indicate less periodontal problems (i.e) inflammatory signs in vegetarians . This is in accordance with linkosalo et al[36] which revealed a lower bleeding on probing in vegetarians linkasalo et al also used gingival index to assess gingival conditions. There are several pathways which may lead to inflammation.

Generally vegetarians have low BMI and more physical activity . Hence prevalence of obesity may cause an increased local inflammatory response[37]. Additionally vegetarians consume a higher amount of antioxidants which improve immune response[38].

Considering plaque scores, our data and most of available scientific literature revealed an increased plaque index score among non vegetarians than vegetarians. It's obvious that a lower plaque index score leads to less inflammatory signs.

In contrast to our study Sedgley et al[39] did not find the difference in plaque index or gingival index among vegetarians and non vegetarians. The importance of adequate nutrition for a healthy periodontium was documented by Jenzsch et al. Kober et al[40] recommended a dietary change that leads to better periodontal health.

A statistically significant correlation between the occurrence of gingivitis and calorie-adjusted phosphorus intake and between gingivitis and calorie-adjusted sugar intake was observed in a study by Goodson et al. Thus, elevated dietary phosphorus consumption may influence inflammatory disease by altering cytokine levels[41].

In another study by Sidi et al, it was found that at 3 weeks significantly higher bleeding scores at the two designated levels were found with the high sugar diet but no significant differences were observed with crevicular fluid flow and plaque amount. It was concluded that frequent sugar intakes result in increased gingival inflammation in experimental gingivitis, as measured by gingival bleeding on probing[42].

Al-Zahrani et al concluded that poor diet quality was significantly associated with more calculus deposits which predisposes to periodontal disease[43].

A randomized control trial on the influence of an anti-inflammatory diet on gingivitis by Woelber et al stated that a diet low in processed carbohydrates and animal proteins, and rich in omega-3 fatty acids, vitamin C, vitamin D, antioxidants, plant nitrates and fibres significantly reduced gingivitis in a clinically relevant range, while serological inflammatory parameters and the subgingival microbiome seem to be unaffected[44].

While interpreting the present data one should keep in mind that generally a vegetarian diet represents a healthy lifestyle. Vegetarians are physically more active and have lower BMI. In the present study the vegetarians and non vegetarians were matched with gingival index and plaque index. However physical activity and BMI were not evaluated. Both have an influence on periodontal tissues[45] and could be considered as a co-founder if correlation between diet and periodontal condition is investigated further.

The results of this study have to be interpreted with the geographic limitation of the study population and the sample size selected. Hence, it cannot be generalized to other populations of geographic and cultural variation.

CONCLUSION

Within the limits of the study there was no significant association between diet pattern and gingivitis, though the prevalence and severity of gingival disease was increased among people with a non-vegetarian diet. There was a significant association between plaque index and gingival index scores, with the severity of gingivitis increasing as the plaque index score increases. Thus a vegetarian diet and patients with lower plaque index had a positive effect on periodontal condition respectively.

ACKNOWLEDGEMENTS

We would like to thank the administration of Saveetha University, Chennai for granting us the clearance to conduct this study and for funding this research. Also we thank the Chancellor and Director of academics, Dean saveetha dental college for encouraging us to the research work

AUTHORS CONTRIBUTION

All the authors contributed equally to the study conception and design, data collection, analysis and interpretation and drafted the work. All authors critically reviewed the manuscript and approved the final version.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

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