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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

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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

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[(Varghese *et al.*, 2015),(Avinash, Malaippan and Dooraiswamy, 2017)]. Protecting oral health is therefore critical in maintaining overall health[(Panda *et al.*, 2014)].

Periodontium refers to the supporting structures around the tooth - namely gingiva, cementum, periodontal ligament and alveolar bone[(Mootha *et al.*, 2016),(Ravi *et al.*, 2017)]. Gingivitis is the inflammation of gums most commonly caused due to plaque accumulation[(Khalid, 2017),(Khalid *et al.*, 2016)]. 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[(Ramesh *et al.*, 2016),(Kavarthapu and Thamaraiselvan, 2018)].

Dental plaque is a complex biofilm accumulation on teeth and oral tissues[(Ramesh, Ravi and Kaarthikeyan, 2017)]. Environmental and genetic factors are influential in the development of dental plaque biofilms.The role of dental plaque in gingivitis is well established[(Ramesh *et al.*, 2019a)]. Within 8 days of the beginning of plaque accumulation, an early lesion exhibiting many features characteristic of delayed hypersensitivity develops[(Priyanka *et al.*, 2017)]. Individuals react differently regarding their inflammatory response to plaque accumulation, with some individuals showing only a mild expression of gingival inflammation[(Ramamurthy, 2018)].

Diet seems to have a profound impact on the gingival and periodontal inflammatory reaction[(Li *et al.*, 2010)]. 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[(Alam, Mishra and Chandrasekaran, 2012)].

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Most importantly, the excessive intake of carbohydrates seems to promote dysbiosis and chronic inflammatory diseases[(Ostberg, Halling and Lindblad, 1999)]. The clinical reduction of carbohydrate intake seems to reduce gingival inflammation[(Sakki, Knuuttila and Anttila, 1998),(Furuta *et al.*, 2011)]. In-vitro studies showed that high levels of glucose promote apoptosis and inhibit proliferation of periodontal ligament cells[(Zhang *et al.*, 2010),(Nazir, Arain and Mohsin, no date)].

Furthermore, the intake of vitamins C and D seem to play an important role in gingival and periodontal inflammation[(Boer *et al.*, 2012)]. Several studies showed the positive impact of vitamin D on periodontal tissues both in clinical and in-vitro studies[(Hujoel, 2009)]. Vitamin C has been described as an important vitamin for periodontal health, both in clinical and in-vitro studies for some time[(Velden *et al.*, 2011)]. The absence of vitamin C causes scurvy, which is accompanied by massive periodontal bone loss[(Nishida *et al.*, 2000)].

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[(Muniz *et al.*, 2015),(Linkosalo and Markkanen, 1985)].

It is important to create awareness about better nutritional interventions among the general population to prevent further progression of gingival disease[(Rahmatulla and Ernest Guile, 1990)]. Our team has rich experience in research and we have collaborated with numerous authors over various topics in the past decade (Subramanyam *et al.*, 2018)('Fluoride, fluoridated toothpaste efficacy and its safety in children - review', 2018; Ezhilarasan, 2018; Felicita, 2018; Kavarthapu and Thamaraiselvan, 2018; Krishnan *et al.*, 2018; Marimuthu *et al.*, 2018; Nair *et al.*, 2018; Padavala and Sukumaran, 2018; Pandian, Krishnan and Kumar, 2018; Rajeshkumar *et al.*, 2018; Rao and Kumar, 2018; Vijayashree Priyadharsini, Smiline Girija and Paramasivam, 2018; Abhinav *et al.*, 2019; Ke *et al.*, 2019; Mehta *et al.*, 2019; Panchal, Jeevanandan and Subramanian, 2019; Ponnulakshmi *et al.*, 2019; Ramesh *et al.*, 2019b; Sridharan *et al.*, 2019; Sweta, Abhinav and Ramesh, 2019; Wu *et al.*, 2019; Palati *et al.*, 2020; Paramasivam, Vijayashree Priyadharsini and Raghunandhakumar, 2020). 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.

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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].

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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[(Johansson and Birkhed, 1994),(Johansson and Ravald, 1995),(Laffranchi *et al.*, 2010),(Linkosalo, 1988)].

Only a few studies investigating the influence of diet on periodontal conditions are available[(Linkosalo *et al.*, 1985),(Linkosalo, Markkanen and Syrjänen, 1985)]. 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[(Tonstad *et al.*, 2009)] 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[(Kuzmanova *et al.*, 2012)]. Additionally vegetarians consume a higher amount of antioxidants which improve immune response[(Jenzsch *et al.*, 2008)].

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[(Sedgley *et al.*, 1996)] 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[(Männle, 2018)] 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[(Goodson, Shi and Razzaque, 2019)].

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[(Sidi and Ashley, 1984)].

Al-Zahrani et al concluded that poor diet quality was significantly associated with more calculus deposits which predisposes to periodontal disease[(Al-Zahrani, Borawski and Bissada, 2004)].

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

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reduced gingivitis in a clinically relevant range, while serological inflammatory parameters and the subgingival microbiome seem to be unaffected[(Woelber *et al.*, 2019)].

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[(Bawadi *et al.*, 2011)] and could be considered as a co-founder if correlation between diet and periodontal condition is investigated further. Our institution is passionate about high quality evidence based research and has excelled in various fields ((Pc, Marimuthu and Devadoss, 2018; Ramesh *et al.*, 2018; Vijayashree Priyadharsini, Smiline Girija and Paramasivam, 2018; Ezhilarasan, Apoorva and Ashok Vardhan, 2019; Ramadurai *et al.*, 2019; Sridharan *et al.*, 2019; Vijayashree Priyadharsini, 2019; Chandrasekar *et al.*, 2020; Mathew *et al.*, 2020; R *et al.*, 2020; Samuel, 2021)

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.

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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.

REFERENCES

[1]. Abhinav, R. P. *et al.* (2019) 'The Patterns and Etiology of Maxillofacial Trauma in South India', *Annals of maxillofacial surgery*, 9(1), pp. 114–117.

[2]. Alam, M. D. N., Mishra, P. and Chandrasekaran, S. C. (2012) 'Gender basis of periodontal diseases', *Indian J Basic Appl Med Res*, 2(1), pp. 128–135.

[3]. Al-Zahrani, M. S., Borawski, E. A. and Bissada, N. F. (2004) 'Poor overall diet quality as a possible contributor to calculus formation', *Oral health & preventive dentistry*, 2(4), pp. 345–349.

[4]. Avinash, K., Malaippan, S. and Dooraiswamy, J. N. (2017) 'Methods of Isolation and Characterization of Stem Cells from Different Regions of Oral Cavity Using Markers: A Systematic Review', *International journal of stem cells*, 10(1), pp. 12–20.

[5]. Bawadi, H. A. *et al.* (2011) 'The association between periodontal disease, physical activity and healthy diet among adults in Jordan', *Journal of Periodontal Research*, pp. 74–81. doi: 10.1111/j.1600-0765.2010.01314.x.

[6]. Boer, M. M. B. *et al.* (2012) 'Chronic inflammatory diseases are stimulated by current lifestyle: how diet, stress levels and medication prevent our body from recovering', *Nutrition & Metabolism*, p. 32. doi: 10.1186/1743-7075-9-32.

[7]. Chandrasekar, R. *et al.* (2020) 'Development and validation of a formula for objective assessment of cervical vertebral bone age', *Progress in orthodontics*, 21(1), p. 38.

[8]. Ezhilarasan, D. (2018) 'Oxidative stress is bane in chronic liver diseases: Clinical and experimental perspective', *Arab journal of gastroenterology: the official publication of the Pan-Arab Association of Gastroenterology*, 19(2), pp. 56–64.

[9]. Ezhilarasan, D., Apoorva, V. S. and Ashok Vardhan, N. (2019) 'Syzygium cumini extract induced reactive oxygen species-mediated apoptosis in human oral squamous carcinoma cells', *Journal of oral pathology & medicine: official publication of the International Association of Oral Pathologists and the American Academy of Oral Pathology*, 48(2), pp. 115–121.

[10]. Felicita, A. S. (2018) 'Orthodontic extrusion of Ellis Class VIII fracture of maxillary lateral incisor - The sling shot method', *The Saudi dental journal*, 30(3), pp. 265–269.

[11]. 'Fluoride, fluoridated toothpaste efficacy and its safety in children - review' (2018) *International journal of pharmaceutical research*, 10(04). doi: 10.31838/ijpr/2018.10.04.017.

[12]. Furuta, M. *et al.* (2011) 'Sex Differences in Gingivitis Relate to Interaction of Oral Health Behaviors in Young People', *Journal of Periodontology*, pp. 558–565. doi: 10.1902/jop.2010.100444.

[13]. Goodson, J. M., Shi, P. and Razzaque, M. S. (2019) 'Dietary phosphorus enhances inflammatory response: A study of human gingivitis', *The Journal of steroid biochemistry and molecular*

biology, 188, pp. 166–171.

[14]. Hujoel, P. (2009) 'Dietary Carbohydrates and Dental-Systemic Diseases', *Journal of Dental Research*, pp. 490–502. doi: 10.1177/0022034509337700.

[15]. Jenzsch, A. *et al.* (2008) 'Nutritional intervention in patients with periodontal disease: clinical, immunological and microbiological variables during 12 months', *British Journal of Nutrition*, pp. 879–885. doi: 10.1017/s0007114508047776.

[16]. Johansson, G. and Birkhed, D. (1994) 'Effect of a long-term change from a mixed to a lactovegetarian diet on human saliva', *Archives of Oral Biology*, pp. 283–288. doi: 10.1016/0003-9969(94)90118-x.

[17]. Johansson, G. and Ravald, N. (1995) 'Comparison of some salivary variables between vegetarians and omnivores', *European Journal of Oral Sciences*, pp. 95–98. doi: 10.1111/j.1600-0722.1995.tb00123.x.

[18]. Kavarthapu, A. and Thamaraiselvan, M. (2018) 'Assessing the variation in course and position of inferior alveolar nerve among south Indian population: A cone beam computed tomographic study', *Indian journal of dental research: official publication of Indian Society for Dental Research*, 29(4), pp. 405–409.

[19]. Ke, Y. *et al.* (2019) 'Photosynthesized gold nanoparticles from Catharanthus roseus induces caspase-mediated apoptosis in cervical cancer cells (HeLa)', *Artificial cells, nanomedicine, and biotechnology* , 47(1), pp. 1938–1946.

[20]. Khalid, W. *et al.* (2016) 'Role of endothelin-1 in periodontal diseases: A structured review', *Indian journal of dental research: official publication of Indian Society for Dental Research*, 27(3), pp. 323–333.

[21]. Khalid, W. (2017) 'Comparison of Serum Levels of Endothelin-1 in Chronic Periodontitis Patients Before and After Treatment', *JOURNAL OF CLINICAL AND DIAGNOSTIC RESEARCH*. doi: 10.7860/jcdr/2017/24518.9698.

[22]. Krishnan, R. P. *et al.* (2018) 'Surgical Specimen Handover from Operation Theater to Laboratory: A Survey', *Annals of maxillofacial surgery*, 8(2), pp. 234–238.

[23]. Kuzmanova, D. *et al.* (2012) 'Vitamin C in plasma and leucocytes in relation to periodontitis', *Journal of Clinical Periodontology*, pp. 905–912. doi: 10.1111/j.1600-051x.2012.01927.x.

[24]. Laffranchi, L. *et al.* (2010) 'Oral implications of the vegan diet: observational study', *Minerva stomatologica*, 59(11-12), pp. 583–591.

[25]. Linkosalo, E. *et al.* (1985) 'Caries, periodontal status and some salivary factors in lactovegetarians', *European Journal of Oral Sciences*, pp. 304–308. doi: 10.1111/j.1600-0722.1985.tb01973.x.

[26]. Linkosalo, E. (1988) 'Dietary habits and dental health in Finnish Seventh-Day Adventists',

Proceedings of the Finnish Dental Society. Suomen Hammaslaakariseuran toimituksia, 84(2), pp. 109–115.

[27]. Linkosalo, E. and Markkanen, H. (1985) 'Dental erosions in relation to lactovegetarian diet', *European Journal of Oral Sciences*, pp. 436–441. doi: 10.1111/j.1600-0722.1985.tb01336.x.

[28]. Linkosalo, E., Markkanen, H. and Syrjänen, S. (1985) 'Effects of a Lacto-ovo-vegetarian Diet on the Free Amino Acid Composition of Wax-Stimulated Whole Human Saliva', *The Journal of Nutrition*, pp. 588–592. doi: 10.1093/jn/115.5.588.

[29]. Li, Y. *et al.* (2010) 'Prevalence and severity of gingivitis in American adults', *American journal of dentistry*, 23(1), pp. 9–13.

[30]. Männle, T. (2018) 'Mit Vollwert-Ernährung die Lebensqualität steigern', *Zeitschrift für Komplementärmedizin*, 10(02), pp. 16–20.

[31]. Marimuthu, M. *et al.* (2018) 'Canonical Wnt pathway gene expression and their clinical correlation in oral squamous cell carcinoma', *Indian journal of dental research: official publication of Indian Society for Dental Research*, 29(3), pp. 291–297.

[32]. Mathew, M. G. *et al.* (2020) 'Evaluation of adhesion of Streptococcus mutans, plaque accumulation on zirconia and stainless steel crowns, and surrounding gingival inflammation in primary molars: Randomized controlled trial', *Clinical oral investigations*, pp. 1–6.

[33]. Mehta, M. *et al.* (2019) 'Oligonucleotide therapy: An emerging focus area for drug delivery in chronic inflammatory respiratory diseases', *Chemico-biological interactions*, 308, pp. 206–215.

[34]. Mootha, A. *et al.* (2016) 'The Effect of Periodontitis on Expression of Interleukin-21: A Systematic Review', *International Journal of Inflammation*, pp. 1–8. doi: 10.1155/2016/3507503.

[35]. Muniz, F. W. M. G. *et al.* (2015) 'The impact of antioxidant agents complimentary to periodontal therapy on oxidative stress and periodontal outcomes: A systematic review', *Archives of Oral Biology*, pp. 1203–1214. doi: 10.1016/j.archoralbio.2015.05.007.

[36]. Nair, M. *et al.* (2018) 'Comparative evaluation of post-operative pain after pulpectomy with k-files, kedo-s files and mtwo files in deciduous molars -a randomized clinical trial', *Brazilian dental science*, 21(4), p. 411.

[37]. Nazir, S., Arain, A. H. and Mohsin, A. (no date) 'Prevalence of Gingival and Periodontal Diseases Among a Teaching Hospital Patients Prevalence of Gingival and Periodontal Diseases Among a Teaching Hospital Patients', *archive.jpda.com.pk*. Available at: http://archive.jpda.com.pk/volume-19-issue-4/prevalence-of-gingival-and-periodontal-diseases-among-a-teaching-hospital-patients/.

[38]. Nishida, M. *et al.* (2000) 'Dietary Vitamin C and the Risk for Periodontal Disease', *Journal of Periodontology*, pp. 1215–1223. doi: 10.1902/jop.2000.71.8.1215.

[39]. Ostberg, A. L., Halling, A. and Lindblad, U. (1999) 'Gender differences in knowledge, attitude, behavior and perceived oral health among adolescents', *Acta odontologica Scandinavica*, 57(4), pp. 231–236.

[40]. Padavala, S. and Sukumaran, G. (2018) 'Molar Incisor Hypomineralization and Its Prevalence', *Contemporary clinical dentistry*, 9(Suppl 2), pp. S246–S250.

[41]. Palati, S. *et al.* (2020) 'Knowledge, Attitude and practice survey on the perspective of oral lesions and dental health in geriatric patients residing in old age homes', *Indian journal of dental research: official publication of Indian Society for Dental Research*, 31(1), pp. 22–25.

[42]. Panchal, V., Jeevanandan, G. and Subramanian, E. (2019) 'Comparison of instrumentation time and obturation quality between hand K-file, H-files, and rotary Kedo-S in root canal treatment of primary teeth: A randomized controlled trial', *Journal of the Indian Society of Pedodontics and Preventive Dentistry*, 37(1), pp. 75–79.

[43]. Panda, S. *et al.* (2014) 'Platelet rich fibrin and xenograft in treatment of intrabony defect', *Contemporary clinical dentistry*, 5(4), pp. 550–554.

[44]. Pandian, K. S., Krishnan, S. and Kumar, S. A. (2018) 'Angular photogrammetric analysis of the soft-tissue facial profile of Indian adults', *Indian journal of dental research: official publication of Indian Society for Dental Research*, 29(2), pp. 137–143.

[45]. Paramasivam, A., Vijayashree Priyadharsini, J. and Raghunandhakumar, S. (2020) 'N6-adenosine methylation (m6A): a promising new molecular target in hypertension and cardiovascular diseases', *Hypertension research: official journal of the Japanese Society of Hypertension*, 43(2), pp. 153–154.

[46]. Pc, J., Marimuthu, T. and Devadoss, P. (2018) 'Prevalence and measurement of anterior loop of the mandibular canal using CBCT: A cross sectional study', *Clinical implant dentistry and related research*. Available at: https://europepmc.org/article/med/29624863.

[47]. Ponnulakshmi, R. *et al.* (2019) 'In silico and in vivo analysis to identify the antidiabetic activity of beta sitosterol in adipose tissue of high fat diet and sucrose induced type-2 diabetic experimental rats', *Toxicology mechanisms and methods*, 29(4), pp. 276–290.

[48]. Priyanka, S. *et al.* (2017) 'Detection of cytomegalovirus, Epstein-Barr virus, and Torque Teno virus in subgingival and atheromatous plaques of cardiac patients with chronic periodontitis', *Journal of Indian Society of Periodontology*, 21(6), pp. 456–460.

[49]. Rahmatulla, M. and Ernest Guile, E. (1990) 'Relationship between dental caries and vegetarian and non-vegetarian diets', *Community Dentistry and Oral Epidemiology*, pp. 277–278. doi: 10.1111/j.1600-0528.1990.tb00077.x.

[50]. Rajeshkumar, S. *et al.* (2018) 'Biosynthesis of zinc oxide nanoparticles usingMangifera indica leaves and evaluation of their antioxidant and cytotoxic properties in lung cancer (A549) cells', *Enzyme and microbial technology*, 117, pp. 91–95.

[51]. Ramadurai, N. *et al.* (2019) 'Effectiveness of 2% Articaine as an anesthetic agent in children: randomized controlled trial', *Clinical oral investigations*, 23(9), pp. 3543–3550.

[52]. Ramamurthy, J. (2018) 'COMPARISON OF EFFECT OF HIORA MOUTHWASH VERSUS CHLORHEXIDINE MOUTHWASH IN GINGIVITIS PATIENTS: A CLINICAL TRIAL', *Asian J Pharm Clin Res*, 11(7), pp. 84–88.

[53]. Ramesh, A. *et al.* (2016) 'Chronic obstructive pulmonary disease and periodontitis – unwinding their linking mechanisms', *Journal of Oral Biosciences*, pp. 23–26. doi: 10.1016/j.job.2015.09.001.

[54]. Ramesh, A. *et al.* (2018) 'Comparative estimation of sulfiredoxin levels between chronic periodontitis and healthy patients - A case-control study', *Journal of periodontology*, 89(10), pp. 1241–1248.

[55]. Ramesh, A. *et al.* (2019a) 'Esthetic lip repositioning: A cosmetic approach for correction of gummy smile – A case series', *Journal of Indian Society of Periodontology*, p. 290. doi: 10.4103/jisp.jisp_548_18.

[56]. Ramesh, A. *et al.* (2019b) 'Esthetic lip repositioning: A cosmetic approach for correction of gummy smile - A case series', *Journal of Indian Society of Periodontology*, 23(3), pp. 290–294.

[57]. Ramesh, A., Ravi, S. and Kaarthikeyan, G. (2017) 'Comprehensive rehabilitation using dental implants in generalized aggressive periodontitis', *Journal of Indian Society of Periodontology*, 21(2), pp. 160–163.

[58]. Rao, T. D. and Kumar, M. P. S. (2018) 'Analgesic efficacy of paracetamol vs ketorolac after dental extractions', *Journal of advanced pharmaceutical technology & research*, 11(8), p. 3375.

[59]. Ravi, S. *et al.* (2017) 'Additive Effect of Plasma Rich in Growth Factors With Guided Tissue Regeneration in Treatment of Intrabony Defects in Patients With Chronic Periodontitis: A Split-Mouth Randomized Controlled Clinical Trial', *Journal of Periodontology*, pp. 839–845. doi: 10.1902/jop.2017.160824.

[60]. R, H. *et al.* (2020) 'CYP2 C9 polymorphism among patients with oral squamous cell carcinoma and its role in altering the metabolism of benzo[a]pyrene', *Oral Surgery, Oral Medicine, Oral Pathology and Oral Radiology*, pp. 306–312. doi: 10.1016/j.oooo.2020.06.021.

[61]. Sakki, T. K., Knuuttila, M. L. E. and Anttila, S. S. (1998) 'Lifestyle, gender and occupational status as determinants of dental health behavior', *Journal of Clinical Periodontology*, pp. 566–570. doi: 10.1111/j.1600-051x.1998.tb02489.x.

[62]. Samuel, S. R. (2021) 'Can 5-year-olds sensibly self-report the impact of developmental enamel defects on their quality of life?', *International journal of paediatric dentistry / the British Paedodontic Society [and] the International Association of Dentistry for Children*, 31(2), pp. 285–286.

[63]. Sedgley, C. M. *et al.* (1996) 'The oral prevalence of aerobic and facultatively anaerobic gram-

negative rods and yeasts in semi-recluse human vegetarians', *Archives of Oral Biology*, pp. 307–309. doi: 10.1016/0003-9969(95)00125-5.

[64]. Sidi, A. D. and Ashley, F. P. (1984) 'Influence of frequent sugar intakes on experimental gingivitis', *Journal of periodontology*, 55(7), pp. 419–423.

[65]. Sridharan, G. *et al.* (2019) 'Evaluation of salivary metabolomics in oral leukoplakia and oral squamous cell carcinoma', *Journal of oral pathology & medicine: official publication of the International Association of Oral Pathologists and the American Academy of Oral Pathology*, 48(4), pp. 299–306.

[66]. Subramanyam, D. *et al.* (2018) 'Comparative evaluation of salivary malondialdehyde levels as a marker of lipid peroxidation in early childhood caries', *European journal of dentistry*, 12(1), pp. 67–70.

[67]. Sweta, V. R., Abhinav, R. P. and Ramesh, A. (2019) 'Role of virtual reality in pain perception of patients following the administration of local anesthesia', *Annals of maxillofacial surgery*, 9(1), pp. 110–113.

[68]. Tonstad, S. *et al.* (2009) 'Type of Vegetarian Diet, Body Weight, and Prevalence of Type 2 Diabetes', *Diabetes Care*, pp. 791–796. doi: 10.2337/dc08-1886.

[69]. Varghese, S. S. *et al.* (2015) 'Estimation of salivary tumor necrosis factor-alpha in chronic and aggressive periodontitis patients', *Contemporary clinical dentistry*, 6(Suppl 1), pp. S152–6.

[70]. Velden, U. V. der *et al.* (2011) 'Micronutritional approaches to periodontal therapy', *Journal of Clinical Periodontology*, pp. 142–158. doi: 10.1111/j.1600-051x.2010.01663.x.

[71]. Vijayashree Priyadharsini, J. (2019) 'In silico validation of the non-antibiotic drugs acetaminophen and ibuprofen as antibacterial agents against red complex pathogens', *Journal of periodontology*, 90(12), pp. 1441–1448.

[72]. Vijayashree Priyadharsini, J., Smiline Girija, A. S. and Paramasivam, A. (2018) 'In silico analysis of virulence genes in an emerging dental pathogen A. baumannii and related species', *Archives of oral biology*, 94, pp. 93–98.

[73]. Woelber, J. P. *et al.* (2019) 'The influence of an anti- inflammatory diet on gingivitis. A randomized controlled trial', *Journal of Clinical Periodontology*, pp. 481–490. doi: 10.1111/jcpe.13094.

[74]. Wu, F. *et al.* (2019) 'Biologically synthesized green gold nanoparticles from induce growth-inhibitory effect on melanoma cells (B16)', *Artificial cells, nanomedicine, and biotechnology* , 47(1), pp. 3297–3305.

[75]. Zhang, J. *et al.* (2010) 'Severity and prevalence of plaque-induced gingivitis in the Chinese population', *The Compendium of continuing education in dentistry*, 31(8), pp. 624–629.

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GRAPHS AND TABLES

Figure 1 : Age distribution of patients included in this study.

Figure 2 : Gender distribution.

Figure 3 : Diet pattern among patients.

Figure 4 : Association between diet pattern and gingivitis.

Figure 5 : Association between plaque index and gingival index scores.

Table 1 : The severity of gingivitis among patients with various diet patterns and plaque index scores.

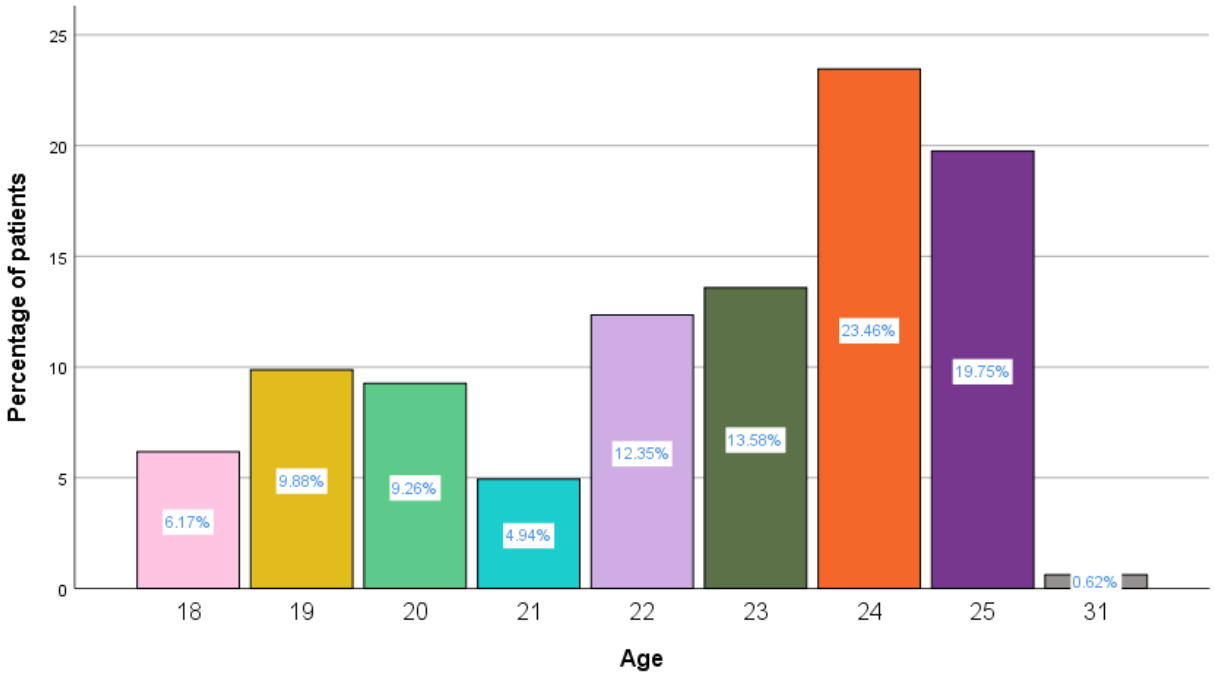

Figure 1 : Bar graph representing the age distribution of patients included in this study. X axis represents the age and Y axis represents the percentage of patients included in this study. The age group of patients included in the study ranged between 18 and 25 years. Majority of the patients were 24(orange)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

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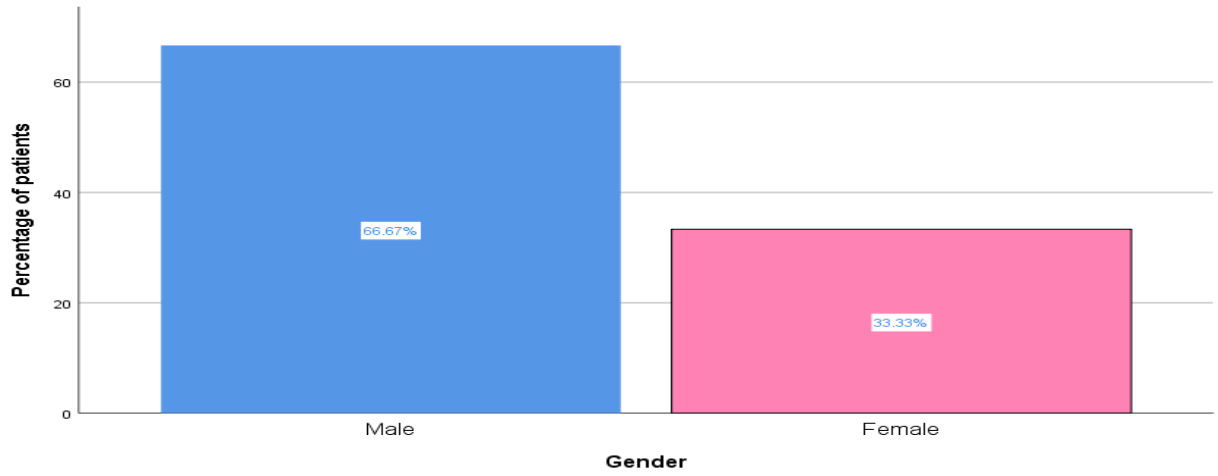

Figure 2 : Bar graph representing the gender distribution. X axis represents the gender and Y axis represents the percentage of patients included in this study. Majority of the patients who had gingivitis were males (blue) compared to females (pink).

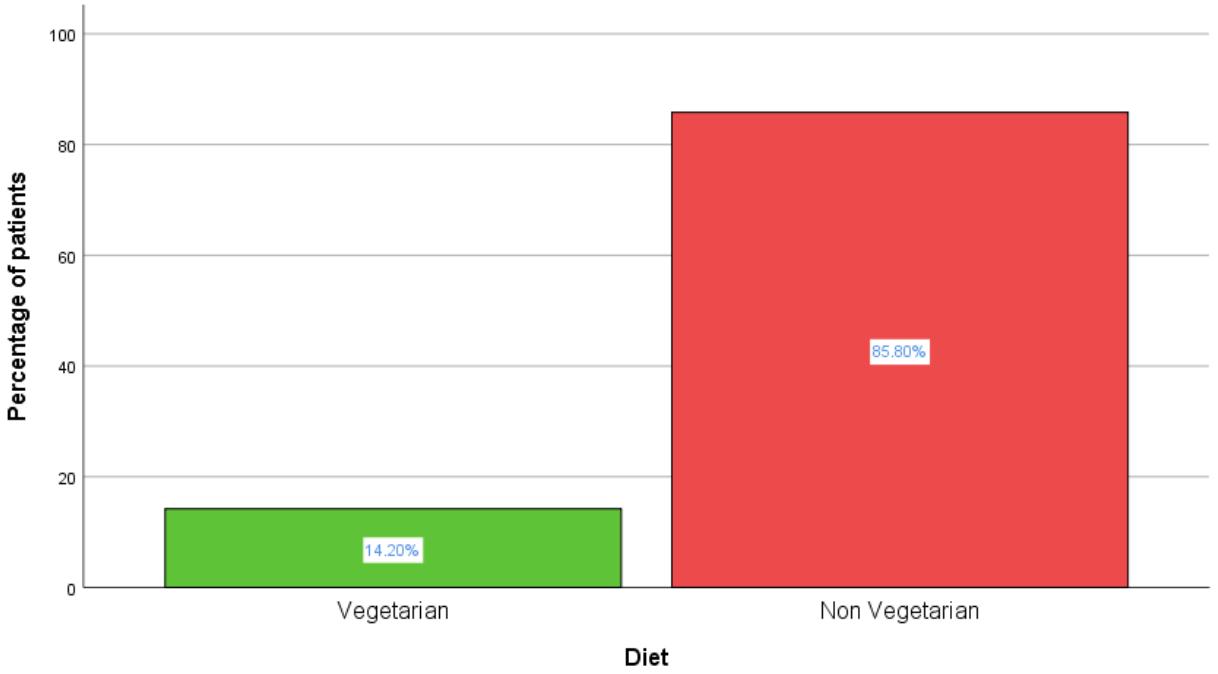

Figure 3 : Bar graph representing the diet pattern among patients. X axis represents the diet pattern and Y axis represents the patients included in this study. Majority of the patients in this study who had gingivitis were non-vegetarian (red) compared to vegetarians (green).

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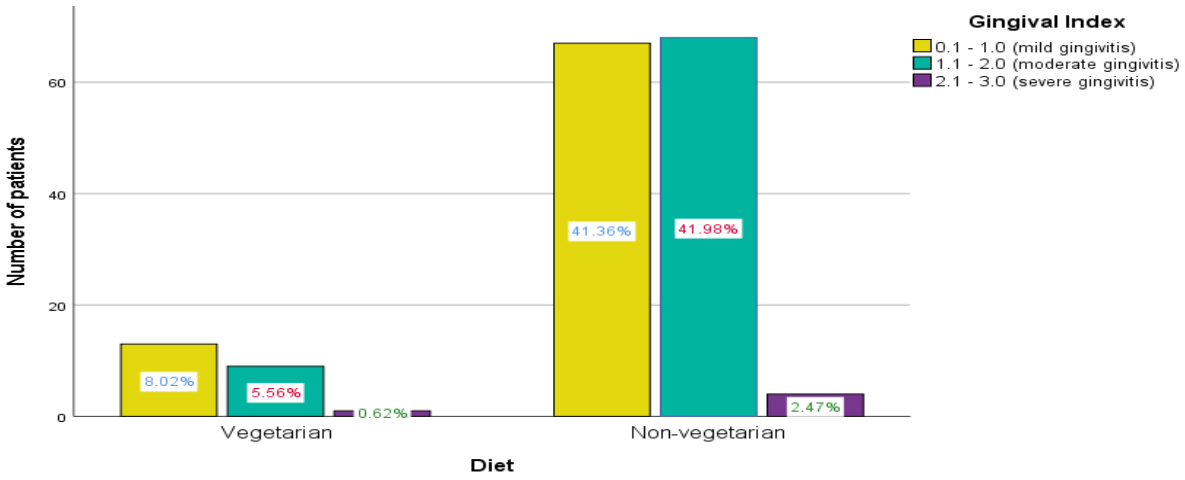

Figure 4 : Bar graph representing the association between diet pattern and gingivitis. X axis represents the diet pattern and Y axis represents the number of patients included in this study. The prevalence and severity of gingivitis was higher in those who consumed a non-vegetarian diet. Chi square test 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).

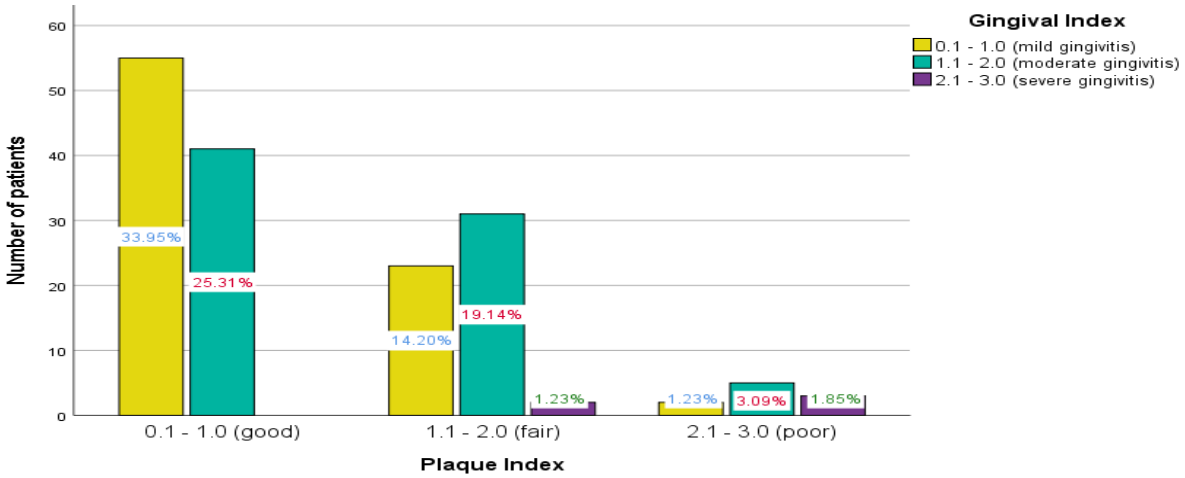

Figure 5 : Bar graph representing the association between plaque index and gingival index scores. X axis represents the plaque index scores and Y axis represents the number of patients included in this study. The severity of gingivitis was higher in patients with fair and poor plaque index. Chi square 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).

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