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Original Article

Effects of raw vegan diet on periodontal and dental parameters

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Abstract

Objectives: Macronutrients and micronutrients present in different types of diet could influence different aspects of both inflammatory and immune responses; thereby, diets could influence oral health and the periodontal condition. The raw vegan diet is a subset of vegetarianism in which only uncooked plant-derived foods are consumed. The present study's aim was to evaluate the effect of the raw vegan diet on periodontal and dental health parameters. **Materials and Methods:** A total of 118 participants (59 raw vegans and 59 controls) were interviewed about their level of education and oral health habits. Samples of unstimulated whole saliva were collected for pH analysis, and dental and periodontal parameters were examined. Then, statistical analysis was performed. **Results:** Raw vegans had better oral hygiene (P = 0.001). The decayed-missing-filling indices were relatively equal in both groups. The probing depth, bleeding on probing (BOP), and simplified oral hygiene index were significantly lower in raw vegans (P = 0.047, P = 0.017, and P = 0.001, respectively). Multiple regression analyses disclosed that probing depth and BOP were significantly related to debris index. **Conclusion:** Based on this study's results, it can be presumed that the better periodontal condition in raw vegans is a result of their better oral care and lifestyle.

Keywords: *Dental caries, Diet, Oral hygiene, Periodontitis, Vegetarian*

Introduction

Vegetarianism refers to a kind of diet in which animal-based foods in particular meat and poultry are mainly eliminated from the diet. Based on the type of products consumed, it is divided into veganism (merely plant-based foodstuffs are used), lacto vegetarianism (plant foods and dairy supplies consumption), lacto-ovo vegetarianism (plant foods, dairy supplies, and egg consumption), and pesco-vegetarianism (plant foods, dairy supplies, egg, and fish consumption) [1,2]. A subdivision of veganism called "raw veganism" is a diet, which consists of plant-derived foods – without any animal products – that are not exposed to heat higher than approximately 118°F [3,4]. It has been claimed that if not heated above the mentioned temperature, food's nutritional content does not alter and its enzymes remain active, which in turn can lead to better digestion. Moreover, high-temperature preparation of plant-based foods results in the production of reactive oxygen species, which can harm the cell structure [5].

The effects of diet on periodontal health and periodontitis are accepted. The periodontal breakdown might be affected by dietary nutrients through their modifying effect on the constituents and formation of supragingival plaque biofilm and through their effect on the secretion of specific pro-inflammatory cytokines and on the volume and the composition of saliva [6,7]. Moreover, the literature suggests that a healthy diet leads to lower risks of many diseases such as obesity, cardiovascular disease, type 2 diabetes, and gestational diabetes, most of which have been proven to be associated with certain periodontal conditions [6,8-10]. The majority of studies conducted on vegetarianism and its divisions have been on the body's general health [2,10]. Studies evaluating the association of vegetarianism and oral condition are scarce and their focus has been the assessment of tooth condition and salivary factors A limited number of these studies have assessed the correlation between vegetarianism and the periodontal condition [11]. Therefore, the aim of this study was to assess the effect of the raw vegan diet on periodontal parameters, decayed-missing-filling (DMF), and salivary pH.

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Materials and Methods

Patients

This study was conducted in Shahid Beheshti Dental Clinic, Tehran, Iran. This study was conducted according to the guidelines laid down in the Declaration of Helsinki [12] and all procedures involving human subjects/patients were approved by the Research Ethics Committee of Shahid Beheshti University of Medical Sciences (code: IR. SBMU. RIDS. REC.1395.280). Written informed consent (signed forms) was obtained from all subjects/patients after proper explanation of the aim and detailed procedure of the investigation to participants. It was designed as a cross-sectional study in which the raw vegans were compared with a group of omnivorous people. Members of the raw vegan group were assigned based on each person's self-report. Those who had embraced a raw vegan regimen and declared that about 80% (or more) of their diet, by weight, is raw, and plant-based foods (without dairy, eggs or meat) were considered as raw vegan adherents [3]. They were informed of and requested to join the experiment by the means of advertisements on the internet and by handing out leaflets in the vegan associations stationed in Tehran, Iran. Of 429 applications received in response to the advertisements, 103 raw vegetarians met the mentioned criteria; and ultimately, 59 individuals participated in the study. Fifty-nine omnivores with sexes and ages matching the raw vegans were randomly chosen from the companions of the case group or companions of other patients of a dental clinic. The following criteria were considered to include a participant in this study:

- Minimum age of 18 years
- Having at least 10 teeth in the mouth (other than third molars)
- No systemic diseases which affect the periodontal condition
- Following the raw vegan diet for at least 18 months (for the case group)

The criteria for exclusion from the study were:

- Pregnant or lactating women
- Smoking.

Measurements

Before the oral examination, participants filled a questionnaire. Then, they received detailed instructions for a proper saliva sampling procedure. After obtaining the saliva sample, dental and periodontal examinations were performed by a periodontist.

A questionnaire was designed to gather information from participants about their sex, age, history of systemic disease, history of smoking, level of education, and their oral hygiene habits (frequency of brushing teeth and application of dental floss). The case group was asked to answer two further questions about their reason for adopting a raw vegan diet and the duration of their adherence to such a diet.

Participants were asked not to eat, drink (water was allowed), chew gum, smoke, and brush their teeth for at least 1 h before the procedure. Saliva was obtained from individuals between 9 a. m. and 12 a. m. to avoid any possible circadian variation. Unstimulated whole saliva was collected by the spitting method [13]. All participants refrained from swallowing or talking during saliva collection. Immediately, after 2–3 mL of saliva was accumulated in a 15 mL sterile falcon, the pH was measured with a digital pH meter (H198103 Checker® pH Tester, HANNA instruments, USA).

The dental caries status of all patients was evaluated under artificial light, applying a dental explorer and a mouth mirror. The decayed, missed, and filled teeth (DT, MT, FT, respectively) were each separately recorded and were used to determine the DMF tooths (DMF-T) and DMF surfaces (DMF-S) indices. The following items representing the periodontal condition were assessed using Williams periodontal probes: Probing pocket depth (PPD) at four sites (buccal, mesial, lingual/palatal, and distal) per tooth, clinical attachment loss (CAL), bleeding on probing (BOP), gingival recession (GR), gingival biotype as thin or thick [14], furcation involvement (based on Glickman's grading system) [15], tooth mobility (according to Miller's method) [16], and simplified oral hygiene index (OHI-S) [17] estimated by the summation of debris and calculus indices.

Statistical analyses

All data were analyzed using the SPSS 11.0 software (ver. 24.0.0.0 (IBM Corp., Armonk, NY, USA)). The appropriate sample size for each group was determined using the appropriate statistical formula for comparing two means with a type-one error of 0.05 and a type-two error of 0.2 (expected power of 80%). According to a pilot study, means and standard deviations of PPD-dependent variable in the groups were 1.9, 2.1, 0.3, and 0.4, respectively. These assumptions resulted in 59 samples in each group and a total sample size of 118. The Chi-square test, the independent samples *t*-test, and Mann–Whitney test were used. To identify associations between different items (predictors) and PD and BOP values that demonstrate the periodontal status, a multiple linear regression model (with a stepwise method) was used in which PD and BOP were considered as dependent variables and gender, age, education, oral hygiene habits, raw vegan or omnivorous diet, and debris and calculus indices were chosen to be independent variables. The level of significance was set at $P < 0.05$ for all hypotheses.

Results

A total of 118 individuals, 59 raw vegans (25 men and 34 women, aged between 18 and 77 years, mean 43.97 ± 14.35), and 59 omnivores (25 men and 34 women, aged between 20 and 77 years, mean 43.90 ± 14.01) participated in this investigation. They were all healthy, nonsmoker, and took no special drugs. The total duration of being on a raw vegan diet for the test group was 48.90 ± 66.11 months on average, which ranged from 18 to 480 months (40 years). The findings from the questionnaires implied that raw vegans had acquired significantly higher levels of education ($P = 0.008$). Regarding oral hygiene habits, more people among the raw vegans applied dental floss ($P = 0.001$); however, two groups did not show any remarkable differences in frequency of tooth brushing ($P = 0.271$).

A comparison between the average amounts of salivary pH using independent sample *t*-test indicated that the pH of

unstimulated whole saliva gathered from the raw vegans was significantly lower than that of the omnivorous group (6.52 ± 0.31 vs. 6.78 ± 0.27 respectively, $P < 0.001$).

There was no significant difference in the mean and standard deviation of DMF-T and DMF-S values between the two groups ($P = 0.412$ and $P = 0.07$, respectively). Nonetheless, analysis of each component of the DMF-T index (DT, MT, FT), manifested that the number of missing teeth was higher in the omnivorous group ($P = 0.024$), while a statistically significant greater number of filled teeth was observed in raw vegans ($P = 0.012$) [Table 1]. Regarding the periodontal status, significantly lower amounts of PPD ($P = 0.047$) and BOP ($P = 0.017$) were measured in raw vegans; however, the difference between the two groups in their average quantities of CAL and GR was negligible [Table 2]. Furcation defects and tooth mobility, which were evaluated as the number of involved teeth and the highest degree of involvement in each person, were almost similar in two groups [Table 3]. In addition, a relatively equal distribution of the thin and thick gingival biotypes was discerned in both groups ($P = 0.273$). OHI-S index, on the other hand, was significantly lower in the case group ($P = 0.001$) which had been caused by the lower values of Debris ($P = 0.046$) and Calculus ($P < 0.001$) indices in raw vegans [Figure 1].

Based on the performed multiple regression analyses with a stepwise method, it is discerned that among the independent variables (gender, age, education, oral hygiene habits, raw vegan or omnivorous diet, debris, and calculus indices), only the debris index could significantly predict the amount BOP (%) in a way that that can be considered positively correlated ($P < 0.001$). In addition, it was noted that PD scales were best predicted by age and debris index ($P = 0.042$ and $P = 0.002$, respectively).

Table 1: Comparison of mean values, standard deviations, and *P* values of dental parameters in raw vegan and control groups using independent samples *t*-test

Dental parameters	Mean±SD		*P*
	Raw vegans	Controls	
DMF-S	30.71±20.07	30.8±27.43	0.070
DMF-T	10.69±4.31	11.44±5.45	0.412
DT	1.49±2.32	2.44±3.53	0.087
MT	2.34±2.76	3.85±4.23	0.024
FT	6.83±3.72	5.17±3.33	0.012

SD: Standard deviation, DMF-S: Decayed, missing, filled teeth surfaces, DMF-T: Decayed, missing, filled teeth, DT: Decayed teeth, MT: Missing teeth, FT: Filled teeth

Table 2: Comparison of mean values, standard deviations, and *P* values of periodontal parameters in raw vegan and control groups using independent samples *t*-test

Periodontal parameters	Mean±SD		*P*
	Raw vegans	Controls	
PPD (mm)	1.86±0.34	2.01±0.46	0.047
CAL (mm)	0.64±0.79	0.64±0.88	0.983
BOP (%)	38.77±34.93	54.59±36.15	0.017
GR (mm)	0.33±0.56	0.31±0.55	0.851

SD: Standard deviation, PPD: Periodontal pocket depth, CAL: Clinical attachment loss, BOP: Bleeding on probing, GR: Gingival recession

Discussion

In the past few years, dietary habits have changed, especially in the developed countries. The incident of industrialization and the mass production of foodstuffs have generated miscellaneous foods, which has led to conflicting ideas in people who care about their nutrition, honor the environment and disagree with dismissal of ethical principles in the science and technology of food [18]. Raw veganism is a subset of the vegetarian diet. To the best of our knowledge, this is the first study to evaluate the effects of raw vegan diet on periodontal and dental conditions of the vegans Assessment of the questionnaire of this study showed that the raw vegans cared more about their oral hygiene. In addition, all of them declared that they were motivated to choose this eating pattern due to its health improvement potential, which may justify the better oral and tooth hygiene observed in this group.

In this study, the evaluation of salivary pH indicated more acidity among the vegans. Linkosalo *et al*. [19] and Laffranchi *et al.* [18] reported lower flow and pH level of the saliva in vegetarians, which corresponds to our results. However, Johansson and Ravald [20] observed that the pH level of the saliva was higher among vegetarians than that the control group, although the difference was not statistically significant. They also noticed a remarkable increase in the salivary flow rate in the vegetarian group and considered this the reason for the more alkaline saliva in them. Johansson and Ravald concluded that the increased saliva secretion in vegetarians had been due to the extra mechanical activity required for the mastication of hard foods and its effects on the salivary glands [20]. Since vegetarians, especially raw vegans, feed on plenty of fruits, and the acidity of fruits is mentioned in some studies [21], it can be deduced that the acidic environment caused by the consumption of such food has resulted in the lower pH of the saliva among the vegans participating in this investigation.

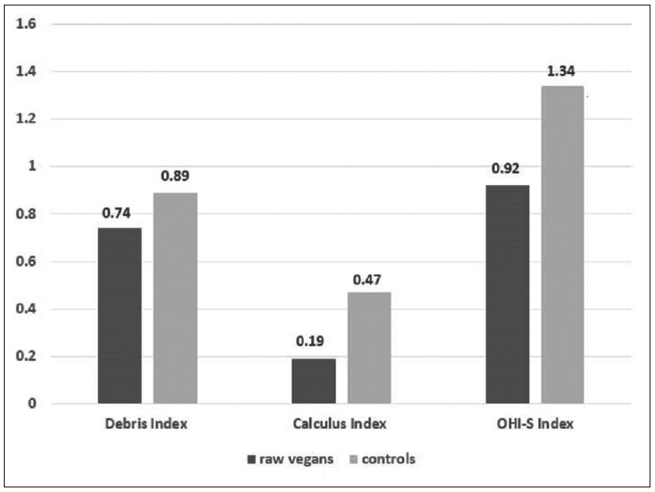

Figure 1: Comparison of simplified oral hygiene index in raw vegan and control groups using independent samples *t*-test; Debris Index ($P = 0.046$), Calculus Index ($P = <0.001$), simplified oral hygiene index ($P = 0.001$)

Table 3: The average, standard deviation, and *P* value of total number of teeth afflicted by furcation involvement and mobility in raw vegan and control groups, and number of teeth for each grade of mobility and furcation defect separately

Clinical parameters	Raw vegans		Controls		*P*
	Average	SD	Average	SD	
Furcation involvement					
Teeth with furcation defect (*n*)[T]	0.77	1.46	0.49	0.97	0.210
Teeth with different grades of furcation defects (*n*)[M]					
I	40		45		0. 277
II	12		10		
III	5		3		
IV	2		1		
Tooth Mobility					
Teeth with mobility (*n*)[T]	0.15	0.66	0.35	1.87	0.440
Teeth with different grades of mobility (*n*)[M]					
0	55		54		0.752
1	2		4		
2	1		0		
3	1		1		

[T]Independent samples *t*-test, [M]Mann-Whitney test. SD: Standard deviation

The significant reduction of the calculus index and the debris index observed in the raw vegetarian group in this study may be a result of their better oral hygiene. Staufenbiel *et al*. [11] observed that the vegetarian group remarkably had better oral hygiene, which resulted in plaque reduction. In a study by Linkosalo *et al*. [19], the two groups of vegetarians and omnivores were similar in their oral hygiene condition, and no significant difference was observed between their calculus and plaque formation. The role of nutrition in calculus formation has been less investigated, and most of the studies have assessed the effects of calcium and phosphorus concentrations and pH of the saliva on calculus formation. However, a study by Stanton [22] demonstrated that people with a lower calculus formation rate had remarkably higher consumption of foods containing ascorbic acid (Vitamin C); on the other hand, heavy calculus formers consumed higher amounts calcium and Vitamin A. Accordingly, he introduced Vitamin C as calculus inhibitory and both calcium and Vitamin A as calculus formation activators [22]. In the raw vegans participating in this study, the rate of BOP and PD was considerably lower than that of the control group. These results are consistent with the findings of Staufenbiel *et al*. [11]; they observed lower inflammatory symptoms in vegetarians' gums. On the other hand, Linkosalo *et al*. [19] did not observe any considerable difference between the inflammation rate and PD among the vegetarians and omnivores. A number of factors can affect BOP and PD rates, including nutrition, exercise, obesity, calculus and plaque amounts, and the level of oral hygiene. Multivariate regression analysis in this study demonstrated that among several possible predisposing factors (age, sex, raw veganism, level of oral hygiene, and amounts of calculus and plaque), an important predisposing factor resulting in the reduction of BOP and PD was the amount of debris. Therefore, a lower amount of calculus and plaque and higher levels of hygiene could be the possible predisposing factors for the reduction of BOP and PD in raw vegans in this study. Moreover, raw vegans utilize more antioxidants due to their particular nutritional status, which may be a probable reason for the improvement of their immune responses and in turn the reduction of inflammatory symptoms [5].

Evaluation of DMF-T and DMF-S in this study did not implicate any significant difference between the two groups. A more detailed assessment of the data demonstrated that a lower number tooth loss and more filled teeth were observed in raw vegans. Whereas Laffranchi *et al*. [18] reported a significant increase in DMF-T in vegetarians. Staufenbiel *et al*. [11] did not observe any significant difference between the vegetarians and the control group in their study but they did observe more decayed teeth in the vegetarians. They acknowledged that the higher rates of tooth decay in vegetarians were due to higher and continuous consumption of acidic foods, which leads to a more acidic environment in the oral cavity, and subsequently, more tooth demineralization [11]. In this study, better oral hygiene may be considered as a probable cause of decreased tooth loss in the participating vegetarians.

Conclusion

Vegetarianism including raw veganism is more than just a diet, and it could be considered a lifestyle that mainly focuses on body health. In this study, raw vegans followed their oral hygiene better. Their amount of calculus and plaque was lower, and the number of their remained teeth was higher, and finally, better periodontal condition and less inflammation were observed in the supporting tissue of their teeth.

Despite the fact that the raw vegan diet has become progressively noticed and tried, adherence to such a strict diet requires self-efficacy and social support [23]; which makes it difficult for most people to follow this eating pattern over a long period. This was the primary point limiting the number of subjects who were eligible to cooperate with this investigation. It is recommended that further evaluations, specifically cohort studies including more individuals with longer duration of raw veganism, be used to further assess the implications of this type of diet on oral condition. A study assessing complete

blood count and serum Vitamin B_{12}, folic acid, ions (calcium and phosphorus), vitamins, reactive oxygen species, iron, homocysteine levels of the vegans, and omnivorous individuals would be also valuable.

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Conflicts of interest

There are no conflicts of interest.

References

1. Herman K, Czajczyńska-Waszkiewicz A, Kowalczyk-Zając M, Dobrzyński M. Assessment of the influence of vegetarian diet on the occurrence of erosive and abrasive cavities in hard tooth tissues. Postepy Hig Med Dosw (Online) 2011;65:764-9.
2. Olfert MD, Wattick RA. Vegetarian diets and the risk of diabetes. Curr Diab Rep 2018;18:101.
3. Link LB, Hussaini NS, Jacobson JS. Change in quality of life and immune markers after a stay at a raw vegan institute: A pilot study. Complement Ther Med 2008;16:124-30.
4. Hobbs SH. Attitudes, practices, and beliefs of individuals consuming a raw foods diet. Explore (NY) 2005;1:272-7.
5. Brožková I, Dvořáková V, Michálková K, Červenka L, Velichová H. Quality and antioxidant activity of buckwheat-based cookies designed for a raw food vegan diet as affected by moderate drying temperature. Plant Foods Hum Nutr 2016;71:429-35.
6. Jenzsch A, Eick S, Rassoul F, Purschwitz R, Jentsch H. Nutritional intervention in patients with periodontal disease: Clinical, immunological and microbiological variables during 12 months. Br J Nutr 2009;101:879-85.
7. Morzel M, Truntzer C, Neyraud E, Brignot H, Ducoroy P, Lucchi G, et al. Associations between food consumption patterns and saliva composition: Specificities of eating difficulties children. Physiol Behav 2017;173:116-23.
8. Dreher ML. Whole fruits and fruit fiber emerging health effects. Nutrients 2018;10. pii: E1833.
9. Zamani B, Milajerdi A, Tehrani H, Bellissimo N, Brett NR, Azadbakht L. Association of a plant-based dietary pattern in relation to gestational diabetes mellitus. Nutr Diet 2019;76:589-96.
10. Kahleova H, Levin S, Barnard ND. Vegetarian dietary patterns and cardiovascular disease. Prog Cardiovasc Dis 2018;61:54-61.
11. Staufenbiel I, Weinspach K, Förster G, Geurtsen W, Günay H. Periodontal conditions in vegetarians: A clinical study. Eur J Clin Nutr 2013;67:836-40.
12. General Assembly of the World Medical Association. World Medical Association Declaration of Helsinki: Ethical principles for medical research involving human subjects. J Am Coll Dent 2014;81:14-8.
13. SahebJamee M, Eslami M, AtarbashiMoghadam F, Sarafnejad A. Salivary concentration of TNFalpha, IL1 alpha, IL6, and IL8 in oral squamous cell carcinoma. Med Oral Patol Oral Cir Bucal 2008;13:E292-5.
14. Kan JY, Morimoto T, Rungcharassaeng K, Roe P, Smith DH. Gingival biotype assessment in the esthetic zone: Visual versus direct measurement. Int J Periodontics Restorative Dent 2010;30:237-43.
15. Pilloni A, Rojas MA. Furcation involvement classification: A comprehensive review and a new system proposal. Dent J (Basel) 2018;6:34.
16. Laster L, Laudenbach KW, Stoller NH. An evaluation of clinical tooth mobility measurements. J Periodontol 1975;46:603-7.
17. Greene JC, Vermillion JR. The simplified oral hygiene index. J Am Dent Assoc 1964;68:7-13.
18. Laffranchi L, Zotti F, Bonetti S, Dalessandri D, Fontana P. Oral implications of the vegan diet: Observational study. Minerva Stomatol 2010;59:583-91.
19. Linkosalo E, Ohtonen S, Markkanen H, Karinpää A, Kumpusalo E. Caries, periodontal status and some salivary factors in lactovegetarians. Scand J Dent Res 1985;93:304-8.
20. Johansson G, Ravald N. Comparison of some salivary variables between vegetarians and omnivores. Eur J Oral Sci 1995;103:95-8.
21. Moynihan P, Petersen PE. Diet, nutrition and the prevention of dental diseases. Public Health Nutr 2004;7:201-26.
22. Stanton G. The relation of diet to salivary calculus formation. J Periodontol 1969;40:167-72.
23. Link LB, Jacobson JS. Factors affecting adherence to a raw vegan diet. Complement Ther Clin Pract 2008;14:53-9.