OPEN ACCESS

GAVIN PUBLISHERS

Dentistry: Advanced Research

Research Article

Boutiou E, et al. Dent Adv Res 7: 160.

DOI: 10.29011/2574-7347.100060

Vegetarian and Vegan Diet: Is it as healthy as it seems? Dental Erosion among the Vegetarians and Vegans

Eirini Boutiou[1*], Aristidis Arhakis[1], Vuokko Anttonen[2,3]

[1]School of Dentistry, Aristotle University of Thessaloniki, Greece

[2]Research Unit of Oral Health Sciences, University of Oulu, Finland

[3]Medical Research Center Oulu, Oulu University Hospital and University of Oulu, Finland

[*]**Corresponding author:** Eirini Boutiou, School of Dentistry, Aristotle University of Thessaloniki, 54636, Thessaloniki, 10 Priamou Street, 54453, Thessaloniki, Greece. Tel: +306955649151; Email: mmeirini@dent.auth.gr

Citation: Boutiou E, Arhakis A, Anttonen V (2019) Vegetarian and Vegan Diet: Is it as Healthy as it Seems? Dental Erosion among the Vegetarians and Vegans. Dent Adv Res 7: 160. DOI: 10.29011/2574-7347.100060

Received Date: 08 August, 2019; **Accepted Date:** 23 August, 2019; **Published Date:** 30 August, 2019

Abstract

Background: Following vegetarian and even vegan diets has become more common recently in developed countries. It has been suggested that dental erosion is associated with vegetarian and vegan diets. The aim of this study is to investigate this possible association according to the literature relevant to the topic.

Methods: Databases PubMed, Scopus and Cochrane Library were used searching "tooth wear", "dental erosion", "vegetarian", "vegan diet". Only articles written in English were included in this study, whereas there was not a time limit on the publication year.

Results: In total five articles were included in analyses. In all the studies, with the exception of only one in which the participants were 14 years old, the participants' mean age range was 29.4 to 49.8 years. Erosion is noted in all of vegetarian groups. However, the difference between the test and control groups in most of the studies was not statistically significant. No studies were found comparing the relation between vegan diet and erosion.

Conclusions: A vague correlation between vegetarian diet and erosion seems to exist, even if it is not statistically significant. There is a need of more randomized studies, especially among the children and adolescents' population.

Keywords: Erosion; Erosive Tooth Wear; Tooth Wear; Vegetarian Diet; Vegan

Abbreviations

ETW: Erosive Tooth Wear; GERD: Gastro-Enterological Reflux Disease

Introduction

Dental erosion is defined as chemical tooth wear caused by extrinsic and/or intrinsic acids enhanced by mechanical wear (erosive tooth wear, ETW). The characteristic clinical features of the condition are loss of surface structure, melted or softened appearance, cupping or grooving of occlusal/ incisal surfaces and shallow concavities coronal from the cement-enamel junction [1]. The prevalence of erosive tooth wear varies from 0 to 100% in adults globally [2], while in children and adolescents the prevalence rates range from 7.2% to 74.0% [3]. The prevalence varies due to the differences in the criteria and severity of the condition reported [4].

A vegetarian is a person, whose diet mostly comprises plant-based alimentation, including fruits, vegetables, legumes, nuts, seeds and grains. The diets followed by vegetarians are divided into four groups as shown in Table 1. The first one is called lacto-ovo-vegetarian diet: those who include dairy products and eggs in their diet, but no meat, poultry or seafood. The second one is the lacto-vegetarian diet which is similar to the previous one, with the exception of eggs, which are excluded. The third one is the ovo-vegetarian diet, in which eggs are included, but no dairy products, meat, poultry or fish. Finally, the fourth diet is followed by a vegan, who does not eat any animal products. Many vegans also avoid honey [5].

Type of Vegetarian Diet	Products Included	Products Excluded
Lacto-ovo-vegetarian	fruits, vegetables, legumes, nuts, seeds, grains, dairy products, eggs	meat, poultry, seafood
Lacto-vegetarian	fruits, vegetables, legumes, nuts, seeds, grains, dairy products	meat, poultry seafood, eggs
Ovo-vegetarian	fruits, vegetables, legumes, nuts, seeds, grains, eggs	meat, poultry, fish, dairy products
Vegan	fruits, vegetables, legumes, nuts, seeds, grains	animal products, (honey)

Table 1: Categories of vegetarian diet.

As far as the etiology of erosion is concerned, causes can be either intrinsic or extrinsic. The most dominant intrinsic cause for erosion is the gastric fluids entering the oral cavity. Common causes for the gastric fluids entering the oral cavity are Gastro-Enterological Reflux Disease (GERD), eating disorder (anorexia, bulimia), chronic alcoholism and pregnancy [6]. The surfaces affected by them are most often the palatal ones.

On the other hand, the most common extrinsic factors associated with erosive tooth wear are soft drinks and acidic fruits [7]. As mentioned before, fruits constitute a major role in a vegetarian diet [5]. In addition; raw food is used among some vegetarians and vegans. Cooking food usually softens the ingredients, and therefore makes the food less abrasive and erosive. Chadwick [8] tested the erosive potential of the cooking method of ratatouille. He concluded that oven roasted foods possess higher erosive potential than stewed foods, which somehow indicates the erosive potential of raw foods. Another study also showed that consuming a raw food diet hides an increased risk of dental erosion [9]. Taking into consideration these two studies, vegetarians and vegans, whose diet mostly consists of raw food (for instance vegetables and fruits), are at the highest risk groups for erosion. Moreover, the consumption of acidic food will decrease the pH of saliva in concurrence with the lack of meat and dairy consumption that could balance this decrease and teeth might consequently be eroded [10]. The erosion pathogenesis suggests the loss of mineral few micrometers below the surface. Although erosion can be solely a chemical procedure, most often it leaves the softened tooth surface susceptible to mechanical forces, which can be occlusal forces or even the tooth brush. So, if erosion occurs more often to vegetarians/vegans due to the reduction of pH, it can also occur more often because of the combination of mechanical and chemical causes [11]. Thus, the aim of this review of literature is to investigate whether vegetarian and vegan diets could lead to erosive tooth wear.

Material and Methods

The literature research was executed by two independent investigators using the following keywords: tooth wear, Erosive Tooth Wear (ETW), dental erosion, vegetarian, vegan diet. Eligible studies were identified through a search of the PubMed bibliographical database, Scopus and the Cochrane Library. Original studies, published in English, reporting on demographics, diagnostic interventions, clinical manifestations, existence of erosion, vegetarian diet had been followed. However, only articles in English were included. All relevant articles were included irrespective of their year of publication. As the purpose of this study was to give a broader range of information on the topic, we included more relevant articles with no restriction to the outcomes in order to widen its perspective.

Excluded studies were: 1) papers published in a language other than English, 2) studies irrelevant to the topic, 3) in vitro studies, 4) animal studies, 5) letters to the editor, comments, errata, 6) abstracts. Any disagreements were resolved by consensus with another author. No sample size restriction was applied when screening for eligible studies. Data extraction was conducted by two reviewers. Study characteristics (first author, year of publication, country, and number of patients), age, sex, diagnostic interventions, vegetarian diet followed and presence of erosion comprised the data extracted for each eligible study.

Results

In total, five articles were discovered that fulfilled the criteria, and they are included in the present review. All the articles found were read thoroughly and the information gained is presented below (Table 2). The age range varied from 29.4 to 49.8 years. Erosion was noted at all of vegetarian groups. However, the difference between the test and control groups in most of the studies was not statistically significant. More specifically, Staufenbiel et al. [11] examined 100 vegetarians (89 lacto-ovo vegetarians and 11 vegans) and 100 non vegetarians (200 patients in total), 71 females and 29 males. Participants had to have had ten or more teeth in the oral cavity and as far as the vegetarian group was concerned, the vegetarian diet should had to have excluded meat, fish and poultry for more than 2 years. In addition, participants should not have presented any systemic disease, pregnancy or breastfeeding or record of drug abuse. Following a simple dental examination, they found that 25% of vegetarians' teeth presented dental erosion compared to 13% of the non-vegetarians' teeth, difference being statistically significant (0.98±2.70 vs 0.40±1.50; P = 0.026) [11].

Author	N	Mean Age	Period of vegetarian diet	Way erosion was diagnosed	Results (proportion of those with dental erosion)	p
Staufenbiel et al. (2015)	200 (100 vegetarians, 100 non-vegetarians)	41.45±14.14	more than 2 years	dental examination	25% of the vegetarians, 13% of the non-vegetarians	0.026
Herman et al. (2011)	92 (46 vegetarians, 46 control group)	30	1-18 years	clinical research included the inspection of teeth for erosion	39.1% of the vegetarians and 23.9% of the control group	NA
Al-Dlaigan et al. (2001)	418 (209 males, 209 females)	14	NA	the levels of tooth wear were recorded using a modification of the (TWI) index	Among vegetarians 52% had low and 48% moderate dental erosion, Among non-vegetarians 48% had low, 51% moderate and 1% severe dental erosion	NA
Linkosalo et al. (1985)	52 (26 lactovegetarians, 26 control group)	39.6±10.2	6.1±5.3, with minimum of 2 years	with impressions and photographs and graded 0,1,2,3 for no erosions, incipient, moderate, grave respectively	of the lactovegetarians 26.9% incipient erosion: 19.2% moderate, 30.8%severe no one from the control group presented erosion	p<0.001
Linkosalo et al.(1984)	28 lactovegetarias and 28 control group	38.8±10.7	at least 2 years	NA	76.9% of the lactovegetarians but none of the controls	p<0.001

Table 2: Demographics of the five studies included in the review of the dental erosion among vegetarian diet.

In another study, there were 102 people equally divided into the control and a test group. The age range was 17-51 years and there were 14 males and 32 females. All the vegetarians were lacto-vegetarians and 76.1% of them lacto-ovo vegetarians. The duration of their diet was 1-18 years. The erosion was reported with clinical examination including the inspection of teeth. The study showed that the percentage of the erosion in the vegetarian group was higher (39.1%) than in the non-vegetarian group (23.9%) but the difference was not statistically significant [12].

In only one of the studies discovered, which was conducted on adolescents, the age of all participants was 14 years. The number of the participants was 418, equally divided into males and females. Ten percent of the study population was vegetarians, which means 42 of the 418 adolescents. The levels of tooth wear were recorded after clinical examination using a modification of the Tooth Wear Index by Smith and Knight [13]. All participants from both groups (vegetarian and non-vegetarian) showed signs of erosion (48-51% of the non-vegetarian teenagers and 48-52% of the vegetarian adolescents). There was no statistically significant association between erosion and vegetarian diet (t-test, $P< 0.083$, $P<0.32$, Chi square test $\chi^2= 0.31$, $P<0.579$) [14].

Linkosalo et al. in two studies [15,16] using 28 and 26 members, retrospectively, in the test group while their age and sex matched the control ones presented that only in the vegetarian group were there signs of erosion, as no one from the control group showed signs of dental erosion. In both studies the vegetarians had been following a vegetarian diet for at least two years. In order to record the erosion, a grading scale was used in combination with the clinical observation. In the first study there were dental erosions on some tooth surfaces of 76.9% of the lactovegetarians [16], whereas in the other study, in which impressions and photographs were used, 26.9% lactovegetarians presented incipient erosion, 19.2% moderate and 30.8% severe erosion [15]. However, none of these studies reports if the results are statistically significant [15,16]. We found no studies concerning solely vegan diet and erosion.

Discussion

The purpose of this study was to investigate Erosive Tooth Wear (ETW) in association with vegetarian and/ or vegan diet after all data available in the literature had been collected and presented. The study of Staufenbiel et al. [11] included only adult patients. One strong feature of this study is that participants of the test group matched accurately (in sex and age) the participants of the control group. It was the only one study in which the vegetarian group included vegans. Nevertheless, they were not distinguished in the results. Furthermore, apart from clinical examination, there was no mention of which criteria were used to identify erosion.

Another limitation was that in this study, vegetarians reported tooth brushing after the consumption of sour foods and beverages significantly more often. Consequently, erosion could be the result not only of nutrition but also of abrasion. Application of fluoride as a measure of prevention was proposed, but the results were negative as fluoride did not offer any further protection. This again is logical, because in contrary to dental caries, there is only limited amount of tooth substance to remineralise in ETW.

In Herman et al. [12] study the participants in the test group matched accurately (in sex and age) the participants of the control group. No criteria for the identification of the erosion presence were used. Tooth erosion was slightly observed among vegetarians but it was not statistically significant. Vegetarian people consumed more frequently sour products such as raw vegetables and fruits, than others. However, the results did not indicate any statistically significant difference in prevalence of ETW between vegetarian and non-vegetarian participants and there was not any indication of direct relation between erosion and the presence or the duration of vegetarian diet [12].

To our knowledge, there was only one study among adolescents. This particular study included 418 14-year-old adolescents (209 males and 209 females) in the United Kingdom. Clinical examination was performed using the Tooth Wear Index of Smith and Knight [13] with some minor alterations suggested by Millward. Incisal edges and occlusal surfaces were excluded arbitrarily because of the potentially high levels of attrition. Two major drawbacks of the study were the absence of the control and the test group and that information on the duration of the vegetarian diet was not available. Erosion is usually noticed among teenagers, but it is not statistically significant between vegetarians and non-vegetarians. However, in both groups it was statistically significant between males and females [14].

Linkosalo et al. conducted two studies. All of them examined only lacto-vegetarians. The first study in 1984 was a pilot study which included one control and one test group. Vegetarian diet had been followed for at least two years. Erosion was noticed only at the lacto-vegetarian group (76.9%). However, there was no reference about the way used for erosion diagnosis and if this percentage is statistically significant [16]. In the second study, the mean duration of vegetarian diet was 6.1±5.3 with minimum two years. Erosion was documented with photographs and impression and was graded according to severity. Incipient erosion (Grade 1) was found in 26.9%, moderate (Grade 2) in 19.2% and severe (Grade 3) in 30.8% of the lacto-vegetarian group, whereas no one from the control group presented erosion. However, it was not mentioned if this difference is statistically significant [15]. Both studies included a limited number of participants [15,16]. According to the given information in the study from 1984, the proportion of vegetarians with ETW was 76.9% and none in the same size non-vegetarian group, the difference between the groups is statistically significant ($p>0.001$) [16]. Early diagnosis and investigating etiologic factors are the key areas in preventing and treating ETW. It is essential to train dentists and dental students appropriately to recognize erosion at its early stages [17]. Diagnosis and monitoring of the condition can be an easier procedure by the use of different indices. BEWE index is a commonly used index which offers a diagnostic mean and also it is a tool for making a treatment plan [18]. Furthermore, the dentist can recommend some instructions to the patients, especially to those that are at high risk according to the individual risk factors. The dentist must be aware of possible intrinsic factors causing dental erosion, and refer the patient for medical care, if needed. At population level, reduction and avoidance of erosive beverages or food must take place among all citizens. Everyone should also be recommended for tooth brushing with a soft toothbrush and fluoride tooth paste twice a day [17]. To our knowledge, this is the first review examining tooth wear caused by vegetarian diet. Methodological strengths of the present study are the literature research and detailed data extraction. There was an attempt of doing this review systematically with the purpose to study the relation of erosion and vegetarian/vegan diet in children/adolescents, but we concluded only to one article. As the purpose of this study is to give a broader range of information on the topic, we included more relevant articles with no restriction in order to widen its perspective. So, this fact renders this article as a narrow review of the literature. However, it was a critical appraisal of the literature, constrained to the including and excluding criteria. Nevertheless, the current study has certain limitations. First, only English articles were included. Moreover, as with any review, it is narrowed based on available data from published articles, which were only few. Thus, it is strongly suggested the conduct of more trials and studies relevant to the topic.

Conclusion

Vegetarians and vegans present a noticeable prevalence within the population. Also, erosive tooth wear is a severe problem in adults and it is suggested to be a growing problem also between children and adolescents. Vegetarian diet and erosion seem to have some association, but more studies must be conducted for more robust results. Thus, the dentists should be informed and be able to notice the early erosive signs and preventive measures should be administered.

Conflict of Interests

There is no conflict of interest to report.

Financial Disclosure

No funding or support was received for this narrative review.

References

1. Ganss C (2006) Definition of erosion and links to tooth wear. Monogr Oral Sci 20: 9-16.

2. Schlueter N, Luka B (2018) Erosive tooth wear- a review on global prevalence and on its prevalence in risk groups. Br Dent J 224: 364-370.

3. Salas MMS, Nascimento GG, Huysmans MC, Demarco FF (2015) Estimated prevalence of erosive tooth wear in permanent teeth of children and adolescents: An epidemiological systematic review and meta-regression analysis. J Dent 43: 42-50.

4. Jaeggi T, Lussi A (2006) Prevalence, incidence and distribution of erosion. Monogr Oral Sci 20: 44-65.

5. Marsh K, Zeuschner C, Saunders A (2012) Health implications of a vegetarian diet: A review. Am J Lifestyle Med 6: 250-267.

6. Bartlett D (2006) Intrinsic causes of erosion. Monogr Oral Sci 20: 119-139.

7. Addy M, Shellis RP (2006) Interaction between attrition, abrasion and erosion in tooth wear. Monogr Oral Sci 25: 32-45.

8. Chadwick RG (2006) The effect of cooking method upon the titratable acidity of a popular vegetarian dish- Scope for reducing its erosive potential?. Eur J Prosthodont Rest Dent 14: 28-31.

9. Ganss C, Schlectriemen M, Klimek J (1999) Dental erosions in subjects living on a raw food diet. Caries Res 33: 74-80.

10. Zotti F, Bonetti S, Dalessandri D, Fontana P (2010) Oral implications of the vegan diet: observational study. Minerva Stomatol 59: 583-591.

11. Staufenbiel I, Adam K, Deac A, Geurtsen W, Guenay H (2015) Influence of fruit consumption and fluoride application on the prevalence of caries and erosion in vegetarians- a controlled clinical trial. Eur J Clin Nutr 69: 1156-1160.

12. Herman K, Czajczynska-Waszkiewicz A, Kowalczyk-Zajac M, Dobrzynski M (2011) Assessment of the influence of vegetarian diet on the occurrence of erosive and abrasive cavities in hard tooth tissues. Postepy Hig Med Dosw 65: 764-769.

13. Smith BG, Knight JK (1984) An index for measuring the wear of teeth. Br Dent J 156: 435-438.

14. Al-Dlaigan YH, Shaw L, Smith AJ (2001) Vegetarian children and dental erosion. Int J Paediatr Dent 11: 184-192.

15. Linkosalo E, Ohtonen S, Markkanen H, Karinpää A, Kumpusalo E (1984) Caries, periodontal status and some salivary factors in lactovegetarians. Scand J Dent Res 93: 304-308.

16. Linkosalo E, Markkanen H (1985) Dental erosions in relation to lactovegetarian diet. Scand J Dent Res 93: 436-441.

17. Lussi A, Helwig E (2006) Risk assessment and preventive measures. Monogr Oral Sci 20: 190-199.

18. Dixon B, Sharif MO, Ahmed F, Smith AB, Seymour D, et al. (2012) Evaluation of the Basic Erosive Wear Examination (BEWE) for use in general dental practice. Br Dent J 213: 4.