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Influence of Certain Nutritional Products On Periodontal Status

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Abstract

Purpose: This paper focuses on determining the impact of certain nutritional products on periodontal status for patients with chronic periodontitis.

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Material and Method: 60 patients within the age range of 35-65 years were included. The selection of the respondents was made by a simple random method. As a criterion in the research sample, the depth of the periodontal pockets was taken into account, which was from 3 to 5 mm, according to which a selection was made. Chronic periodontal disease with a clinically manifest stage was diagnosed in all patients. Each of the respondents had the opportunity to estimate the frequency of personal consumption of 6 selected food items (vegetables, fast food, fish, meat, fruits, and desserts) by choosing one of three possible answers (never, infrequently and often consumed). For the clinical part of the study, 4 parameters were measured, namely: GI-gingival inflammation, PI-plaque index, PPD-depth of periodontal pockets, and CAL-clinical loss of attachment. The findings were statistically processed.

Results: For the male and female respondents, the average age was 39.8 ± 5.3 with min/pop of 30/53 years and 41.2 ± 6.3 with min / pop of 32/55 years, respectively.

The analysis showed that, for $p > 0.05$, the frequency of consumption of vegetables significantly decreased, and the consumption of fast food insignificantly increased the values of the four clinical parameters (GI, PI, PPD, CAL).

Conclusion: Consumption of fish, meat, and vegetables reduces the values of clinical parameters (PI, GI, PPD, CAL). This is in contrast to fast food and dessert which indicated an increase in the values of PPD and CAL.

Keywords: Chronic periodontitis, nutritional products, clinical attachment loss

Introduction

Chronic periodontitis (CHP) is a condition caused by multiple bacterial strains that are predominantly associated with their presence in the subgingival dental plaque (Slots et al., 2000). Of all of them, the primacy belongs to P. gingivalis which destroys the epithelial attachment and contributes to the inflammatory, resorptive, and destructive processes in the tissues of the periodontium (Yilmaz, 2008). However, in periodontal lesions, despite the detection of P. gingivalis, F. nucleatum (Akarslan et al., 2008) is no less present, as well as other periopathogens that have a significant role in the pathogenetic developments in the periodontium (Wu et al., 2007). F. nucleatum is a bridge between bacterial colonies and periopathogens and it has the power to increase the ability of adhesion and invasion of P. gingivalis and A. actinomycetemcomitans in the epithelial cells of gingival (Li et al., 2015). Due to the virulent components at their disposal, they manage to survive in their complicated environment by selectively modulating the host's immuno- inflammatory response (De Andrade et al., 2019). In essence,

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bacterial infection induces and modulates the immune response of the host (De Andrade et al., 2019). However, immune reactivity is simultaneously modulated by several genes, which in combination with lifestyle and environment, are additional factors for the occurrence and progression of this disease (Bartold et al., 2000).

Additionally, systemic diseases such as cardiovascular disease (Liccardo et al., 2019), kidney disease (Hickey et a., 2020), diabetes (Kocher et al., 2018), premature birth (Puertas et al., 2018), bad habits, and nutritional factors (Chapple et al., 2017) are cited as instigators and supporters of chronic periodontitis. Nutritional deficiencies of vitamins B12 (Zong et al., 2016), calcium and vitamin D (Garcia et al. 2011), Zinc (Jentsch et al., 2016) and many other vitamins and trace elements endanger the periodontal health of individuals. Although these deficiencies arise from genetic factors, certain systemic diseases such as gastrointestinal disorders can be the cause of poor absorption and malnutrition, including inadequate nutrition, application of various dietary protocols, as well as behavior and lifestyle in populations of different nationality in the world. Studies in this area shows that in an environment where food is rich in vitamins and proteins are consumed, they have a more satisfactory oral status, unlike those whose consumption of foods is rich in carbohydrates. The oral and periodontal status is far more serious in terms of caries or gingivitis (Tsang et al., 2019). Based on the findings, the objective of this paper is to determine the impact of certain nutritional products on periodontal status for patients with chronic periodontitis (CHP).

Material and Method of Work

a. Material

This study was conducted at the Clinic for Oral and Periodontal Diseases. For research purposes, a total of 60 patients aged 35-65 years were included.

The study is a prospective clinical trial implemented from 2019 to March 2020 for patients with chronic periodontitis. The selection of the respondents was carried out through the simple random selection method in accordance with the pre-set inclusion and exclusion criteria.

All respondents noted the diet according to the consumption of certain food products with the help of a survey questionnaire published in the paper of Akarslan et al. (2008). This is employed to achieve the goals of this research published on the basis of PubMed.

As a criterion for the group of respondents who are part of the research sample, the depth of the periodontal pockets was taken into account, which was from 3 to 5 mm. Chronic periodontal disease (CH) with a clinically manifest stage is diagnosed in all subjects.

Patients who were part of this study met certain criteria for inclusion or exclusion from the study.
Inclusion criteria:
- Non-smoking patients;
- Patients who have not received antiviral drugs in the previous six months;
- Patients in whom the absence of certain systemic diseases such as diabetes, cardiovascular, hematological, etc. diseases have been registered.

Exclusion criteria:
- Smoking patients;
- Patients undergoing antibiotics in the last three months;
- Patients with a systemic disease (kidney, cardiovascular, respiratory, malignant diseases, diabetes);
- Patients undergoing long-term treatment drugs (non-steroidal anti-inflammatory drugs);
- Pregnant and lactating women.

Each patient involved in the study was informed orally and in writing about the course of the study, after which a consent was signed for voluntary participation in it. For the course of the study and the procedures undertaken in it, approval was obtained from the ethics commission at the Faculty of Dentistry in Skopje.

b. **Methods**

A questionnaire was applied to observe eating habits where each of the respondents had the opportunity to assess the frequency of personal consumption of 6 selected food items (vegetables, fast food, fish, meat, fruits, and desserts) by choosing one of three possible answers (never, infrequent and frequent consumption).

For the clinical part of the research, 4 parameters were measured as follows: GI-gingival inflammation, PI-plaque index, PPD-depth of periodontal pockets, and CAL-clinical loss of attachment.
CAL and PPD are determined at the first examination, when the clinical diagnosis is made, and at the stage of chronic periodontitis. DP and GI, according to Loè-Silness, are determined in the same time periods.
Clinical Attachment Loss Index (CAL), which assesses the degree of periodontal destruction that provides data on the clinical stage of periodontitis (AAP, International Workshop for Classification of Periodontal Diseases, 1999), is measured from the enamel-cement joint to the bottom of the periodontal pocket. Periodontal pocket depth measurements (PPDs) are determined with a periodontal probe and correspond to the distance from the edge of the gingiva to the bottom of the periodontal pocket. This in turn provides data on the clinical condition of the periodontium.

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The data obtained during the research were statistically processed with SPSS software package, version 22.0 for Windows (SPSS, Chicago, IL, USA). The analysis of the qualitative series were done by determining the coefficient of relations, proportions, and rates and they were presented as absolute and relative numbers. The quantitative series were analyzed with the measures of central tendency (average, median, minimum and maximum values), as well as with the measures of dispersion (standard deviation).
Pearson Chi square test was used to determine the association between certain attributable dichotomous features. Furthermore, the Spearman rank correlation coefficient was adopted to determine the correlation between numerical variables with incorrect frequency distribution. The Shapiro-Wilk W test was also employed to determine the correctness of the frequency distribution of certain variables. To determine the statistical significance, a significance level of $p < 0.05$ was used.

Results

A total of 60 patients with chronic periodontitis were included in the study. Gender distribution indicated equal representation for 30 (50%) men and women. In the whole sample, the average age was 40.5 ± 5.8 years with a minimum/maximum age of 30/55 years. According to Median (IQR) = 39 (36-45), 50% of the respondents in the sample were over 39 years old. For the male and female respondents, the average age was 39.8 ± 5.3 with a min/ pop of 30/53 years and 41.2 ± 6.3 with min/pop of 32/55 years, respectively.

Table 1. Analysis of Gl, Pl, PPD, and CAL by sex for patients with periodontal findings

Parameters		N	$\overline{X}$ ± SD	Min/ Max	Median (IQR)	[1]p
Gl	men	30	1,83±0,65	1/3	2,0 (1,0-2,0)	Z=-0,6579; p=0,5106
	women	30	1,97±0,72	1/3	2,0 (1,0-2,0)	
	total	60	1,97±0,72	1/3	2,0 (1,0-2,0)	
Pl	men	30	1,97±0,72	1/3	2,0 (1,0-2,0)	Z=-0,6505; p=0,5154
	women	30	2,10±0,80	1/3	2,0 (1,0-3,0)	
	total	60	2,03±0,76	1/3	2,0 (1,0-3,0)	
PPD	men	30	3,89±0,65	2,3/4,9	3,9 (3,3-4,5)	Z=0,8871; p=0,3750
	women	30	3,77±0,61	3,05/4,9	3,7 (3,2-4,2)	
	total	60	3,83±0,63	2,3/4,9	3,8 (3,3-4,4)	
CAL	men	30	4,19±0,65	2,5/5,0	4,1 (3,6-4,9)	Z=0,9758; p=0,3292
	women	30	4,08±0,58	3,2/5,0	3,9 (3,5-4,7)	
	total	60	4,13±0,61	2,5/5,0	3,5 (4,0-4,8)	

[1]Mann-Whitney U test * significant for $p < 0.05$
GI-gingival inflammation; PI-plaque index; PPD-depth of periodontal pockets; CAL-clinical loss of attachment

The analysis of the patients in the sample indicated the following average values: a) gingival inflammation (GI) - 1.97 ± 0.72 with min/max of 1/3 and

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50% of patients with a value above 2; b) plaque index (PI) - 2.03 ± 0.76 min/max of 1/3 and 50% patients with a value above 2; c) depth of periodontal pockets (PPD) - 3.83 ± 0.63 with a min/max of 2.3 / 4.9 and 50% of patients with a value above 3.8; and d) clinical loss of attachment (CAL) - 4.13 ± 0.61 with a min/max of 2.5/5.0 and 50% of patients with a value above 3.5. The individual analysis of the four clinical parameters (Gl, Pl, PPD, and CAL), for $p< 0.05$, did not indicate a statistically significant difference between the sexes in relation to Gl ($p = 0.5106$), Pl ($p = 0, 5154$), PPD ($p = 0.3750$), and CAL ($p = 0.3292$) (Table 1).

A total of 25 (41.7%) and 3 (5%) respondents in the sample stated that they had never consumed fast food or desserts, respectively (Table 2). A total of 40 (66.7%) and 38 (63.3%) respondents also stated that they often consume vegetables and fish, respectively. This was followed by a total of 25 (41.6%) respondents who stated that they often consume meat.

A significant proportion of 29 (48.3%) respondents said they often consume desserts. For $p< 0.05$, no significant association was found between the sex of the respondents and the frequency of consumption of selected foods such as vegetables ($p = 0.583$), fast food ($p = 0.507$), fish ($p = 0.284$), meat ($p = 0.190$), and dessert ($p = 0.191$).

Table 2. Frequency of consumption of selected food items by gender for patients with periodontal findings

Food items		Frequency of consumption			[1]p
		Never N (%)	Rarely N (%)	Often N (%)	
Vegetables	men	-	11 (36.67%)	19 (63.33%)	X^2=0,300; df=1; p=0,583
	women	-	9 (30%)	21 (70%)	
	total	-	20 (33.33%)	40 (66.67%)	
Fast food	men	11 (36.37%)	13 (43.33%)	6 (20%)	X^2=1,360; df=2; p=0,507
	women	14 (46.67%)	13 (43.33%)	3 (10%)	
	total	25 (41.67%)	26 (43.33%)	9 (15%)	
Fish	men	-	13 (43.33%)	17 (56.67%)	X^2=1,148; df=1; p=0,284
	women	-	9 (30%)	21 (70%)	
	total	-	22 (36.67%)	38 (63.33%)	
Meat	men	-	15 (50%)	15 (50%)	X^2=1,714; df=1; p=0,190
	women	-	20 (66.67%)	10 (33.33%)	
	total	-	35 (58.33%)	25 (41.67%)	
Desserts	men	1 (3.33%)	11 (36.67%)	18 (60%)	X^2=3,309; df=2; p=0,191
	women	2 (6.67%)	17 (56.67%)	11 (36.67%)	
	total	3 (5%)	28 (46.67%)	29 (48.33%)	
[1]Pearson Chi-square test				* significant for p <0.05	

The analysis showed that, for $p< 0.05$, the frequency of consumption of vegetables significantly decreased, and the consumption of fast food

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insignificantly increased the values of the four clinical parameters (GI, PI, PPD, CAL) (Table 3). For $p < 0.05$, a significant linear negative correlation was found between the frequency of fish consumption and: a) GI - weak ($R = -0.354$; $p = 0.005$); b) PI - moderate ($R = 0.402$; $p = 0.001$; c) PPD - weak ($R = 0.273$; $p = 0.035$); and d) CAL - weak ($R = 0.323$; $p = 0.011$). Frequent consumption of fish significantly reduced the values of clinical parameters. A significant linear negative correlation, for $p < 0.05$, was also found between the frequency of meat consumption and: a) GI - weak ($R = -0.379$; $p = 0.003$); b) PI - weak ($R = 0.397$; $p = 0.002$; c) PPD - weak ($R = 0.259$; $p = 0.045$); and d) CAL - weak ($R = 0.277$; $p = 0.032$). Frequent consumption of meat significantly reduced the values of the examined clinical parameters. It was found that the increase in the frequency of dessert consumption, for $p < 0.05$, was significantly positive but weakly correlated with the values of PPD and CAL for $R = 0.270$; $p = 0.037$ vs. $R = 0.27$; and $p = 0.032$.

Discussion

The global nutritional transition has become increasingly relevant in the world in the last decade. The population is increasingly susceptible to various diets, and less susceptible to food shortages except in remote villages and certain rural areas. The amount of food consumed is very important in many aspects. Nonetheless, the priority of the food which is the choice of the individual is even more important. Basically, diets based on rich amount of vegetables and fruits are popular (Pries et al., 2017). However, the consumption of sugars in the form of various desserts are quite attractive on different occasions, especially for children, which leads to systemic disorders obesity, type 2 diabetes or cardiovascular disease (Black et al., 2013). Apart from the systemic disorders that are evident, in this global nutritional change in diet, it is normal to expect changes in oral and periodontal health. Thus, a solid dental and periodontal status is observed in certain individuals alongside a condition of more prevalent caries and impaired periodontal status (Hujoel et al., 2017). These two conditions in the mouth are largely related to diet.
Frequent consumption of juices and sweets for children leads to advanced caries (Tsang et al., 2019). Experience has shown that the composition of food strongly affects the periodontal status through micro and macro elements in the form of antioxidants (Dodington et al., 2015). The anti-inflammatory effect is achieved through ROS radicals, which acts on the ice periodontium (Acquier et al., 2016).

In this study, it was recorded that, for $p < 0.05$, there is a significant linear negative correlation between the frequency of fish consumption and: weak GI ($R = -0.354$; $p = 0.005$), PPD ($R = 0.273$; $p = 0.035$), and CAL ($R = 0.323$; $p = 0.011$) while moderate for PI was recorded ($R = 0.402$; $p = 0.001$). Frequent consumption of fish significantly reduced the values of clinical

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parameters. Significant linear negative correlation, for $p < 0.05$, is determined between the frequency of meat consumption with: weak GI ($R = -0.379$; $p = 0.003$), PI ($R = 0.397$; $p = 0.002$), PPD ($R = 0.259$; $p = 0.045$), and CAL ($R = 0.277$; $p = 0.032$).

The positive findings obtained on the periodontium was interpreted based on the intake of proteins (meat and fish). Protein foods are rich in zinc and this trace element is due to the results obtained. More so, it is a coenzyme of many enzymatic processes in organisms and has a beneficial effect on periodontal tissues (Dommisch et al., 2018). At the same time, it has a potent antioxidant effect that neutralizes bacterial toxins by expelling ROS radicals which affects the maintenance or healing of periodontal health (Jentsch et al., 2016).

In the study, it is evident that more frequent consumption of meat significantly reduces the values of the examined clinical parameters.

Fish, dairy products, and vegetables are rich in calcium which are needed for the normal functioning of body fluids, blood cells, bone calcification, and maintenance of calcified tissues (Van der Velden et al., 2011). This shows the importance of some of these products and why they were often included by the respondents. Increased intake of these foods reduces the severity of periodontitis, which is reflected in the obtained clinical parameters.

Regarding vegetables, the analysis showed that, for $p > 0.05$, the frequency of consuming vegetables insignificantly decreased, and the consumption of fast food insignificantly increased the values of the four clinical parameters (GI, PI, PPD, CAL).

Vegetables are rich in many vitamins, of which vitamin C is especially important for the condition of the periodontium. Vitamin C is primarily needed for collagen synthesis and is defined as a scavenger of ROS radicals. In the presence of magnesium, its anti-inflammatory effect on the periodontium is emphasized, thereby reducing bleeding and gum pain (Camarena et al., 2016). However, in this paper, it was established that the increase in the frequency of dessert consumption, for $p < 0.05$, is significantly positive but weakly correlated with the values of PPD and CAL for $R = 0.270$; $p = 0.037$ and $R = 0.27$; $p = 0.032$, respectively.

It is known that the type of diet, especially if it is rich in carbohydrates, affects dental plaque. On the one hand, food that is sticky, mushy, soft or creamy is easier to keep in hard-to-reach areas. Even patients who maintain satisfactory or solid oral hygiene cannot remove these plaque deposits very successfully. On the other hand, foods rich in sugars are an ideal medium for the development of microorganisms that alter the biofilm, especially the subgingival. The microorganisms that are part of the oral symbiosis experience a quantitative and qualitative change that leads to a disturbed balance in the direction of increased pathogenicity. Under these conditions,

inflammatory, destructive, and resorptive changes of periodontal tissues occur, resulting in the occurrence or progression of periodontal disease.
Furthermore, frequent consumption of desserts results in the already indicated pathogenetic events which are explained by a positively weak correlation with the values of PPD and CAL.
From the conducted research, it is evident that the consumption of fish, meat, and vegetables reduces the values of clinical parameters (PI, GI, PPD, CAL). This is in contrast to fast food and dessert which indicated an increase in the values of PPD and CAL.

Conclusion

From the conducted research, it can be concluded that the consumption of fish, meat,
and vegetables reduce the values of clinical parameters (PI, IG, PPD, CAL). This is in contrast to fast food and dessert which indicated an increase in PPD and CAL values. Hence, this led to the recommendation to change the diet. Therefore, the population that prefers fast food and food
rich in carbohydrates will face the problem of worse periodontal status, better conditions for initiation of periodontal disease, as well as faster progression of inflammatory, destructive, and resorptive processes of all structures of the periodontium, which is opposed to the group which uses fish, meat, and vegetables in their diet.

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