10.21608/adjc.2024.252064.1438 Advanced Dental Journal
Volume 6 (2024) | Issue 4| Pages 819-832

Original Article

The Effect of Quality of Diet on Periodontal Health Status among a Sample of Adult Egyptian Patients: A Hospital-Based Cross-Sectional Study

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Submitted: 19-2-2024
Accepted: 11-3-2024

Abstract

Aim: The aim of this study was to determine the effect of quality of diet on periodontal health status in a sample of adult Egyptian patients.

Material & methods: This cross-sectional investigation was conducted on 328 cases; clinical assessment of each patient was performed to achieve a consensus regarding to the novel classification of periodontal disorders published in 2018. Then, a questionnaire was filled out, where the 1st section included questions regarding demographic information about the individual (age, sex, marital status, occupation, and education level), and the 2nd section was about dietary habits.

Results: There were statistically significant relation regarding values of PI with meat, cereals, dairy products, fats, sweets, and nuts. And there were a statistically significant association regarding values of BOP only with fat and fruits, the association between (CAL/PD), and quality of diet showed statistical significance relation in cereals, dairy products, and nuts. Clinical diagnosis showed that 33 participants had healthy, localized, or generalized gingivitis (109 and 135, respectively). 22 patients had stage I periodontitis, 18 had stage II, 3 had stage III, and 8 had stage IV of the disease. 18 of the periodontitis participants were in the grade A group, 21 were in the grade B group, and 12 were in the grade C group.

Conclusion: Cereals, fruits, dairy products, fats, sweets, and nuts consumption revealed a statistically significant association between the quality of diet and periodontal health. Periodontal clinical parameters (PI, BOP, CAL, and PD) showed statistically significant association among different quality of diet groups.

Keywords: Nutrition, Diet, Periodontal Health, Periodontitis, Vitamins, Minerals.

Introduction

Nutrition from diet aid in energy creation and regulate various metabolic activities in the body. Additionally, it preserves the body systems functioning properly and maintains general health, involving oral health. The concept of 'Nutrition' refers to the scientific study of how the human body exert food to fulfill the essential needs related to maintenance, development, repair, and growth. Produces both systemic and local impacts on the body's tissues [1].

World Health Organization (WHO) defines 'nutrition' as the method and mechanism by which any living organism can live and alter extraneous solid and liquid substances, which may be essential for the daily preservation of life, development, and regular functions of numerous organs, apart from energy creation [2].

Periodontal disease is an inflammatory illness of the periodontium that is distinguished by chronicity and high prevalence. It is the chief reason for adult tooth loss globally. The pathological change in the gingival sulcus is represented by the pocket depth (PD), which is the measurement from the gingival border to the base of periodontal pocket that's >3 mm [3].

The vitality of the periodontal tissues relies on sufficient essential nutrients for the host in both health and disease. The epithelium of the dento-gingival junction and the fundamental connective tissue are the foremost dynamic tissues within the body. So, the integrity and preservation of these tissues depend upon a sufficient consumption of a balanced diet [2].

The health of the periodontium is greatly influenced by several types of nutrients. According to some research, both macronutrients (needed in large amounts like fats, carbohydrates and proteins) and micronutrients (needed in small quantities like minerals and vitamins) could modulate anti-inflammatory cascades and proinflammatory, affecting the host immune response in general [4].

Periodontitis can progress due to the disruption of some pro-inflammatory mediators that are released into the bloodstream, including metalloproteases, interleukins, prostaglandins, and high-sensitive c-reactive proteins (hs-CRP) [5]. These might increase the chronic risk of systemic inflammation, endothelial dysfunction and cardiovascular disease (CVD) through a particular oxidative stress pathway [6].

The higher amounts of reactive oxygen species (ROS) in periodontitis affected tissues compared to healthy tissues contribute to periodontal tissue destruction [7]. Highly reactive free radicals are capable of tissue damage by altering the chemical structure of molecules [8], by activating osteoclasts for resorbing bone [9], by damaging DNA and stimulating the production of cytokines from macrophages and monocytes [10].

According to recent research showed that a balanced diet has benefits on periodontal health by preventing inflammation. Encourage healthy lifestyle and diet in patients with periodontal disease [11].

In the light of this study the aim was carried out to investigate the effect of the quality of diet on periodontal health status within a sample of Adult Egyptian Patients.

Subjects and Methods

1.1. Study design and setting:

The present observational cross-sectional study investigating the relationship between periodontal health condition body mass index and quality of diet on adult Egyptian dental patients attending the Oral Diagnostic Center at Faculty of Dentistry, Cairo University, which is an open

public facility, a tertiary healthcare and a referral center. This observational cross-sectional study was registered in U.S. National Institutes of Health Clinical Trials Registry, ClinicalTrials.gov Identifier: ID: NCT04557670.

1.2. Study population:

A total sample of 328 adult patients were involved in the study. Subjects were recruited in a consecutive manner from the Diagnostic Center of The Faculty of Dentistry, Cairo University. Then periodontal examination was continued at the outpatient clinic, Department of Oral Medicine and Periodontology, Faculty of Dentistry, Cairo University.

1.3. Study Eligibility criteria:

1.3.1. Inclusion criteria were as follows:

- Patients whose age were between 18-70 years old,
- Provide informed consent,
- Patient have at least 20 natural teeth
- Patient had no received periodontal treatment within previous 4 months.

1.3.2. Exclusion criteria were as follows:

- Individuals with chronic systemic diseases such as cancer, osteoporosis, endocrine and hematological pathologies.
- Patients having problem in opening their mouth or undergoing intermaxillary fixation where oral examination would not be possible.
- Pregnant women.
- Patients diagnosed with psychiatric problems or intoxicated with alcohol or drugs.
- Patients with orthodontic appliances.
- Patient had autoimmune condition.

1.4. Sample size:

This power analysis used percentage of obese with Community Periodontal Index CPI >2 as the primary outcome. Based upon the results of [3], the percentage of obese with CPI >2 = 8.4%. Using alpha (α) level of (5%), acceptable margin of error = 3%; the minimum estimated sample size was 328 subjects. Sample size calculation was performed using Epi Info 7.2.2.2.

1.5. Variables and Data Collection:

The medical history was taking, thorough oral examination was done and a full questionnaire was filled for each patient. Before filling the questionnaire, the aim of the study was explained to the patient and the patient's acceptance to participate in the survey was received. The questionnaire was filling through a face-to-face personal interview with the patient using simple, short, easily comprehended questions.

The interview questions were prepared in English and translated into Arabic and then reversed by a certified translator to ensure accuracy. All the interviews were done by the same Investigation **(Al-shantub)**

Clinical examination done on a dental unit using the light of the unit, mirror and UNC 15 periodontal probe which is 15mm long probe with markings at each millimeter and colour coded at 5th, 10th, and 15th mm. Periodontal status evaluated which included Plaque index (PI), Bleeding on probing (BOP), Clinical attachment level (CAL) and probing depth (PD) were measured. These parameters were recorded using UNC 15 periodontal probe at the site of interproximal intra-bony defect and were rounded up to the nearest millimeters. All permanent fully erupted teeth, excluding third molars, were examined at six sites for each tooth;

mesio-buccal, mid-buccal, disto-buccal, disto-lingual, mid-lingual, and mesio-lingual [12].

1.6. Predictors:

The questionnaire which was applying in study was include the following:

The 1st section of the questionnaire included a series of questions related to demographic characteristics of the individuals: (age, sex, marital status, occupation, and education level and Height (m^2) and weight (kg).

To estimate the level of overweight and obesity. commonly used the (BMI); was calculated as the body weight (kg) divided by the square of the height (m) by using Digital Electronic Platform scale with capacity 180kg calibrate weight and height [13].

The 2nd section of the questionnaire a validated food frequency form was used to collect information about dietary patterns. Participants noted how often they consumed certain food [14].

1.7. Clinical Periodontal parameters:

Plaque index (PI): was by measuring the four aspect of each tooth (buccal, lingual, mesial, and distal) and giving a score from 0-3 [15].

Bleeding on probing (BOP): was assessed by softly probing of the opening of the gingival crevice. Score was assessed as the percentage of bleeding locations (dichotomous yes/no) in case bleeding happened in 10 seconds a positive result was noted [16].

Clinical attachment loss (CAL): was measured from the CEJ to the bottom of the gingival sulcus. Each tooth was probed using UNC 15 periodontal probe with a light force not exceeding .25 newton (25 gram force) at six points: mesiobuccal, midbuccal, distobuccal, mesiolingual, midlingual and distolingual force [12].

Pocket depth (PD): It was measured from the gingival margin to the bottom of the gingival sulcus. The UNC 15 periodontal probe was inserted parallel to the long axis of the tooth using light force [12].

The most affected area had a radiographic test to assess the bone loss and calculate the percentage of bone loss based on the classification of periodontal and peri-implant diseases and conditions developed by the world workshop [17].

1.8. Statistical methods:

Data were presented as frequency and percentages for categorical outcomes and as mean with standard deviation, and 95% confidence interval (95% CI) for numerical outcomes. The chi-square test was used to compare categorical data. Numerical data were checked for normality using Kolmogorov-Smirnov and Shapiro-Wilk tests. For parametric outcomes, a one-way ANOVA test was used with a Tukey post-hoc test for pairwise comparisons. For non-parametric outcomes, the Kruskal-Wallis test was utilized with the post-hoc Mann-Whitney test in case of significance.

All tests were two-tailed and the significance level was set at a level of $P \leq 0.05$. Statistical analysis was performed using IBM (NY: IBM Corp. USA) Statistical Package for Social Sciences SPSS for Windows version 26. Data analysis was performed, using (SPSS Inc., and PASW statistics for Windows version 25. Chicago: SPSS Inc.). Qualitative data were described using numbers and percentages. The significance of the obtained results was judged at the (0.05) level. Binary logistic regression was used to assess the effect of the combination of more than 2 independent variables on

dichotomous outcomes using the Stepwise technique.

Result

1. Descriptive statistics:

1.1. Demographic data:

The predominant age group was from 18–70 years old and the largest group was between 31-40 years. The study included 140 males and 188 females. Concerning marital status, the largest group was married who were 216. Regarding the occupation, 65 were students, there were 126 employed, unemployed 123 and retired 14 respectively. Regarding the education level, the largest group was participants with higher education 185 as observed in **Table (1)**.

Table (1): Demographic data distribution in numbers, (%).

Parameter	**Categories, number (%)**			
Age	18-30 104 (31.7)	31-40 111(33.8)	41-50 84(25.6)	51-70 29(8.8)
Sex	Male 140(42.7)	Female 188(57.4)		
Marital status	Single 101(30.8)	Married 216(65.9)	Divorced 9(2.7)	Widowed 2(0.6)
Occupation	Student 65(19.8)	Employed 126(38.4)	Unemployed 123(37.5)	Retired 14(4.3)
Education level	No education 50(15.2)	Elementary 41(12.5)	Middle 52(15.9)	Higher 185(56.4)

1.2. Quality of diet:

For meat intake, low consumption was 72, moderate 236 and high 20 participants. For fish intake, there were 222 in the low consumption, 99 with moderate and 7 with high. For eggs intake, there were 40 with low consumption, 138 and 150 participants with moderate and high consumption respectively. Pulses low, moderate and high consumption groups had 70, 222 and 36 participants respectively. For cereals intake, there were no participants in the low consumption group which moderate and high consumption was present it 55 and 273 participants respectively. Dairy products consumption was 65 in low, 174 in moderate and 89 in high. Fats consumption was low in 143, moderate in 141 and high in 44. Participants with low vegetables consumption were 16, there were 70 and 242 participants in moderate and high consumption groups respectively. Similarly, fruit consumption had 58, 143 and 127 participants in same groups respectively. Sweets intake presented in 65 as low, 110 as moderate and 153 as high. Beverages consumption was low in 8, moderate in 100 and high on 220 participants. Finally, nuts intake was

low in 166 participants, moderate in 147 and high in 15 participants as shown in (Table 2).

Table (2): Consumption of different quality of diet items was illustrated.

DIETARY ITEMS	**CONSUMPTION, NUMBER (%)**		
	Low	**Moderate**	**High**
Meat	72(22.0)	236(72.0)	20(6.0)
Fish	222(67.7)	99(30.2)	7(2.1)
Eggs	40(12.2)	138(42.1)	150(45.7)
Pulses	70(21.3)	222(67.7)	36(11.0)
Cereals	0	55(16.8)	273(83.2)
Dairy products	65(19.8)	174(53.0)	89(27.1)
Fats	143(43.6)	141(34.0)	44(13.4)
Vegetables	16(4.9)	70(21.3)	242(73.8)
Fruits	58(17.7)	143(43.6)	127(38.7)
Sweets	65(19.8)	110(33.5)	153(46.6)
Beverages	8(2.4)	100(30.5)	220(67.1)
Nuts	166(50.6)	147(44.8)	15(4.6)

1.3. Clinical parameters and periodontal status:

The clinical examination revealed that average PI was 2.34 ± 0.79 with 95% CI of [2.25-2.42], BOP had a mean of 35.33 ± 22.67 percent, with 95% CI [32.87 – 37.80], CAL was on average 0.46 ± 1.21 and 95% CI [0.33 – 0.59], Finally, PPD was on average 1.81 ± 0.42 mm, 95% CI corresponded to [1.76 – 1.85]. While the clinical diagnosis showed that healthy participants were 33, accounting for 10.1% of the sample. Participants with localized or generalized gingivitis were 109 and 135 respectively. Of periodontitis patients, 22 were in stage I, 18 in stage II, 3 in stage III, and 8 in stage 4. Out of periodontitis participants, 18 were in grade A group, 21 in grade B and 12 in grade C group of all periodontitis patients as observed in **Table (3**

Table (3): Clinical parameters and Diagnosis distribution in numbers, (%)

Clinical parameters	Mean ± SD	95% CI[1]	Mini-mum	Maxi-mum	Diagnosis	Numbers, (%)
PI[2] (score)	2.34±0.79	2.25-2.42	0	3.00	Healthy	33(10.0)
BOP[3] (%)	35.33±22.67	32.87-37.80	10.04	100	Localized gingivitis	109(33.2)
CAL[4] (mm)	0.46±1.21	0.33 – 0.59	0	8.20	Generalized gingivitis	135(41.2)
PD[5] (mm)	1.81±0.42	1.76 – 1.85	1	4.58	Periodontitis stage I	22(6.7)
					Periodontitis stage II	18(5.5)
					Periodontitis stage III	3(0.9)
					Periodontitis stage IV	8(2.4)
					Grade A	18(35.3)
					Grade B	21(41.2)
					Grade C	12(23.5)

2. Association between clinical parameters and quality of diet:

There were statistically significant relation regarding values of PI with meat (p=0.001), cereals (p=0.041), dairy products (p<0.001), fats (p=0.025), sweets (p=0.012) and nuts (p<0.001), while the association between

BOP and different diet categories, there were statistically significant relation regarding values of BOP only with fat (p=0.019) and fruits (p=0.047) as shown in **Table (4)**.

[1] Confidence interval
[2] Plaque index
[3] Bleeding on probing
[4] Clinical attachment loss
[5] Pocket depth

Table (4): PI and BOP values in different quality of diet consumption categories

	Low consumption mean±SD		Medium consumption mean±SD		High consumption mean±SD		P-value	
Parameters & categories	**PI**	**BOP**	**PI**	**BOP**	**PI**	**BOP**	**PI**	**BOP**
Meat	2.61±0.74	36.08±22.01	2.25±0.79	35.11±22.92	2.30±0.80	35.25±23.0	0.001*	0.793
Fish	2.32±0.80	33.60±21.53	2.36±0.75	38.68±23.79	2.43±1.13	43.02±36.25	0.72	0.175
Eggs	2.60±0.67	39.11±25.77	2.31±0.82	31.71±18.93	2.29±0.79	37.66±24.55	0.058	0.2
Pulses	2.47±0.74	37.78±21.84	2.28±0.81	35.64±23.79	2.39±0.80	28.68±15.11	0.181	0.177
Cereals			2.53±0.72	32.28±19.63	2.30±0.80	35.95±23.21	0.041*	0.515
Dairy Product	2.20±0.83	36.04±23.39	2.25±0.80	33.30±22.09	2.61±0.69	38.93±23.05	<0.001*	0.142
Fat	2.44±0.82	26.24±23.18	2.26±0.75	37.01±22.86	2.23±0.80	27.02±18.68	0.025*	0.019*
Vegetables	2.63±0.62	28.57±16.57	2.47±0.76	32.69±18.37	2.28±0.81	36.54±24.0	0.052	0.431
Fruits	2.40±0.77	40.48±23.59	2.27±0.80	32.71±22.02	2.39±0.79	35.94±22.69	0.342	0.047*
Sweets	2.14±0.79	24.96±21.95	2.46±0.77	35.52±22.99	2.33±0.79	35.36±22.88	0.012*	0.982
Beverages	2.00±0.93	23.11±15.60	2.33±0.84	33.34±22.51	2.35±0.77	36.69±22.83	0.509	0.124
Nuts	2.41±0.76	35.01±21.84	2.19±0.82	34.73±23.10	2.93±0.26	44.83±26.69	<0.001*	0.321

*Statistically significant at p-value p<0.05

The association between CAL and quality of diet among different food items regarding CAL showed statistical significance relation in cereals (p<0.001), dairy products (p<0.001) and nuts (p=0.001).

Whereas, the correlation among PD and quality of diet showed a statistically significant relation between dairy products (p=0.031) and nuts (p<0.001) as demonstrated in **Table (5)**.

Table (5): CAL & PD values in different quality of diet consumption categories

	Low consumption mean±SD		Medium consumption mean±SD		High consumption mean±SD		P-value	
Parameters & categories	**CAL**	**PD**	**CAL**	**PD**	**CAL**	**PD**	**CAL**	**PD**
Meat	0.76±1.41	1.88±0.41	0.40±1.17	1.78±0.40	0.15±0.67	1.82±0.55	0.189	0.167
Fish	0.48±1.30	1.82±0.43	0.37±0.94	1.74±0.29	1.00±1.91	2.17±0.96	0.581	0.186
Eggs	0.51±1.32	1.79±0.32	0.56±1.22	1.82±0.48	0.36±1.18	1.80±0.37	0.122	0.881
Pulses	0.69±1.45	1.84±0.34	0.42±1.17	1.81±0.44	0.25±0.94	1.75±0.38	0.109	0.284
Cereals			0.94±1.71	1.89±0.58	0.36±1.06	1.79±0.38	<0.001*	0.512
Dairy Product	0.52±1.35	1.79±0.42	0.22±0.74	1.75±0.30	0.89±1.67	1.94±0.55	<0.001*	0.031*
Fat	0.56±1.24	1.83±0.47	0.37±1.22	1.80±0.40	0.40±1.09	1.73±0.30	0.133	0.306
Vegetables	0.23±0.92	1.94±0.89	0.56±1.43	1.83±0.41	0.45±1.16	1.79±0.37	0.571	0.525
Fruits	0.73±1.51	1.87±0.41	0.41±1.12	1.80±0.35	0.40±1.16	1.78±0.49	0.359	0.328
Sweets	0.35±1.05	1.83±0.47	0.49±1.18	1.81±0.44	0.48±1.30	1.80±0.38	0.662	0.985
Beverages	0.41±1.15	1.79±0.23	0.57±1.34	1.79±0.49	0.41±1.16	1.81±0.39	0.641	0.230
Nuts	0.66±1.48	1.86±0.45	0.18±0.67	1.72±0.37	0.93±1.48	2.00±0.31	0.001*	<0.001*

*Statistically significant at p-value p<0.05

2.1. Multivariate analysis:

For poor meat & eggs consumption quality, the presence of periodontitis stages I, II & IV were statistically significant predictor with increased risk by 1.34, 1.38 & 2.18, and 1.23, 1.16 & 1.13, respectively than cases with healthy gingiva with overall % predicted =78.4%, and 88.7%, respectively. For poor fish consumption quality, the presence of stages II & III periodontitis were statistically significant predictors with increased risk by 1.56 & 1.95, respectively than cases with healthy gingiva with overall % predicted =68.6%.

The presence of periodontitis stages II & IV was statistically significant predictor of poor pulses consumption quality with increased risk by 1.42 & 1.09, respectively than healthy gingiva cases with overall % predicted =79.3%. In the case of poor dairy products consumption quality, the stage III & IV were statistically significant predictor with increased risk by 1.12 & 1.09, respectively than cases with healthy gingiva with overall % predicted =79.6%, with the evaluation of other products as illustrated in **Table (6 & 7)**.

Table (6): Predictors of poor consumption of (Meat, Fish & Eggs).

Predictors of poor consumption	Diagnosis	β	P-value	Odds ratio (95%CI)
Meat	Healthy		.117	
	L. gingivitis	.511	.329	1.666(0.598-4.64)
	G. gingivitis	.063	.902	.939(0.348-2.54)
	Periodontitis stage I	1.073	.03*	1.342(1.087-1.897)
	Periodontitis stage II	.955	.04*	1.385(1.097-1.856)
	Periodontitis stage III	19.781	.998	undefined
	Periodontitis stage IV	.171	.01*	2.185(1.163-3.6)
Fish	Healthy		.227	
	L. gingivitis	.684	.137	1.504(0.205-1.94)
	G. gingivitis	.098	.824	1.10(0.465-2.62)
	Periodontitis stage I	.254	.697	0.776(0.216-2.78)
	Periodontitis stage II	.272	.04 *	1.56(1.03-2.1)
	Periodontitis stage III	.716	.02*	1.95(1.07-2.712)
	Periodontitis stage IV	-20.715	.999	undefined
Eggs	Healthy		.513	
	L. gingivitis	-.887	.295	.412(0.078-2.17)
	G. gingivitis	-.858	.305	.424(0.082-2.18)
	Periodontitis stage I	.751	.04*	1.23(1.024-1.659)
	Periodontitis stage II	1.828	.01*	1.161(1.02-1.598)
	Periodontitis stage III	18.892	.999	Undefined
	Periodontitis stage IV	1.999	.03*	1.135(1.008-2.57)

*Statistically significant at p-value $p<0.05$. β, regression coefficient. CI, confidence interval.

Table (7): Predictors of poor consumption of (Pulses, Dairy product & Fat).

Predictors of poor consumption	Diagnosis	β	P-value	Odds ratio (95%CI)
Pulses	Healthy		.162	
	L. gingivitis	-.208	.735	.812(0.244-2.71)
	G. gingivitis	-.655	.269	.519(0.163-1.66)
	Periodontitis stage I	-1.131	.135	.323(0.073-1.42)
	Periodontitis stage II	.866	.01*	1.421(1.09-3.89)
	Periodontitis stage III	19.071	.999	Undefined
	Periodontitis stage IV	2.406	.015*	1.090(1.013-1.627)
Dairy products	Healthy		.263	
	L. gingivitis	-.636	.298	.530(0.160-1.75)
	G. gingivitis	-.396	.514	.673(0.205-2.21)
	Periodontitis stage I	.090	.920	1.914(0.156-5.36)
	Periodontitis stage II	.068	.944	1.071(0.160-7.14)
	Periodontitis stage III	2.067	.03*	1.127(1.006-1.548)
	Periodontitis stage IV	2.333	.025*	1.097(1.013-1.747)
Fat	Healthy		0.152	1
	L. gingivitis	0.779	0.072	2.18(0.932-5.09)
	G. gingivitis	0.495	0.241	1.64(0.717-3.75)
	Periodontitis stage I	0.139	0.03*	1.870(1.265-1.940)
	Periodontitis stage II	0.643	0.02*	1.526(1.139-1.856)
	Periodontitis stage III	0.859	0.04*	1.35(1.160-1.78)
	Periodontitis stage IV	0.564	0.01*	1.76(1.303-1.920)

*Statistically significnt at p-value $p<0.05$. β, regression coefficient. CI, confidence interval.

Discussion

Periodontal health could be explained as a condition of being free of inflammatory periodontal disease that permits patient to operate properly while avoiding the negative repercussions (mental or physical) of the present or previous disease [18].

The importances of recognizing the main factors of periodontal disease and health as controllable and uncontrollable predisposing and adjusting elements, as well as their evaluation for each patient, cannot be overstated, and their observation of each case is critical to achieve and preserving clinical periodontal health [19].

"Nutrition" is the science of how the body uses diet for advancement, development, repair, and upkeep. It has a solid impact on the integrity of the periodontium, and it's lacking state can change the expression of essential etiologic variables, influence the variables that affect the host immune reaction, and play a role in the preservation of the tissues of the oral cavity. A severe lack of one or more of these nutrients might cause pathological changes in periodontal tissues [1].

Different vitamins are needed for preserving oral health and periodontal tissues [20]. Vitamins including Vit A, B, C, D, and E are considered antioxidant micronutrients [21]. Those nutrients exert antioxidant and immunomodulatory effects, co-enzymes for energy production, and metabolic process [22].

In the recent study done by **Abou El Fadl et al.**, who assessed the incidence of tooth loss and periodontitis among Egyptian individuals and evaluate the relationship between periodontal diseases & possible risk variables and found that the prevalence of periodontitis was 26% compared to 15.5% in the current study [23].

In this research, a novel classification system was used, where periodontitis is graded into stages based on the severity and the complexity of the therapy needed to remove local risk variables [24]. The advantage of this classification over others is that it provides information on the severity, diagnosis, and necessary treatments for periodontal diseases [17, 25].

Positive relationships were found among periodontitis, age, and level of education. It's obviously known that periodontal damage is correlated with periodontal disorder activity, which is cumulative and extends with age [24, 26].

While other authors concur socioeconomic status (SES) [27, 28] and education [28, 29], between other variables are influential on oral and periodontal health, the education level of personal is element of SES.

Persons with a greater degree of education often have a better income and socioeconomic status and are more likely to have routine, preventative dental appointments [30]. In addition, education grade impacts oral hygiene practice and diet habits in patient's [31].

Among different diet categories, there was a statistically significant relation regarding values of PI and meat consumption, cereals, dairy products, fats, sweets, and nuts. However, there were statistically significant association regarding values of BOP only with fat and fruits consumptions. Regarding CAL there was statistical significance in cereals, dairy products, and nuts. PD values showed a statistically significant relation between consumption levels of dairy products and nuts. This was in agreement with the results revealed by **Bawadi et al.**, who showed that the subjects with poor-quality diets had a significantly higher average of CAL in comparison to those who had a good-quality diet [32].

Eberhard et al. concluded that a semi-vegetarian diet with high- fat wholegrain, fruits, and nuts as a reference of carbohydrates and unsaturated fats in the form of olive oil, seeds and nuts, has significant positive impacts on the clinical parameters of periodontal health [33].

Additionally, **Alsyefi et al.** investigated the impact of diet quality and related dietary habits in adult Saudi subjects on periodontal health, they reported that reduction of the consumption and frequency of intake for sticky and refined sugars in the diet is correlated with enhanced periodontal health [34].

Furthermore, the study done by **Costa et al.** aimed to explore the effect of micronutrient intake on the periodontal status of adults Brazilan individuals supported by a public health care protocol revealed that poor periodontal status was correlated with low intake of Zn, Cu, K, fiber, vitamin C, and omega-3 [35]. However, healthy periodontal status was linked to a high intake of Zn, fiber, omega-3, retinol, riboflavin, and calcium. Their conclusion was that diet can significantly impact periodontal status, and nutritional insufficiencies are very important variables in countries with upper-middle-income economies.

In the present work, a positive relationship among the attendance of periodontitis stages III and IV were statistically significant predictor of poor dairy products consumption. Our outcomes agreed with the results of **Adegboye et al.**, who informed that

dairy calcium, especially milk-originated, is correlated with a decreased risk of periodontitis [36].

Conversely, **Abbass et al.** observed an inverse correlation among milk drinking and periodontitis [24]. Similarly, a positive correlation was discovered among eggs, pulses, cereals, and beverages consumption and periodontitis. These findings confirm those of **Abbass et al.**, who found a relationship between the intake of eggs, citrus juices, caffeinated beverages, soda, and grains and a decreased incidence of periodontitis [24].

Conclusion

- The present study shows a statistically significant between BMI groups regarding the distribution of diagnosis. And regarding clinical parameters and body mass index, only the BOP and CAL outcomes showed a statistically significant comparisons among different BMI groups.
- Nutritional counseling may be had beneficial the effects of inflammatory damage on the periodontal tissues as well as to keep a tight control on bacterial population with the help of good oral hygiene practices for patients receiving periodontal treatment.

Recommendations

It is important to acknowledge that the presence of confounding factors increases the risk of periodontitis exponentially. Thus, patients need to be aware of the impact of life style factors such as smoking and obesity on their overall periodontal health status. Also, systemic diseases, medication and dietary intake into consideration, although deterioration of periodontal health could be due to high fat/sugar intake, systemic diseases and medication which could induce inflammation without causing a weight increase.

In addition to conventional periodontal treatment, the dentists could recommend an anti-inflammatory diet (e.g. reduced intake of fats, red meat, and processed foods and accordingly increased consumption of green leafy vegetables, fruits, whole grains, and fish) to their patients.

Vitamin C, E, β-carotene, highfiber foods, and serum albumin concentration may be protective factors; n-6 to n-3 polyunsaturated fatty acids (PUFAs) ratio, saturated fatty acids (SFA), and sweets may be risk factors for the worsening of periodontal conditions.

Conflict of Interest:

The authors declare no conflict of interest.

Funding:

This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors

Ethics:

This study protocol was approved by the ethical committee of the faculty of dentistry-Cairo university on the 8th of June 2020, approval number:PER1-1-1

References

1. Pathan, F.L., G.U.M. Ardale, and S. Vyavhare, *NUTRITION IN PERIODONTAL HEALTH AND DISEASE.* Maharashtra Institute of Dental Sciences & Research, Latur, 2020: p. 13.
2. Sarkar, S., D.K. Singh, and M. Jalaluddin, *Impact of Nutrition on Periodontal Health: The victuals and periodontium.* 2021.
3. Dhaifullah, E., et al., *Body mass index and periodontal health status among young Saudi adults: a cross-sectional study.* Annals of Saudi medicine, 2019. **39**(6): p. 433-440.
4. Woelber, J.P. and C. Tennert, *Diet and periodontal diseases.* The impact of nutrition and diet on oral health, 2020. **28**: p. 125-133.
5. Cosgarea, R., et al., *Effects of non-surgical periodontal therapy on periodontal laboratory and clinical data as well as on disease activity in patients with rheumatoid arthritis.* Clinical oral investigations, 2019. **23**: p. 141-151.
6. Isola, G., et al., *Impact of periodontitis on gingival crevicular fluid miRNAs profiles associated with cardiovascular disease risk.* Journal of Periodontal Research, 2023. **58**(1): p. 165-174.
7. Younis, L.T., et al., *The role of reactive oxygen species in initiation and progression of periodontal diseases.* Current Journal of Applied Science and Technology, 2015. **8**(6): p. 541-549.
8. Al Ostwani, A.E.O., *Gingival Disease-A Professional Approach for Treatment and Prevention*. 2019.
9. Hall, T., et al., *The role of reactive oxygen intermediates in osteoclastic bone resorption.* Biochemical and biophysical research communications, 1995. **207**(1): p. 280-287.
10. Chapple, I., *Reactive oxygen species and antioxidants in inflammatory diseases.* Journal of clinical periodontology, 1997. **24**(5): p. 287-296.
11. Santonocito, S., et al., *Dietary factors affecting the prevalence and impact of periodontal disease.* Clinical, cosmetic and investigational dentistry, 2021: p. 283-292.
12. Ramfjord, S.P., *The periodontal disease index (PDI).* 1967.
13. Organization, W.H., *Oral health surveys: basic methods*. 2013: World Health Organization.
14. Ruiz-Cabello, P., et al., *Association of dietary habits with psychosocial outcomes in women with fibromyalgia: the al-Andalus project.* Journal of the Academy of Nutrition and Dietetics, 2017. **117**(3): p. 422-432. e1.
15. Silness, J. and H. Löe, *Periodontal disease in pregnancy II. Correlation between oral hygiene and periodontal condition.* Acta odontologica scandinavica, 1964. **22**(1): p. 121-135.
16. Trombelli, L., et al., *Plaque-induced gingivitis: Case definition and diagnostic considerations.* Journal of clinical periodontology, 2018. **45**: p. S44-S67.
17. Papapanou, P.N., et al., *Periodontitis: Consensus report of workgroup 2 of the 2017 World Workshop on the Classification of Periodontal and Peri-Implant Diseases and Conditions.* Journal of periodontology, 2018. **89**: p. S173-S182.
18. Np, L., *Bartold PM. Periodontal Health.* J Periodontol, 2018. **89**(1): p. s9-s16.
19. Murakami, S., et al., *Dental plaque–induced gingival conditions.* Parodontologiya, 2019. **24**(3): p. 244-252.
20. Najeeb, S., et al., *Therapeutic potential of melatonin in oral medicine and*

periodontology. The Kaohsiung journal of medical sciences, 2016. **32**(8): p. 391-396.
21. Lieberman, S. and N.P. Bruning, *The Real Vitamin and Mineral Book: The Definitive Guide to Designing Your Personal Supplement Program*. 2007: Penguin.
22. Varela-López, A., et al., *Nutraceuticals in periodontal health: a systematic review on the role of vitamins in periodontal health maintenance.* Molecules, 2018. **23**(5): p. 1226.
23. Abou El Fadl, R.K., et al., *Periodontal diseases and potential risk factors in Egyptian adult population—Results from a national cross-sectional study.* PLoS One, 2021. **16**(11): p. e0258958.
24. Abbass, M.M., et al., *The occurrence of periodontal diseases and its correlation with different risk factors among a convenient sample of adult Egyptian population: a cross-sectional study.* F1000Research, 2019. **8**.
25. Tonetti, M.S., H. Greenwell, and K.S. Kornman, *Staging and grading of periodontitis: Framework and proposal of a new classification and case definition.* Journal of periodontology, 2018. **89**: p. S159-S172.
26. Dye, B.A., *Global periodontal disease epidemiology.* Periodontology 2000, 2012. **58**(1): p. 10-25.
27. Kadtane, S.S., et al., *Periodontal health status of different socio-economic groups in out-patient department of TMDC & RC, Moradabad, India.* Journal of clinical and diagnostic research: JCDR, 2014. **8**(7): p. ZC61.
28. Almerich-Silla, J.-M., et al., *Socioeconomic factors and severity of periodontal disease in adults (35-44 years). A cross sectional study.* Journal of clinical and experimental dentistry, 2017. **9**(8): p. e988.
29. Bonfim, M.d.L.C., et al., *Social determinants of health and periodontal disease in Brazilian adults: a cross-sectional study.* BMC Oral Health, 2013. **13**: p. 1-7.
30. Watson, C.A. and S. Nilam, *Educational level as a social determinant of health and its relationship to periodontal disease as a health outcome.* J Dent Sci Ther, 2017. **1**(3): p. 8-11.
31. Gomes, A.P.M., et al., *Relationship between patient's education level and knowledge on oral health preventive measures.* International Dental & Medical Journal of Advanced Research, 2015. **1**(1): p. 1-7.
32. Bawadi, H., et al., *The association between periodontal disease, physical activity and healthy diet among adults in Jordan.* Journal of periodontal research, 2011. **46**(1): p. 74-81.
33. Eberhard, J., et al., *A randomized clinical trial to investigate the effect of dietary protein sources on periodontal health.* Journal of Clinical Periodontology, 2022. **49**(4): p. 388-400.
34. Alsyefi, A.A. and M. Alasqah, *Dietary habits and periodontal health in Saudi Arabia: A qualitative study.* Eur J Mol Clin Med, 2021. **8**(1): p. 1258-70.
35. Costa, P.D., et al., *Influence of micronutrient intake, sociodemographic, and behavioral factors on periodontal status of adults assisted by a public health care system in Brazil: a cross-sectional multivariate analysis.* Nutrients, 2021. **13**(3): p. 973.
36. Adegboye, A.R., et al., *Intake of dairy products in relation to periodontitis in older Danish adults.* Nutrients, 2012. **4**(9): p. 1219-1229.