

The Relationship between Body Mass Index and Periodontal Disease

Somaye Ansari Moghadam MSD¹, Saeed Salimi MD², Farin Kiany MSD³, Mohamad naebi⁴, Sirous Risbaf Fakour^{5*}¹Associate Professor, Periodontology Department of Zahedan Dental School, Oral and Dental Disease research center, Zahedan University of Medical Sciences, Zahedan, Iran²General Dentist, Tehran, Iran³Associate Professor, Periodontology Department of Shiraz Dental School, Oral and Dental Disease Research Center, Shiraz University of Medical Sciences, Shiraz, Iran⁴Oral and Dental Disease Research Center, Zahedan University of Medical Sciences, Zahedan, Iran⁵Associate Professor, Oral and Dental Disease Research Center, Zahedan University of Medical Sciences, Zahedan, Iran

*Corresponding author: Sirous Risbaf Fakour

| Received: 14.01.2019 | Accepted: 23.01.2019 | Published: 18.02.2019

DOI: [10.21276/sjams.2019.7.2.18](https://doi.org/10.21276/sjams.2019.7.2.18)

Abstract

Original Research Article

The rate of obesity has increased dramatically in recent years. Obesity is among the important major risk factors for periodontal disease. We aimed to assess the relationship between body mass index (BMI) and periodontal disease in a sample of Iranian patients. In this case-control study, 150 age and sex-matched individuals referring to the Periodontics Department of Zahedan University of Medical Sciences, were recruited. Of them, 50 were periodontally healthy, 50 had gingivitis, and 50 had severe chronic periodontitis. After obtaining the participants' written informed consent and completing the periodontal chart, their BMI were calculated. Data were analyzed using variance analysis and Pearson's correlation coefficient. Tukey test results showed that, the mean BMI in patients with severe chronic periodontitis (28.90 kg/m²) was significantly higher than patients with gingivitis (25.81 kg/m²) and healthy individuals (23.17 kg/m²) [<0.001]. Increased BMI can be considered as an important risk factor for the occurrence of periodontal disease. It seems that there is a relationship between increasing BMI and prediction of periodontal disease.

Keywords: Body mass index, Gingivitis, Periodontitis.

Copyright @ 2019: This is an open-access article distributed under the terms of the Creative Commons Attribution license which permits unrestricted use, distribution, and reproduction in any medium for non-commercial use (NonCommercial, or CC-BY-NC) provided the original author and source are credited.

INTRODUCTION

Periodontal disease is a damaging inflammatory disease of the periodontal tissue as a result of chronic infections caused by gram-negative and gram-positive bacteria [1]. Currently, obesity is considered as the second major risk factor for periodontal disease after smoking. Smoking and obesity are two independent risk factors for periodontitis, and are considered as appropriate factors for predicting the occurrence of periodontitis [2]. The rate of obesity based on population is 35.7% in the USA [3]. Iran, with an overweight population of 62.2% and obese population of 28%, does not have a proper obesity rate [4].

In obese people, inflammation starts as a response to bacterial infection and adipose tissue. During the inflammatory process acute phase proteins (adipokine) are produced and alteration of metabolic processes such as elevation in triglyceride levels occurs. Insulin resistance may occur afterwards. The elevation of such factors in obese individuals predisposes them to cardiovascular diseases and type II diabetes mellitus [5].

Body mass index (BMI), is a common term in the field of nutrition. BMI assess whether people's weight is within the healthy range. To calculate BMI, an individual's body mass is divided by the square of height. Age is one of the most important factors associated with the ideal weight. As the age increases, the amount of stored adipose tissue naturally increases leading to a higher BMI [6].

Although BMI is generally reliable for describing the body status of men and women, it has its limitations and shortcomings. For instance, this index might incorrectly show a higher BMI for athletes and individuals with dense muscular tissue because of the higher weight of muscular tissue compared with adipose tissue. Moreover, in the elderly, this index might be incorrectly lower because of the reduction of muscular density in this age group [6]. Based on BMI, individuals are divided into the following four categories: underweight (<18.5 kg/m²), normal (18.5-24.9 kg/m²), overweight (25-29.5 kg/m²), and obese (≥ 30 kg/m²).

Dentists encounter overweight and obese people in their daily profession. Considering their metabolic systems, overweight and obese people should be monitored more carefully than other individuals [7]. Considering the increasing trend in obesity and the fact that increased BMI is an important risk factor for the occurrence of periodontal disease and based on the inconsistent results of previous studies, we aimed to assess the relationship between BMI and periodontal disease in the present study.

MATERIALS AND METHODS

In this case-control study, 150 age and sex-matched individuals with age range of 18-54 years referring to the Periodontics Department of Zahedan University of Medical Sciences were recruited from 2012. Of them, 50 were periodontally healthy, 50 had gingivitis, and 50 had severe chronic periodontitis. After obtaining the participants' written informed consent, the periodontal examination was performed for patients with gingivitis and periodontitis. Periodontal examination consisted of measuring gingival recession, periodontal pocket depth, and clinical attachment level using Williams probe with an accuracy of 1 mm. The protocol of the study was approved by the Ethics Committee of Zahedan University of Medical Sciences (no 91-1826).

The patients' weight was measured using a digital scale (Personen wage, PS07, Burer, Germany) with an accuracy of 0.1 kg. Their height was measured using a stature meter fixed vertically on the wall with an accuracy of 0.01 mm. The participants' BMI was also calculated.

The diagnostic criteria for gingivitis were redness, severe inflammation, and gingival bleeding during probing. Also, in probing, a pocket depth of >3 mm should not be observed. The diagnostic criteria for severe chronic periodontitis included inflammation, bleeding during probing, and deep periodontal pockets and attachment loss ≥ 5 mm. Healthy individuals did not have any clinical signs of gingival inflammation or periodontal pocket formation and the calculated plaque index for these individuals, using the O'Leary plaque index, was less than 20%. Patients diagnosed as aggressive periodontitis were excluded from the study.

Individuals who suffered from systemic diseases such as diabetes mellitus, cardiovascular diseases and hypertension, individuals with a history of

smoking or use of medication, and pregnant women were also excluded from the study. To meet ethical considerations, necessary treatment was done for the patients with periodontal disease including scaling and root Planning and surgery.

SPSS software, version 18, was used for data analysis. Mean and standard deviations were calculated for data description. Variance analysis (Tukey test), Pearson's correlation coefficient, and independent *t* tests were used as appropriated.

RESULTS

In this study, the participants were matched for age, sex, and number of the participants in each group [tables 1 and 2]. The mean \pm SD age of the participants in the study was 35.29 \pm 10.66 years.

We did not find a significant relationship between the three groups with respect to the participants' mean BMI and sex ($P=0.29$) [table 3]. Moreover, we did not find a significant relationship between the men and women with respect to the mean severity of chronic periodontitis ($P=0.31$) [table 4].

Table 5 shows the frequency distribution of BMI in three groups. Tukey test results showed a significant difference in the mean BMI of the patients with severe chronic periodontitis comparing the patients with gingivitis and healthy individuals. Also, a significant relationship was found between the mean BMI of patients with gingivitis and healthy individuals [table 6].

We found a significant relationship between the age of the patients with severe chronic periodontitis and severity of the disease ($P<0.001$, $r=0.82$) as well as their BMI and severity of the disease ($P<0.0001$, $r=0.74$, Pearson's correlation coefficient). As the age and BMI of the patients increased, the severity of periodontitis also increased [table 7].

In patients with severe chronic periodontitis, after assessing the BMI in different age groups, we found that as their age increased, their BMI also increased significantly [table 8]. However, this trend was not significant in patients with gingivitis, although their BMI also increased with age ($P=0.81$). No significant difference was found between the mean BMI of healthy individuals of different age groups ($P=0.52$) [table 8].

Table-1: Frequency of the participants in each age group

Age group (years)	Frequency	Percentage
18-24	36	24
25-34	36	24
35-44	36	24
45-54	42	28
Total	150	100

Table-2: Comparison of the three study groups with respect to sex and age

Variable		Periodontitis (n=50)	Gingivitis (n=50)	Healthy (n=50)	P Value
Sex	Men (n=25)	25(16.66)	25(16.66)	25(16.66)	
	Women (n=25)	25(16.66)	25(16.66)	25(16.66)	
Age (Mean±SD)		35.08±10.53	35.34±10.88	35.45±10.80	0.98

Table-3: Mean±SD BMI in the three study groups based on sex

Group	Men (n=25)	Women (n=25)	Total	Total Min.	Total Max.	P value
Healthy (n=50)	22.79±2.11	23.55±1.71	23.17±1.94	19.61	27.71	0.29
Gingivitis (n=50)	26.38±2.50	25.24±2.05	25.81±2.34	21.30	30.37	0.21
Periodontitis (n=50)	28.81±2.66	28.99±2.73	28.90±2.67	21.88	33.20	0.81

Table-4: Mean±SD severity of periodontitis in patients with severe chronic periodontitis based on sex (independent t test)

Severity		Mean (%)	SD	Min. (%)	Max. (%)	P value
Sex	Men	22.70	15.19	3.33	56.52	0.31
	Women	23.60	13.62	3.13	61.90	
	Total	23.15	14.28	3.13	61.90	

Table-5: BMI distribution in the three study groups based on frequency (%)

Groups	Normal	Overweight	Obese	Total
Periodontitis (n=50)	5(10)	23(46)	22(44)	50(100)
Gingivitis (n=50)	21(42)	28(56)	1(2)	50(100)
Healthy (n=50)	43(86)	7(14)	0(0)	50(100)
Total	69(46)	58(37.8)	23(15.3)	50(100)

Table-6: Comparing the mean BMI in the three study groups

Group	Mean (%)	SD	Min. (%)	Max. (%)	P value
Periodontitis (n=50)	28.90	2.67	21.88	33.20	0.001
Gingivitis (n=50)	25.81	2.34	21.30	30.37	
Healthy (n=50)	23.17	1.94	19.61	27.71	

Table-7: Pearson's correlation results based on the assessed indices

Relationship	Age	BMI	Severity
Age		r=0.63 p=0.23	r=0.82 p<0.0001
BMI	r=0.63 p=0.23		r=0.74 p<0.0001
Severity	r=0.82 p<0.0001	r=0.74 p<0.0001	

Table-8: Assessing different age groups with respect to their mean BMI

Groups		Frequency	Mean	SD	Min. (%)	Max. (%)	P value
Severe chronic periodontitis	18-24	12	26.40	2.1	21.88	40.30	<0.001
	25-34	12	29.11	2.13	63.25	37.32	
	35-44	12	29.71	2.68	51.24	20.33	
	45-54	14	30.16	2.26	17.24	11.33	
	Total	50	28.9	2.67	21.88	20.33	
Gingivitis	18-24	12	23.99	1.67	21.30	26.61	0.81
	25-34	12	25.74	2.18	22.21	29.74	
	35-44	12	26.43	2.08	23.31	30.37	
	45-54	14	26.92	2.42	22.21	29.74	
	Total	50	25.81	2.34	21.30	30.37	
Healthy	18-24	12	21.48	1.48	19.71	24.80	0.52
	25-34	12	22.84	1.28	19.61	24.53	
	35-44	12	23.66	2.05	19.97	26.88	
	45-54	14	24.50	1.59	22.23	27.71	
	Total	50	23.17	1.94	19.61	27.71	

DISCUSSION

We found that increased BMI can be considered as an important risk factor for the periodontal disease occurrence. It seems that there is a relationship between increasing BMI and prediction of periodontal disease, but more studies with extended sample size should be undertaken. Also performing longitudinal studies help clarifying this relationship.

Obesity is a multi-dimensional subject that could create destructive social and health-related problems. Obesity is not only considered as a complication contributing to the severity of other systemic diseases but it is also effective in the occurrence of periodontal diseases [8].

In our study, we found that patients with severe chronic periodontitis had a significantly higher BMI than those with gingivitis and healthy individuals. This finding was consistent with some other previous studies [9-12]. Moreover, patients with gingivitis also had significantly higher BMI than healthy individuals which was inconsistent with another study that did not find a significant relationship between gingivitis and BMI [11]. Since our groups were matched, further studies should be done to confirm any relationship between gingivitis and BMI.

We found a positive relationship between age and BMI only in the group of patients with severe chronic periodontitis. Our finding was consistent with that of Reeves and colleagues [13] which showed that, with increasing age, BMI also increased in patients with periodontitis. Our finding was inconsistent with Zahrani and colleagues' study [14] that showed a significant relationship between BMI and periodontal disease in the 18-34 year age group, but not in the middle-aged and elderly. These differences could be attributed to the different research designs of the mentioned studies.

In our study, no significant difference was found between the three groups with respect to sex, which is inconsistent with another report. Dalla Vecchia and co-workers [15] found no significant relationship between the occurrence of periodontal disease in men with normal BMIs and obese men, while overweight and obese women suffered from periodontal disease more than women with normal BMIs. Our study showed that even people with normal BMI can suffer from periodontal disease [16]. This finding could be attributed to the lack of oral hygiene, poor economic status, and existence of microbial plaque that are effective in the occurrence of periodontal disease. In other words, although increased BMI is a major risk factor for periodontal disease, it is not the only risk factor for periodontal disease. Increased BMI, alongside the other risk factors, can increase the risk of periodontal disease.

CONCLUSION

There is a significant relationship between increasing BMI and prediction of periodontal disease. Dentists confront obese people every day and obesity is the most common nutritional problem leading to many other complications including periodontitis and systemic diseases such as cardiovascular disease and metabolic syndrome. Therefore dentists can inform obese individuals about the higher risk of periodontal disease and encourage them to follow a healthy nutritional lifestyle in order to reach their ideal weight.

Acknowledgements

We would like to thank the personnel of the Periodontology Department of Dental School and the Health Promotion Research Center of Zahedan University of Medical Sciences for their kind assistance.

REFERENCES

1. Heidari Z, Mahmoudzadeh-Sagheb H, Hashemi M, Ansarimoghaddam S, Sheibak N. Estimation of volume density of interdental papilla components in patients with chronic periodontitis and interleukin-6 (-174G/C) gene polymorphisms. *Dental research journal*. 2016 Mar;13(2):139.
2. Nishida N, Tanaka M, Hayashi N, Nagata H, Takeshita T, Nakayama K, Morimoto K, Shizukuishi S. Determination of smoking and obesity as periodontitis risks using the classification and regression tree method. *Journal of periodontology*. 2005 Jun 1;76(6):923-8.
3. Centers for Disease control and prevention. 2011; CDC home [last accessed 2011 April 11]. Available from: <http://www.cdc.gov/obesity/data/adult.html>.
4. Bahrami H, Sadatsafavi M, Pourshams A, Kamangar F, Nouraei M, Semnani S, Brennan P, Boffetta P, Malekzadeh R. Obesity and hypertension in an Iranian cohort study; Iranian women experience higher rates of obesity and hypertension than American women. *BMC public health*. 2006 Dec;6(1):158.
5. Basklin ML, Ard J, Franklin F, Allison DB. National prevalence of obesity: Prevalence of obesity in the united states. *Obesity Reviews*. 2005; 6, 5 – 7.
6. Kopelman PG. Obesity as a medical problem. *Nature*. 2000; 404,635-43.
7. Alm A, FÅhraeus C, WENDT LK, Koch G, ANDERSSON-GÄRE BO, Birkhed D. Body adiposity status in teenagers and snacking habits in early childhood in relation to approximal caries at 15 years of age. *International journal of paediatric dentistry*. 2008 May;18(3):189-96.
8. Dahiya P, Kamal R, Gupta R. Obesity, periodontal and general health: The Relationship and management. *Indian journal of endocrinology and metabolism*. 2012 Jan;16(1):88.

9. Sarlati F, Akhondi N, Etehad T, Neyestani T, Kamali Z. Relationship between obesity and periodontal status in a sample of young Iranian adults. *International dental journal*. 2008 Feb 1;58(1):36-40.
10. Khader YS, Bawadi HA, Haroun TF, Alomari M, Tayyem RF. The association between periodontal disease and obesity among adults in Jordan. *Journal of clinical periodontology*. 2009 Jan;36(1):18-24.
11. Salekzamani Y, Shirmohammadi A, Rahbar M, Shakouri SK, Nayebi F. Association between human body composition and periodontal disease. *ISRN dentistry*. 2011 Nov 2;2011.
12. Saito T, Shimazaki Y, Koga T, Tsuzuki M, Ohshima A. Relationship between upper body obesity and periodontitis. *Journal of dental research*. 2001 Jul;80(7):1631-6.
13. Reeves AF, Rees JM, Schiff M, Hujoel P. Total body weight and waist circumference associated with chronic periodontitis among adolescents in the United States. *Archives of pediatrics & adolescent medicine*. 2006 Sep 1;160(9):894-9.
14. Al-Zahrani MS, Bissada NF, Borawski EA. Obesity and periodontal disease in young, middle-aged, and older adults. *Journal of periodontology*. 2003 May 1;74(5):610-5.
15. Dalla Vecchia CF, Susin C, Rösing CK, Oppermann RV, Albandar JM. Overweight and obesity as risk indicators for periodontitis in adults. *Journal of periodontology*. 2005 Oct;76(10):1721-8.
16. Mathur LK, Manohar B, Shankarapillai R, Pandya D. Obesity and periodontitis: A clinical study. *Journal of Indian Society of Periodontology*. 2011 Jul;15(3):240.