

Association of Obesity with Periodontal Indices: A Cross Sectional Research Study

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Abstract

Introduction: Periodontitis is an inflammatory condition that affects the supporting tissue of teeth and has been associated with obesity in various researches. The objective of this study was to observe an association between obesity and different periodontal indices.

Materials and Methods: This cross-sectional study using non-probability convenience sampling technique was conducted at the Department of Periodontology, Fatima Jinnah Dental College and Hospital after ethical approval. Total 343 dental out-patients between 20 - 75 years of age of either gender, with/without any past medical history pregnant or lactating patients who were below 20 years of age were excluded.

Association of obesity with Basic Periodontal Examination Index, Bleeding Index, Gingival Index and Plaque Index was assessed using chi-square test. A p-value of ≤ 0.05 was considered as statistically significant.

Results: The mean age and body mass index of patients was 34 ± 12 years and 25 ± 7 kg/m². 177 (51.6%) patients were male and 166 (48.4%) were female. Majority of the enrolled patients (40%) had poor oral hygiene. More than 50% of patients were non-obese. A significant association was observed between obesity and Basic Periodontal Examination Index ($p = 0.01$) while Bleeding Index ($p = 0.05$), Gingival Index ($p = 0.7$) and Plaque Index ($p = 0.6$) were not found to be associated with obesity.

Conclusion: It was concluded in our study that obesity was associated with basic periodontal examination index. However, the relationship between obesity and bleeding index, gingival index and plaque index was insignificant. Furthermore, oral hygiene was seen to be poor in most of the cases in our study.

Keywords: Periodontitis; Obesity; Periodontal Index

Introduction

The inflammatory condition of supporting tissues of teeth is termed as periodontitis [1]. The inflammatory responses depend on multiple factors such as host immunity, systemic conditions, genetic factors, and oral hygiene [2]. Periodontitis is ranked as one of the most prevalent chronic oral diseases globally. As per W.H.O statistics, 18% of the population in Pakistan has some form of periodontal disease, in which ratio of periodontitis is 31% [3]. Moreover, the incidence of periodontitis is expected to increase more due to lack of awareness or dental education, poor oral hygiene maintenance, imbalanced dietary habits (carbohydrate rich diet) leading to obesity and consumption of smoked and smokeless tobacco products [4]. This is a major concern for health care professionals and policy-makers since periodontitis has been a potential risk for initiating systemic inflammatory conditions [5].

Obesity or excessive weight gain can be defined as conditions in which excessive fat accumulates in the body and produces adverse effect on the health of an individual. Obesity can lead to chronic diseases, which has high morbidity and mortality in the long term [6]. The incidence of obesity has increased over time, which was stated in a population-based research conducted in Brazil in 1986 where the prevalence of being overweight at 4 years of age was only 7% while in that same population at 30 years of age this rate had exponentially increased to approximately 60% [7]. The increase in obesity over-time has been seen in 1982 participants of the Pelotas Birth Cohort which may be due to dietary changes (e.g. ultra-processed food consumption) [8].

The risk of many systemic disorders, such as diabetes mellitus, cardiovascular diseases and cancer increases with obesity [9]. Systematic reviews have supported the association between obesity and periodontal disease [10,11]. This complex relationship has been explained by few mechanisms such as, decreased levels of adiponectin due to excess deposition of adipose tissues creating a reservoir for pro-inflammatory mediators that cause chronic inflammation. The underlying biological mechanisms for the association of obesity with periodontitis are not well known; however, adipose tissue-derived cytokines and hormones, may play a key role in this link by modulating periodontitis [12]. This systemic inflammation makes obese persons prone to infectious diseases by decreasing immune response a positive association between obesity and periodontitis has recently been shown in animal and human epidemiological studies [13]. Some of the factors reported, associated with obesity and periodontitis by literature, are very prevalent such as cigarette smoking and unhealthy dietary habits. After poor oral hygiene, it has been suggested that obesity is second only to smoking as the strongest risk factor for inflammatory periodontal tissue destruction [14].

Though studied earlier, there is a lack of information from middle- and low-income countries in this regard. Moreover, most of the previously reported relevant literature from Pakistan is on children and elderly people while such studies among adults are limited at best.

Objective of the Study

The objective of this study therefore was to assess the association between obesity and different periodontal indices.

Methodology

This cross-sectional study using non-probability convenience sampling technique was carried out in the Out-Patient Department of Periodontology at Fatima Jinnah Dental College and Hospital (FJDC&H). Taking the percentage frequency of the study outcome as 50% for the most liberal estimate, with 95% confidence level and 5.5% precision, the minimum required sample size was calculated to be 318 patients. Against the calculated sample size, a total of 343 patients which had reported to the periodontology department were included in the study. The inclusion criteria were dentate patients aged between 20 - 75 years, patients with or without any medical history like diabetes, hypertension, osteoarthritis and patients taking any medication regularly were included in the study. Pregnant and lactating mothers and physically and mentally challenged patients were excluded from the study.

Patients who reported to the Department of Periodontology were assessed for periodontal status under the supervision of a single examiner and their Basic Periodontal Examination (BPE) was evaluated.¹⁹ Patients' height (cm) and weight (kg) were also evaluated for calculation of body mass index (BMI). According to WHO classification, BMI less than 30 points was categorized as non-obese and BMI over 30 points marked as obese/obesity. Bleeding index was recorded according to Silness and Loe by measuring qualitative changes in the gingiva by scoring the marginal and interproximal tissues separately on a scale of 0 - 3 (0 = Normal gingiva, 1 = mild inflammation, 2 = moderate inflammation and 3 = severe inflammation).

Plaque Indices were determined by assessing the presence of plaque at the cervical margin of the tooth closest to the gingiva (scoring 0 - 3 where 0 = no plaque, 1 = a film of plaque adhering to the free gingival margin and adjacent tooth, 2 = moderate accumulation of soft

deposits within the gingival pocket, or the tooth and gingival margin, 3 = abundance of soft matter within the gingival pocket and/or on the tooth and gingival margin).

Oral hygiene index was assessed by determining the presence of plaque and calculus and combining their scores to obtain results on a scale of 0 - 6 where the average individual or group debris and calculus scores are combined to obtain the Simplified Oral Hygiene Index.

Study data was entered in SPSS version 20 and analysed statistically. Mean and SD was calculated for quantitative variables and frequency/percentages for qualitative variables. Association of obesity with Basic Periodontal Examination Index, Bleeding Index, Gingival Index and Plaque Index was assessed using chi-square test. A p-value of ≤ 0.05 was considered as statistically significant.

Results

In 343 patients, mean age and BMI was 34 ± 12 years and 25 ± 7 kg/m² respectively, 51.6% (n = 177) of them were males while the rest were females. Diabetes and hypertension was observed in 20 (5.8%) and 28 (8.2%) patients respectively. Oral hygiene was maintained occasionally, once daily and twice daily in 56 (16.3%), 178 (51.9%) and 109 (31.8%) respectively. Oral hygiene status was maintained as good, moderate and bad in 74 (21.6%), 131 (38.2%) and 138 (40.2%) respectively (Table 1).

Variables		Mean \pm SD/n (%)
Age (years)		34 \pm 12
BMI (kg/m ²)		25 \pm 7
Group	10 - 19 years	22 (6.4%)
	20 - 30 years	129 (37.6%)
	31 - 40 years	97 (28.3%)
	41 - 50 years	53 (15.5%)
	51 - 60 years	28 (8.2%)
	61 - 70 years	13 (3.8%)
	71 - 80 years	1 (0.3%)
Gender	Male	177 (51.6%)
	Female	166 (48.4%)
Medical History	Hypertension	28 (8.2%)
	Diabetes	20 (5.8%)
	Hepatitis B	10 (2.9%)
	Drugs	9 (2.6%)
	Hepatitis C	2 (0.6%)
	Hypothyroidism	1 (0.3%)
Oral Hygiene	Occasionally	56 (16.3%)
	Once daily	178 (51.9%)
	Twice daily	109 (31.8%)
Oral Hygiene Status	Good	74 (21.6%)
	Moderate	131 (38.2%)
	Bad	138 (40.2%)
Habits	Chalia	45 (13.1%)
	Smoking	44 (12.8%)
	Pan	24 (7.0%)
	Naswar	10 (2.9%)
	None	220 (64.1%)
Stress	Yes	105 (30.6%)
	No	238 (69.4%)
Obesity	Non obese	176 (51.3%)
	Pre obese	62 (18.1%)
	Obese	105 (30.6%)

Table 1: Descriptive analysis of the patients (n = 343).

Among all the indices studied, only basic periodontal examination index was found to be significantly associated with obesity of the patients ($p = 0.01$) where non-obese patients were more likely to have lower scores while those who were obese or pre-obese were more likely to have higher score on basic periodontal examination index (Table 2).

Variables		Non-Obese n (%) (n = 176)	Obesity n (%) (n = 105)	Pre-Obesity n (%) (n = 62)	p-value
Basic Periodontal Examination Index	0	21 (48.8%)	9 (20.9%)	13 (30.2%)	0.01
	1	80 (56.3%)	23 (16.2%)	39 (27.5%)	
	2	60 (55.0%)	13 (11.9%)	36 (33.0%)	
	3	15 (30.6%)	17 (34.7%)	17 (34.7%)	
Bleeding Index	0	30 (58.8%)	10 (19.6%)	11 (21.6%)	0.05
	1	51 (50.0%)	19 (18.6%)	32 (31.4%)	
	2	41 (53.9%)	7 (9.2%)	28 (36.8%)	
	3	39 (53.4%)	12 (16.4%)	22 (30.1%)	
	4	14 (36.8%)	14 (36.8%)	10 (26.3%)	
	5	1 (33.3%)	0 (0.0%)	2 (66.7%)	
Gingival Index	0	26 (53.1%)	9 (18.4%)	14 (28.6%)	0.7
	1	69 (54.3%)	18 (14.2%)	40 (31.5%)	
	2	53 (51.5%)	22 (21.4%)	28 (27.2%)	
	3	25 (46.3%)	10 (18.5%)	19 (35.2%)	
	4	3 (30.0%)	3 (30.0%)	4 (40.0%)	
Plaque Index	0	9 (75.0%)	1 (8.3%)	2 (16.7%)	0.6
	1	42 (46.7%)	21 (23.3%)	27 (30.0%)	
	2	50 (47.6%)	19 (18.1%)	36 (34.3%)	
	3	43 (55.1%)	12 (15.4%)	23 (29.5%)	
	4	27 (58.7%)	7 (15.2%)	12 (26.1%)	
	5	5 (41.7%)	2 (16.7%)	5 (41.7%)	

Table 2: Association of obesity with basic periodontal examination, bleeding, gingival and plaque index.

Discussion

In a study conducted by Giri DK, *et al.* out of 323 individuals, 112 were found as obese and 54 (48%) had periodontal diseases. They reported that Plaque Index (PI) was not related with periodontal disease ($p = 0.7$) as lower plaque scores were observed in majority of the obese individuals with periodontitis [17]. Among all obese individuals, only 16 had moderate to severe gingivitis where majority having a low Gingival Index (GI) score were periodontally healthy, having a substantial difference ($p = 0.008$) [17]. In line with results reported by Giri DK, *et al.* our study didn't find any association between obesity with bleeding index, plaque status and gingival index [17].

Study results showed a significant association between obesity and basic periodontal examination index. Amin HE has reported a significant co-relation between obesity and periodontal disease with respect to Gingival Index (GI) and Basic Periodontal Index (BPE) in both genders aged between 20 - 26 years [18]. In females, the mean GI among normal, pre-obese and obese were significant ($p < 0.01$)

with values of 0.3, 1.0 and 1.8 respectively, while in males the mean GI was not significant ($p = 0.06$) with values of 0.5, 0.6 and 0.7 respectively [18]. In contrast to this, our study reported a non-significant difference with respect to GI among obese, pre-obese and non-obese. However, in our study we calculated the difference among all the patients regardless of the gender distribution.

In a 31-year long cohort by Nascimento GG., *et al.* it was reported that among 539 participants of the study, pre-obese participants had 11% more chance of periodontitis, while obese had 22% greater chance of periodontitis, 21% of pre-obese had high risk for BPE and Bleeding on Probing (BOP) denoted by Bleeding Index (BI) [19]. Similarly, in our study, both BPE and BI were found to be significant among obese patients as compared with pre-obese or non-obese.

Several systematic reviews suggested a link between obesity and periodontal disease and were identified as a risk factor for periodontitis development [20]. The prevalence of obesity is increasing dramatically around the globe and its association with periodontitis is a matter of attention for health-care providers to prevent these public health issues [21]. Some cross-sectional studies have shown that obese people have more periodontal disease than average weight populations and some have observed this association to be stronger as the level of obesity increases [22]. Our research found that an increase in weight / obesity showed an increase in periodontitis. A similar trend has been noted above. Some of the reviewed research indicates that excess weight, obesity, and large waist circumference can be risk factors for periodontitis or make it worse. It was predicted that obesity and the subsequent development of periodontitis have a direct connection. In turn, such studies have also established a direct relationship between overweight and periodontitis development [23,24]. Our research determined the association between obesity and periodontal disease by calculating the BMI, further research using various anthropometric obesity-related interventions to link obesity to periodontitis would help us to better understand their relation.

Most studies show a relationship between obesity and periodontal disease, signifying the link of obesity and periodontitis [14,25]. In addition, one of the studies determined an inverse relation between obesity and loss of clinical periodontal attachment has been noted [25].

These findings, however, lack a strong justification as these studies use various variables to assess obesity and periodontal disease using distinct cut-off points. Most studies reporting an association between obesity and periodontitis relied on the incidence of disease and determine the extent and severity of periodontal disease [14,26]. All studies have generally assessed anthropometric and periodontal parameters to determine the relation. Obesity was evaluated by BMI and other parameter like waist circumference, waist-hip ratio and body fat percentage. Another study actually showed an important relationship between periodontal diseases and waist circumference. Furthermore, its correlation with BMI was not significant [27]. However, in our study significant relationship of obesity with periodontitis was reported which was contradictory to above study.

The qualitative approach of our study has assured that we have assessed the extensive range of patients and their association with periodontitis. However, the study might not be immune from observer and recall bias. Considering the observations of our study and to the extent to which the periodontal indices are related to the oral hygiene of the patient, it would be enlightening to discover more facts about the disease.

Conclusion

It was concluded in our study that obesity was significantly associated with basic periodontal examination index. However, the relationship of obesity with bleeding index, gingival index and plaque index was insignificant in this study. Furthermore, majority of the patients presented with poor oral hygiene and increased weight in our study. Further studies are required to be conducted in order to find a valid association of obesity and periodontal diseases.

Conflict of Interest

None.

Ethics Approval/Disclosure

Fatima Jinnah Dental College and Hospital, FJDC&H

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Patient Consent

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Availability of Data and Materials

Department of Periodontology, FJDC&H.

Authors' Contributions

MS manuscript writing.

MS, BS, AH concept, designed.

MS, BS, AH, AJ, GA literature review.

AJ, GA editing and proof-reading of manuscript.

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