



## Original Article

# Association between Periodontal Disease and Obesity in a Sample of Libyan Adults

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## ABSTRACT

**Background:** Obesity is a growing chronic health issue all around the globe. It has a serious number of complications. It has shown through several observational and clinical trials its association with periodontal disease. Both chronic illnesses have a bidirectional relationship.

**Materials and methods:** A case control study involved 208 patients in total, 104 individuals in each group. Periodontal examination was done for both groups. Body mass index (BMI), waist circumference (WC), and neck circumference (NC) was measured by a dietician. Chi-square test and independent t-test were used to compare between the two groups. A multiple regression analysis was done to assess the relationship between multiple factors.

**Results:** The case group included obese subjects with BMI  $\geq 30$ . The control group BMI index was  $\leq 24$ . There was no significant difference between the two groups in regard to the oral hygiene measures. However, significant difference was noticed regarding periodontal parameters such as Higher Pocket depth (PD) and Clinical Attachment Loss (CAL) in the obese groups with a p-value of 0.001. Multiple regression analysis showed a significant relation between periodontal disease and the following factors; male gender, increasing in BMI, NC, and WC.

**Conclusion:** There is a relationship between obesity and periodontal disease. The higher level of BMI, WC, and NC was associated with increased prevalence of periodontal disease. Therefore, obesity is considered a high risk for periodontal disease. More awareness and education are needed among obese subjects.

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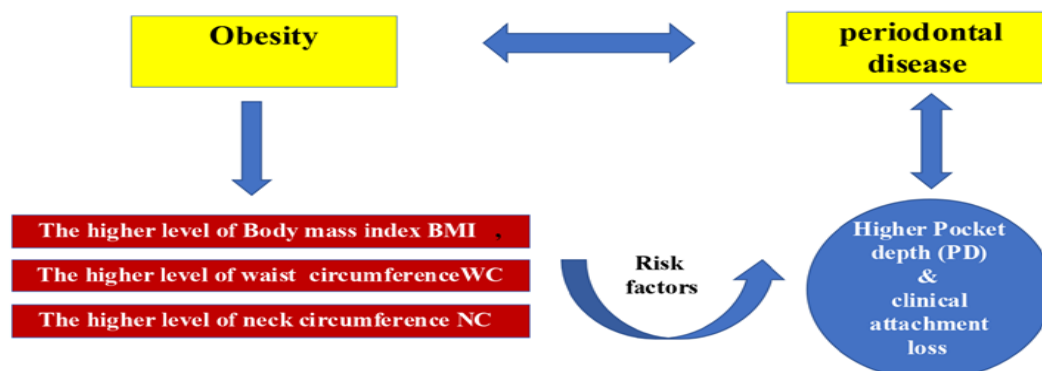
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# GRAPHICAL ABSTRACT

**The association between periodontal disease and obesity in a sample of Libyan adults.**

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## Introduction

Being obese has become a common global issue in the last decade. Obesity in general is defined by the body mass index (1), which is calculated by dividing the body weight in Kilograms (KG) and body height in meters (M). Other rising important measurements related to overweight and obese individuals are waist and neck circumference (WC and NC) [1, 2]. Measuring waist circumference is the easiest way to determine body fat distribution. However, the most accurate method to determine obesity measurements is by the assessment of body fat distribution. The latest is recorded using the dual energy x-ray absorptiometry scan [3].

The latest definition of obesity as defined by the Obesity Medicine Association which recites obesity as a "chronic, relapsing, and multifactorial illness" [4]. Periodontal disease is a chronic inflammatory disease which causes bone loss and eventually tooth loss [5]. Not only both diseases share similar characteristics such as multifactorial and periods of relapse, but also they share similar risk factors such as cardiovascular disease, smoking, and diabetes mellitus [6]. The link between the two chronic diseases has been under investigation over the last decade.

Obesity has been identified as a risk factor for multiple systemic diseases such as cardiovascular illness, diabetes, and asthma [5]. The role and pathogenesis of obesity in relation with systemic

diseases is still not clear, but could be related to lipo-inflammation [5]. This new term means that the adipose tissue in obese individuals, loses its normal structure, and behaves like an inflammatory tissue. Adipose tissue also causes immune disturbance that may affect several body organs [7]. It induces the release of certain cytokines which causes the initiation of an inflammatory process [8, 9]. In addition, the release of inflammatory cytokines were found in gingival crevicular fluid, such findings suggest the link between obesity and periodontal disease [8, 9].

For the last few decades, many studies showed a relationship between obesity and periodontal disease. Multiple clinical trials documented the presence of the link between the two chronic diseases despite the difference in periodontal disease definition which is used in these studies [10-12]. One of the classical studies demonstrated that there was a strong association between obesity and periodontal disease in younger adults' age range between 18 and 34 years old. The later study showed that the prevalence of periodontal disease was 76% among the youngsters who had large (WC) [10].

The aim of this study is to examine the relation between obesity and periodontal disease in a sample of Libyan adults.

## Materials and methods

This study is a case-control study that took place in a private obesity center (Diet center) between December 2020 and November 2021. Ethical approval was gained by the Medical Ethical Committee in Benghazi University. A total of 208 individuals completed the study, were each of the case and control groups had 104 patients. All patients were informed of the nature of the study and consent was gained from all participants.

### Inclusion criteria

- 1- Libyan patients,
- 2- All subjects were systemically healthy and fell in the age group ranging from 20-65 years old, and
- 3- Both genders were included in this study.

### Exclusion criteria

- 1- Patient who had received periodontal treatment or antibiotics for at least 3 months prior to study,
- 2- Chronic usage of anti-inflammatory drugs and premedication within 3 months prior to study,
- 3- Patients who require prophylactic antibiotic coverage,
- 4- Physically and mentally challenged patients,
- 5- Pregnant women, lactating mother, and women who use oral contraceptive pills,
- 6- Patients who smoker, and
- 7- Diabetic patients.

History was taken from each group by both a general dentist and a dietician. The history was gained through a structured interview questionnaire, which is divided into two parts. First part included demographical status; age, nationality, gender, level of education, and medical history. The second part was about the daily practice of oral hygiene (index I), and then patients were seen by a dietician to record their weights and heights to measure the BMI, and their neck and waist circumferences.

Following that, full mouth periodontal probing depth and clinical attachment loss (CAL) was recorded at six sites for each tooth using Michigan o probe with William's calibration by two periodontists using UCLA periodontal chart

(Index I). Periodontal disease is diagnosed if two sites with detectable interproximal attachment loss  $\geq 2$  of unadjacent teeth, or buccal or oral CAL  $\geq 3$  mm are detectable at  $\geq 2$  teeth, the observed CAL cannot be ascribed to non-periodontal causes as tooth related factors. Final diagnosis was put according to the total sites involved with CAL and CAL severity for each patient. Patients were given oral hygiene instructions and informed of their periodontal condition to receive proper treatment.

### Statistical analysis

Data were fed to the computer using IBM SPSS software package version 24.0. Qualitative data were described using number and percent. Quantitative data were described using mean and standard deviation for normally distributed data. Comparison between different groups regarding categorical variables was tested using Chi-square test. Quantitative data were described using mean and standard deviation for normally distributed data. For normally distributed data, comparison between two independent populations were done using independent t-test. Significance test results are quoted as two-tailed probabilities. Significance of the obtained results was judged at the 5% level. Regression analysis enables the identification and characterization of relationships among multiple factors. It also enables the identification of risk factors and the calculation of risk scores for periodontal disease.

## Results and Discussion

This study was carried out on 208 cases, divided into two groups, 104 in each group. The case group included obese subjects with BMI at least 30, they were further classified as three classes, which were: Class I obese those with (BMI between 30 and less than 35), Class II obese (BMI starting from 35 and less than 40), Class III obese (BMI starting from 40 and higher) (4). Control group included 104 normal weight subjects with BMI less than or equal 24.

Table 1 presents the dental habitats which included a visit to dentist, tooth brush technique, and frequency of its use, there were matched in

the two studied groups without significant difference ( $p > 0.05$ ).

Comparing the obese cases with normal weight cases regarding probing pocket depth, it was

found that there was a significant increase in the incidence of probing pocket depth in obese group more than the normal weight group ( $p < 0.002$ ), as presented in [Table 3](#) and [Figure 1](#).

**Table 1:** Comparison between the two groups regarding demographic data

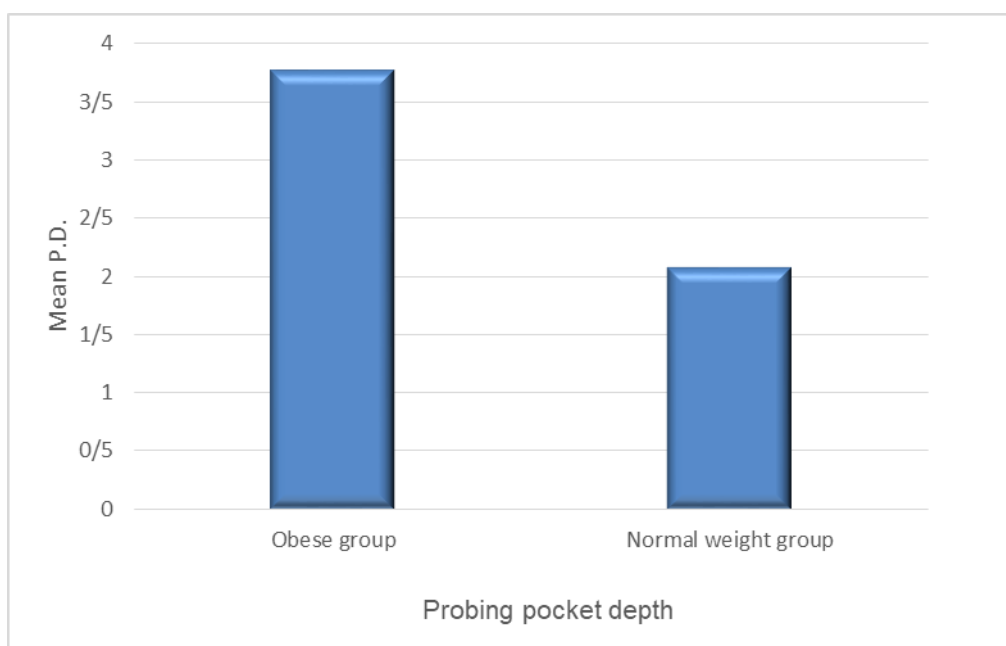
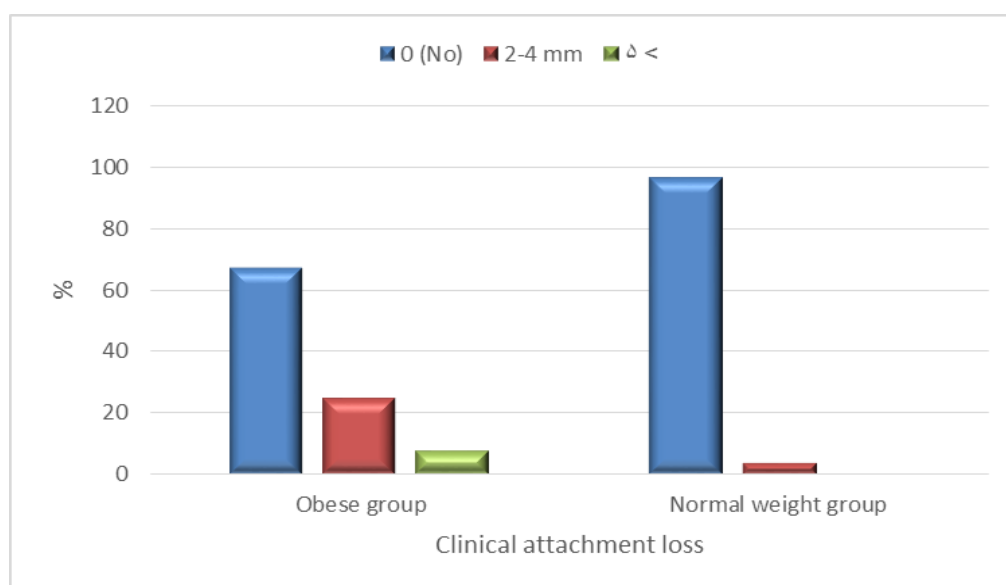
*	Obese group "n=104"	Normal weight group "n=104"	Test P-value
Age (years)			
Range	22.0-72.0	23-66.0	T=0.85
Mean±S.D.	35.5±9.38	34.1±8.96	P =0.698
Sex			
Male	33 (31.7%)	30 (28.8%)	X <sup>2</sup> =0.20
Female	71 (68.3%)	74 (71.2%)	P 0.650
Level of education			
Primary	4 (3.8%)	6 (5.8%)	X <sup>2</sup> = 0.36 P 0.588
Secondary	31 (29.8%)	38 (36.5%)	
High education	69 (66.3%)	60 (57.7%)	
BMI			
Normal weight	0	104	X <sup>2</sup> = 115.2 P 0.0001*
Class I obese	31	0	
Class II obese	48	0	
Class III obese	25	0	
Range	30.5-58.54	20.0-24.0	T= 28.9
Mean±S.D.	38.47±6.42	21.66±1.47	P = 0.001*
Waist circumference			
Range	100.0-189.0	94.0-102.0	T= 16.52
Mean±S.D.	123.2±14.65	98.5±5.1	P = 0.001*
Neck circumference			
Range	42.0-65.0	34.0-47.0	T= 14.8
Mean±S.D.	51.2±5.7	42.9±4.1	P = 0.001*

**Table 2:** Comparison between the two groups in dental habits

	Obese group "n=104"		Normal weight group "n=104"		X <sup>2</sup> test P-value
	No.	%	No.	%	
Visit to dentist					
Regular	9	8.7	11	10.6	0.526 0.768
Have pain	66	63.5	68	65.4	
Other	29	27.9	25	24.0	
Tooth brush technique					
Bass	5	4.8	12	11.5	0.67 0.754
Other	96	92.3	91	87.5	
No	3	2.9	1	1.0	
Frequency of tooth brush					
0	3	2.9	2	1.9	0.91 0.58
1	40	38.5	52	50.0	
2	48	46.2	42	40.4	
3	13	12.5	8	7.7	

**Table 3:** Comparison between the two groups in Probing depth and attachment loss

	Obese group “n=104”		Normal weight group “n=104”		Test P-value
	No.	%	No.	%	
Clinical attachment loss					X <sup>2</sup> = 21.4 0.001*
0 (No)	70	67.3	100	96.2	
2-4 mm	26	25.0	4	3.8	
≥ 5	8	7.7	0	0.0	
Probing pocket depth					
Mean	3.70		2.08		T= 3.11
SD.	1.23		0.72		0.002*

**Figure 1:** Probing pocket depth for obese group and normal weight group**Figure 2:** Comparison between the two studied groups regarding loss of attachments

On the other hand, the clinical attachment loss was significantly higher in obese group more than normal weight group ( $p < 0.01$ ) [Figure 2](#). [Table 4](#) shows the multiple logistic regression analysis of different risk factors of periodontal disease, it was found that the model was significant ( $p < 0.05$ ), the most significant factors affecting on the periodontal disease was male sex, increasing in BMI, waist circumference, and neck circumference, the odd's ratio showed that the male sex increase the periodontal disease by 3.08 more than female, the BMI increase the risk of periodontal disease by 2.11 times more than normal BMI. The waist circumference and neck circumference increase the incidence of periodontal disease by 1.96 and 1.66 times more than the normal waist and neck circumference.

Being obese has a major impact on general health. It has been reported that obese people have more risk to other chronic illness such as diabetes type II, heart disease, and cerebrovascular disease [9]. The number of overweight individuals has increased dramatically over the past decade, not only in the USA and developed countries, but also primitive developed nations numbers of obese are rising [3]. Obesity and periodontal diseases are multifactorial and they share similar risk factors such as cardiovascular disease, smoking, and diabetes mellitus [3, 6]. As it is shown that both studied and control group were approximately within the same age range between 22 to 65 years old, females precipitants were more than

males. Level of education was nearly similar in both groups. According to the BMI measurement level, the obese group has been subdivided into three classes; I, II, and III. Class II obesity were the majority about 49 participants.

Comparing both groups, there was a significant difference in waist and neck circumference with a p-value of 0.001. Coming to the oral health behaviors like visit to the dentist, toothbrush technique and frequency of brushing, there was no significant difference between the two groups. This disagrees with a similar study done in Europe, which showed that the association between oral habits such as (brushing once and visiting the dentist when there is pain) is statistically significant [13].

In this study, there was a significant association between obesity and the increase in both periodontal pocket depth and clinical attachment loss ( $P$ -value=0.002 and 0.001), respectively. These results are in agreement with other previous cross-sectional case-control studies [14-16]. These studies explained that high incidence of worsening clinical periodontal parameters may cause high circulating inflammatory interleukins like IL-6 [14].

Another study explained that being obese in young age have a strong association with periodontal disease. Because this age category gain weight with age, which leads to metabolic changes that may be more stronger and cause this association to be more dominant than old individuals [10].

**Table 4.** Multiple logistic regression analysis of different risk factors for periodontal disease

Model	Unstandardized Coefficients		Standardized Coefficients	O.R.	t	Sig.
	B	Std. Error	Beta			
(Constant)	-0.738	3.225			-3.229	0.020*
Age	0.041	0.025	0.166	1.08	1.665	0.099
Sex (male)	1.495	0.522	0.298	3.08	4.866	0.005*
Level of education	0.173	0.412	0.041	1.00	0.420	0.676
BMI	-0.024	0.036	-0.065	2.11	3.952	0.016*
Waist circumference	-0.001	0.017	-0.009	1.96	3.083	0.034*
neck circumference	0.008	0.041	0.019	1.66	2.193	0.047*

*Dependent Variable: Periodontal Disease.*

*O.R. = Odd's ratio.*

During this study, we conducted a multivariable analysis with logistic regression after the adjustment of confounders to study, the relation

between periodontal disease and different risk factors. The analysis revealed a significant relation between periodontal disease and male



gender, high BMI index, and waist and neck circumference. Similar results were published by the longitudinal study in Japan which presented that the higher BMI index, the more likely the individual to develop periodontal disease and it was statistically significant as reported [15]. In contrast to a study conducted on Finnish adult obese patients where the results failed to show any association between the increase of body weight and periodontal disease, although it showed that the participants had deeper pockets when compared to baseline [17].

A longitudinal study on the UK obese individuals over a five years period, demonstrated a high statistical significance between the association of obesity with periodontal disease [18], and as mentioned by the latest study that high BMI index in early life is not an indicator of periodontal disease in the later life [18].

Similar to this study, there was an association between periodontal disease and WC, another Finnish case-control study showed the same relation between the BMI, WC, and periodontal infection [19]. In a recent systemic review, it was mentioned that there is a strong link between obesity and periodontal disease despite the pathophysiological mechanism is not clear [20, 21].

### Limitation of the study

The number of the samples could be raised for more precise results that would be an honest reflection of the existing relation between periodontal disease and obesity. A longitudinal design would help in observing the progression of periodontal disease among the obese individuals.

### Conclusion

It is concluded that there is a relationship between periodontal disease and obesity. As both conditions share inflammatory pathways, obese people show deeper periodontal pockets and increase in CAL when compared to normal weight individuals.

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No potential conflict of interest was reported by the authors.

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### Authors' Contributions

All authors contributed to data analysis, drafting, and revising of the paper and agreed to be responsible for all the aspects of this work

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