



An Association between Obesity and Chronic Periodontitis: A Cross Sectional Study

1. Dr. Nisha Verlianey, 2. Dr. Bela Dave, 3. Dr. Nayana Patel, 4. Dr. Radha Vachchani, 5. Dr. Arti Dedara, 6. Dr. Harsh Panchal

¹M.D.S(PhdScholar, Gujarat University)Assistant Professor, Department of Periodontology Government Dental College and Hospital, Jamnagar, Gujarat

²M.D.S Professor and Head, Department of Periodontology, AMC Dental College, Bhalakya Mill Compound, Khokhara, Ahmedabad, Gujarat

³M.D.S Professor and Head, Department of Periodontology, Government Dental College and Hospital, Jamnagar, Gujarat

⁴M.D.S Assistant Professor, Department of Periodontology Government Dental College and Hospital, Jamnagar, Gujarat

^{5,6}Post Graduate Student Department of Periodontology Government Dental College and Hospital, Jamnagar, Gujarat

Date of Submission: 20-01-2025

Date of Acceptance: 30-01-2025

ABSTRACT: One of the main factors impacting overall health is obesity, a disease brought on by abnormal or excessive fat buildup. WHO defines obesity when the Body Mass Index(BMI) is at least 30 kg/m² and BMI for tells obesity related disease risks in a population. Chronic Periodontitis is a multifactorial infectious disease of tooth supporting structures resulting in increased inflammatory burden on the periodontal soft tissues thereby leading to tooth mobility and mortality.

OBJECTIVE: To establish the significance of the association between obese patients & chronic periodontitis. **METHODOLOGY:** 900 patients visiting the OPD of the Department of Periodontology at GDC Jamnagar were enrolled after informed consent and necessary data was collected in detailed manner with demographic data, chief complaint and comprehensive periodontal examination by a single examiner. 20-65 aged individuals having at least 20 teeth present were examined for Probing Pocket Depth, Clinical Attachment Levels, Gingival Index and Plaque Index. Non-Invasive data assessed was, Body fat percentage, BMI, Waist-Hip ratio and circumference.

RESULTS: Oneway Anova, Independent t test and Pearson's coefficient test analysed the data to find no statistical significance for this study.

CONCLUSION: Within the constraints of this study, we found no correlation between obesity and, However within the scope and the limitations of this study, we could observe that the presence of periodontitis was almost the same in obese as well as non-obese patients. This could be attributed to high plaque index scores, presence of habit and/or poor socio-economic status of the patients.

KEYWORDS: Body Mass Index(BMI), Body fat percentage, Waist-Hip ratio and circumference, chronic periodontitis

KEYWORDS: Body Mass Index(BMI), Body fat percentage, Waist-Hip ratio and circumference, chronic periodontitis

I. INTRODUCTION

Excessive fat storage is the cause of obesity, a complex disorder impacted by genetic, behavioral, psychological, social, cultural, and metabolic variables. Chronic periodontal disease, a prevalent condition affecting the human oral cavity, is a bacterial disease marked by changes in the composition of micro biota in the plaque biofilms and host-driven breakdown of periodontium of the teeth. [1,2] The severity of periodontal disease increases with age so it is crucial to manage risk factors in younger populations to prevent its occurrence. [3] There is an association between systemic diseases like uncontrolled diabetes, cardiovascular diseases and low birth weight with periodontitis, impacting both its onset and progression.[2]

Obesity or overweight as a disease characterized by excessive body fat accumulation, potentially impairing overall health as mentioned by World Health Organization (WHO).[4] An individual is classified as obese -with at least 30.0 kg/m² body mass index (BMI), and overweight (OW) if their BMI falls between 25–29.9 kg/m². BMI within 19–24.9 kg/m² indicates a normal weight range. Obesity-related health risk in populations is measured with the help of body mass index, that is obtained by dividing kilogram body weight by the height in square meters (kg/m²).[5,6].



The pattern of fat storage and distribution is also significant. The central obesity, of fat stored around visceral tissues, is associated with cardiovascular disease. [4],also called apple-shaped obesity in contrast to pear-shaped obesity where fat is stored subcutaneously. Body fat distribution can be assessed by waist circumference (WC), with risk thresholds of 102 cm for males and 88 cm for females.[7]

Currently, obesity is a major contributor to mortality and is linked to various diseases, including diabetes mellitus, certain cancers, dental caries, and periodontal diseases.[8] Studies have shown a correlation between obesity or overweight and periodontitis, with some indicating a positive moderate association, [9,10,11,12] while others report no link between the two.[13,14] Limited research exists on the relationship between obesity and periodontitis within India, which led this study which aims to assess the relationship between obesity, its determining factors, and periodontitis in this population.

II. MATERIALS AND METHODS

The participants of the study were enrolled from the Department of Periodontology, Government Dental College and Hospital Jamnagar, Size of the sample was calculated to 900 people. The study was approved by the Institutional ethics committee of Shree M.P. Shah Medical College & Guru Gobind Singh hospital, Jamnagar with Project No.

85/01/2023. The participants were educated regarding the study purpose and a written

informed consent were taken. In the selection criteria patients were included who were aged between 20-65 years, with at least 20 teeth in the mouth and no systemic diseases. Patient who had taken antibiotics or periodontal treatment within the duration of 6 months, mentally and physically challenged, and those who are pregnant or nursing were excluded. All patients are enrolled in the study after complete information and informed consent forms are duly filled. The investigator gathered sociodemographic data including age, gender, height, weight in the case record sheet. The percentage of body fat, waist circumference and hip circumference were recorded to get the waist-hip ratio. Periodontal status were assessed by measuring the probing pocket depth, clinical attachment level, plaque index and gingival index. Obesity was classified as class 1 ,2 and 3 with the BMI range 30-34.9,35-35.9 and >40.[5].

Based on the waist circumference,>0.90 for males, and >0.85 for females [5,9]. Body fat percentage was higher for values ≥ 25 for males and ≥ 32 for females. [5,10] Periodontitis was present when ≥ 4 teeth in one site or more with clinical attachment level ≥ 3 mm and probing pocket depth ≥ 4 mm. [9,15] Full mouth periodontal condition was evaluated by gingival index, plaque index, pocket probing depth and clinical attachment level.

III. STATISTICAL ANALYSIS

Unpaired or independent t-test ,one-way ANOVA, post hoc tests and Pearson's correlation coefficient(r) were used as the statistical analysis of this study

IV. RESULTS (TABLES)

	STAGE II GRADE B PERIODONTITIS	STAGE GRADE PERIODONTITIS	III STAGE B GRADE PERIODONTITIS	III STAGE C PERIODONTITIS	TOTAL
NO N-OBESE	250	198	4		452
CLASS I OBESE	164	145	3		312
CLASS II OBESE	64	45	4		113
CLASS III OBESE	13	10	0		23
TOTAL	491	398	11		900

CHISQUARE TEST ANALYSIS	VALUE	DEGREE OF FREEDOM	PVALUE
X ² Test	7.91	8	0.443
Sample size=900			



Different stages of periodontitis and Bodyfat%	Pearson's r	0.041
	Degree of freedom	897
	Pvalue	0.221
	Spearman's rho	0.021
	Degree of freedom	897
	Pvalue	0.522

Different stages of periodontitis & Body Mass Index Value	Pearson's r	-0.015	0.314
	Degree of freedom	897	897
	Pvalue	0.650	<0.001
	Spearman's rho	-0.002	0.293
	Degree of freedom	897	897
	Pvalue	0.956	<0.001

V. DISCUSSION

There is a link between chronic periodontitis and obesity as well as over-weight because both the diseases increase the susceptibility of the host by increasing burden of the inflammatory mediators responsible for periodontal breakdown[13,18,19]. Cytokines which are pro inflammatory in nature like IL-1, IL-6 and TNF- α have a direct impact on the periodontium, whereas a reciprocal association is observed with antioxidant.[13,19] According to Genco et al.,[20] obesity is associated with elevated plasma TNF- α levels, proceeding to a hyper inflammatory state and subsequent destruction of tissue.

Studies by Bhola et al.[21] and Rivera et al.[22] included larger sample sizes. Of the participants in this study, 203(64%) were male and 114 (36%) were female. Saito et al. [11] (2001) reported that obesity was more prevalent among males, while Anaet al.[23](2016) found it more common in females. The mean participant age was 41.05 ± 10.8 years, aligning with findings by Mathur et al.[10] and Al-Zahrani et al. [19] This study utilized BMI to assess and categorize obesity. Although several methods exist for evaluating obesity, BMI is widely used.[3,9,11,24,25] The WHO has also recognized BMI as a valuable population-level measure of overweight and obesity for both sexes across adult age groups. Based on BMI values, participants in this study were classified to those with normal weight having $<24.9 \text{ kg/m}^2$, overweight or pre-obese with $25\text{--}29.9 \text{ kg/m}^2$, and obese who have $>30 \text{ kg/m}^2$,[5] with

further categorization of obese individuals into Classes 1, 2, and 3 per WHO standards. Within the obese group, 16.4% were classified as overweight, 2.8% as obese class 2, 1.6% as obese class 3, and the majority (79.2%) as Class 1 obese. Few studies have categorized obese individuals this way, though Pataro et al.[25] have used a similar classification in research involving obese women.

A correlation was observed between BMI and various periodontal parameters, with higher BMI significantly linked to increased probing pocket depth (PPD). This aligns with research by Nishida et al.,[26] which confirmed a positive association between obesity and periodontitis, a finding also supported by Vecchia et al.[27] and Al-Zahrani et al.[19]

The adipose tissue in non-obese individuals has 5-10% macrophages compared to 60% infiltration in obese individuals which explains the biological plausibility of mechanism of action in higher BMI individuals.[4] The adipocytes in the adipose tissue secrete adipokines which locally and systematically up regulate inflammation and fat metabolism and influence the liver muscles and endocrines. This makes the adipose tissue an active endocrine organ.[4,18]

Conversely, Goodson et al.[28] suggested a role for oral bacteria in obesity through three potential mechanisms. First, oral bacteria may increase metabolic efficiency, as posited by the "infect obesity" hypothesis, where small calorie imbalances could result in weight gain.[28] Second, oral bacteria might stimulate appetite, leading to



increased food intake. Third, elevation of elevated TNF- α levels or reduce adiponectin levels by the oral bacteria, can potentially foster insulin resistance and altering energy metabolism.[28]

This study also defined obesity using body fat percentage (BF%), with WHO recommending a cutoff of >25% for men and >35% for women. Khader et al.[9] and Saxlin et al.[29] have also included BF% in defining obesity. Here, they found a significant relation between with increased PPD and clinical attachment loss (CAL) as well as with plaque index (PI) and gingival index (GI) with BF%.

TNF- α media test heosteo last stimulation and formation and the host response to periodontal pathogens which leads to connective tissue degradation and alveolar bone destruction. IL-6 has been linked to periodontitis; however, its pro- and anti-inflammatory effects complicate this association.[20]

Additionally, parameters such as waist circumference (WC) and waist-to-hip ratio (WHR) used to describe obesity. Studies have reported various findings regarding WC, with Khader et al.[9] reporting 42.5%, Han et al.[12] 30%, and Gorman et al.[30] 9% HWC. In some studies, abdominal obesity measures like WC and WHR have shown stronger associations with periodontal disease than BMI.

Within constraints of this study, we found no correlation between obesity and chronic periodontitis. Genetic factors, oral health habits (such as flossing and tooth brushing), dietary habits and psychosocial aspects were not included in this analysis.

VI. CONCLUSION

Within constraints of this study, we found a clear relation between obesity and chronic periodontitis, however within the scope and the limitations of this study, we could observe that the presence of periodontitis was almost same in obese as well as non-obese patients. This could be attributed to high plaque index scores, presence of habit and/or poor socio-economic status of the patients.

REFERENCES

- [1]. Scannapieco FA. Position paper of the American Academy of Periodontology: Periodontal disease as a potential risk factor for systemic diseases. *J Periodontol.* 1998;69:841–50. [PubMed:9706864]
- [2]. Ekuni D, Yamamoto T, Koyama R, Tsuneishi M, Naito K, Tobe K. Relationship between body mass index and periodontitis in young Japanese adults. *J Periodontol Res.* 2008;43:417–21. [PubMed: 18942190]
- [3]. Chaffee BW, Weston SJ. Association between chronic periodontal disease and obesity: A systematic review and meta-analysis. *J Periodontol.* 2010;81: 1708–24. [PMCID: PMC3187554]
- [4]. [PubMed:20722533]
- [5]. Nascimento GG, Seerig LM, Vargas-Ferreira F, Correa FO, Leite FR, Demarco FF. Are obesity and overweight associated with gingivitis occurrence in Brazilian schoolchildren? *J Clin Periodontol.* 2013;40:1072–8. [PubMed: 24118092]
- [6]. World Health Organization. Obesity: Preventing and Managing the Global Epidemic. Report of a WHO Consultation. World Health Organization Technical Report Series 894. World Health Organization. 2000:1–252. [PubMed: 11234459]
- [7]. Gerber FA, Sahrman P, Schmidlin OA, Heumann C, Beer JH, Schmidlin PR. Influence of obesity on the outcome of non-surgical periodontal therapy – A systematic review. *BMC Oral Health.* 2016;16:90. [PMCID: PMC5010690] [PubMed:27590050]
- [8]. Amrutiya MR, Deshpande N. Role of obesity in chronic periodontal disease – A literature review. *J Dent Oral Disord.* 2016;2:1012–6.
- [9]. Gaio EJ, Haas AN, Rosing CK, Oppermann RV, Albandar JM, Susin C. Effect of obesity on periodontal attachment loss progression: A 5-year population-based prospective study. *J Clin Periodontol.* 2016;43: 557–65. [PubMed:26970086]
- [10]. Khader YS, Bawadi HA, Haroun TF, Alomari M, Tayyem RF. The association between periodontal disease and obesity among adults in Jordan. *J Clin Periodontol.* 2009; 36:18–24. [PubMed: 19046327]
- [11]. Mathur LK, Manohar B, Shankarapillai R, Pandya D. Obesity and periodontitis: A clinical study. *J Indian Soc Periodontol.* 2011;15:240–4. [PMCID: PMC3200019] [PubMed: 22110259]
- [12]. Saito T, Shimazaki Y, Koga T, Suzuki M, Ohshima A. Relationship between upper body obesity and periodontitis. *J Dent Res.* 2001;80:1631–6. [PubMed: 11597023]
- [13]. Han DH, Lim SY, Sun BC, Paek DM, Kim HD. Visceral fat area-defined obesity



- and periodontitis among Koreans. *J Clin Periodontol.*2010;37:172–9.[PubMed:20041978]
- [14]. Culebras Atienza E, Silvestre FJ, Silvestre Rangil J. Possible association between obesity and periodontitis in patients with Down syndrome. *Med Oral Patol Oral Cir Bucal.* 2018;23:e335–43.[PMCID:PMC5945240] [PubMed:29680852]
- [15]. Linden G, Patterson C, Evans A, Kee F. Obesity and periodontitis in 60-70-year-oldmen. *J Clin Periodontol.* 2007;34:461–6. [PubMed: 17403015]
- [16]. Armitage GC. Development of a classification system for periodontal diseases and conditions. *Ann Periodontol.*1999;4:1–6.[PubMed:10863370]
- [17]. Silness J, Loe H. Periodontal disease in pregnancy. II. Correlation between oral hygiene and periodontal condition. *Acta Odontol Scand.* 1964;22:121–35. [PubMed: 14158464]
- [18]. Loe H, Silness J. Periodontal disease in pregnancy. I. Prevalence and severity. *Acta Odontol Scand.* 1963;21:533–51. [PubMed: 14121956]
- [19]. Reeves AF, Rees JM, Schiff M, Hujoel P. Total body weight and waist circumference associated with chronic periodontitis among adolescents in the United States. *Arch Pediatr Adolesc Med.* 2006;160:894–9. [PubMed: 16953012]
- [20]. Al-Zahrani MS, Bissada NF, Borawski EA. Obesity and periodontal disease in young, middle-aged, and older adults. *J Periodontol.* 2003; 74:610–5. [PubMed: 12816292]
- [21]. Genco RJ, Grossi SG, Ho A, Nishimura F, Murayama Y. A proposed model linking inflammation to obesity, diabetes, and periodontal infections. *J Periodontol.* 2005;76:2075–84. [PubMed: 16277579]
- [22]. Bholra S, Varma S, Shirlal S, Jenifer HD, Gangavati R, Warad S. Assessment of association of periodontal disease status with obesity and various other factors among a population of South India. *J Obest Metab Res.* 2014;14:218–24.
- [23]. Rivera R, Andriankaja OM, Perez CM, Joshipura K. Relationship between periodontal disease and asthma among overweight/obese adults. *J Clin Periodontol.* 2016;43:566–71. [PMCID: PMC4900929] [PubMed: 27028763]
- [24]. Ana P, Dimitrije M, Ivan M, Mariola S. The association between periodontal disease and obesity among middle-aged adults periodontitis and obesity. *J Metab Syndr.* 2016;5:2167–3.
- [25]. Francis D, Raja B, Chandran C. Relationship of obesity with periodontitis among patients attending a dental college in Chennai: A cross-sectional survey. *J Indian Assoc Public Health Dent.* 2017;15:323–7.
- [26]. Pataro AL, Costa FO, Cortelli SC, Cortelli JR, Abreu MH, Costa JE. Association between severity of body mass index and periodontal condition in women. *Clin Oral Investig.*2012;16: 727–34. [PubMed: 21556849]
- [27]. Nishida N, Tanaka M, Hayashi N, Nagata H, Takeshita T, Nakayama K, et al. Determination of smoking and obesity as periodontitis risks using the classification and regression tree method. *J Periodontol.* 2005; 76:923–8. [PubMed: 15948686]
- [28]. Dalla Vecchia CF, Susin C, Rosing CK, Oppermann RV, Albandar JM. Overweight and obesity as risk indicators for periodontitis in adults. *J Periodontol.* 2005;76:1721–8. [PubMed: 16253094]
- [29]. Goodson JM, Groppo D, Halem S, Carpino E. Is obesity an oral bacterial disease? *J Dent Res.* 2009;88: 519–23. [PMCID: PMC2744897][PubMed:19587155]
- [30]. Saxlin T, Ylostalo P, Suominen-Taipale L, Mannisto S, Knuuttila M. Association between periodontal infection and obesity: Results of the health 2000 survey. *J Clin Periodontol.* 2011; 38:236–42. [PubMed: 21198765]
- [31]. Gorman A, Kaye EK, Apovian C, Fung TT, Nunn M, Garcia RI. Overweight and obesity predict time to periodontal disease progression in men. *J Clin Periodontol.* 2012;39:107–14. [PMCID: PMC3258330] [PubMed: 22150475]