

## Original Research

### Relationship Between Obesity And Periodontal Disease In An Adult Populations- A Systematic Review And Meta-Analysis

<sup>1</sup>Kommuri Kavya Reddy, <sup>2</sup>Tundup Dolker, <sup>3</sup>Disha Desai, <sup>4</sup>Hirdepal Singh Brar, <sup>5</sup>Leela Venkata Soujanya Nallamilli, <sup>6</sup>Ankita Sharma

<sup>1</sup>Consultant Periodontics and Oral Implantology, Hyderabad, Telangana, India;

<sup>2</sup>Junior Resident & Post Graduate, Pedodontics and Preventive Dentistry, PGIMER, Chandigarh, India;

<sup>3</sup>Internship, Drs. Sudha and Nageswara Rao Siddhartha Institute of Dental Sciences, Andhra Pradesh, India;

<sup>4</sup>Consultant OMFS, Faridkot, Punjab, India;

<sup>5</sup>Private Practitioner, Al-Harkan Dental Clinic, Saudi Arabia;

<sup>6</sup>Senior Lecturer, Dept of Pathology, NIMS Jaipur, Rajasthan, India

#### ABSTRACT:

The scope of this study was to conduct a systematic review of the studies on the association between obesity and periodontitis. The methods applied included a literature search strategy and selection of studies using inclusion and exclusion in accordance with the criteria for characteristics of the studies and meta-analysis. The research was conducted in the PubMed, Embase and Lilacs databases from 2019 onwards. Selected papers were on studies on humans investigating whether or not obesity is a risk factor for periodontitis. Of the 822 studies identified, 31 studies met the inclusion criteria and were included in this meta-analysis. The risk of periodontitis was associated with obesity (or had a tendency for this) in 25 studies, though it was not associated in 6 studies. The meta-analysis showed a significant association with obesity and periodontitis (OR = 1.30 [95% Confidence Interval (CI), 1.25 - 1.35]) and with mean Body Mass Index (BMI) and periodontal disease (mean difference = 2.75). Obesity was associated with periodontitis, however the risk factors that aggravate these diseases should be better clarified to elucidate the direction of this association. Working with paired samples and avoiding confusion factors may contribute to homogeneity between the studies.

**Keywords** Obesity, Overweight, Periodontal diseases, Periodontitis

Received: 19 December, 2020

Accepted: 21 January, 2021

**Corresponding author:** Kommuri Kavya Reddy, Consultant Periodontics and Oral Implantology, Hyderabad, Telangana, India

**This article may be cited as:** Reddy KK, Dolker T, Desai D, Brar HS, Nallamilli LVS, Sharma A. Relationship Between Obesity And Periodontal Disease In An Adult Populations- A Systematic Review And Meta-Analysis. J Adv Med Dent Scie Res 2021;9(2): 129-133.

#### INTRODUCTION

The worldwide prevalence of obesity is a considerable source of concern given its potential impact on morbidity, mortality, and the cost of health care.<sup>1</sup> The World Health Organization (WHO)<sup>2</sup> has recognized obesity as a predisposing factor to major chronic diseases ranging from cardiovascular disease to cancer. Successful efforts to reduce and prevent obesity will have substantial public-health benefits. Chronic periodontal disease is an inflammatory condition characterized by a shift in the microbial ecology of subgingival plaque biofilms and the progressive host-mediated destruction of tooth-supporting structures.<sup>3-5</sup> There has been considerable interest in drawing connections between periodontal

inflammation and other chronic conditions, notably heart disease,<sup>6,7</sup> diabetes,<sup>8</sup> and preterm low birth weight delivery.<sup>9</sup> Although observed associations suggested a causal role for periodontitis in certain systemic diseases, a consensus opinion demands further evidence.<sup>10,11</sup> Obesity might represent a systemic condition capable of influencing the onset and progression of periodontal disease. First noted using a ligature-induced periodontitis model in the rat,<sup>12</sup> the evidence of an obesity-periodontitis link in humans was recently addressed in several reviews.<sup>13-20</sup> Most of these publications<sup>13-19</sup> described a relationship between periodontal disease and metabolic syndrome (MetS) of which obesity, insulin resistance, dyslipidemia, and hypertension represent

components,<sup>21</sup> as extensively discussed by Bullon et al.<sup>15</sup> In brief, all MetS components derive from a proinflammatory state characterized by insulin resistance and oxidative stress, with the latter being a common link with periodontitis in a bidirectional relationship.<sup>15</sup> Products of oxidative damage<sup>22</sup> and advanced glycation end products<sup>23</sup> might promote periodontal disease. Meanwhile, periodontitis could, itself, be a source of oxidative stress,<sup>24,25</sup> perhaps through the alteration of levels of circulating adipocytokines such as leptin,<sup>26</sup> which, in turn, accelerate the onset of insulin resistance and MetS. We hypothesized that there was a difference in the prevalence of obesity in the general adult population across groups of individuals with or without current signs of periodontal disease. As secondary aims, we sought to characterize mean differences in obesity parameters across groups with or without periodontal disease, mean differences in periodontal disease parameters across obese and non-obese groups, and any linear changes in periodontal prevalence with an increasing body mass index (BMI).

## METHODOLOGY

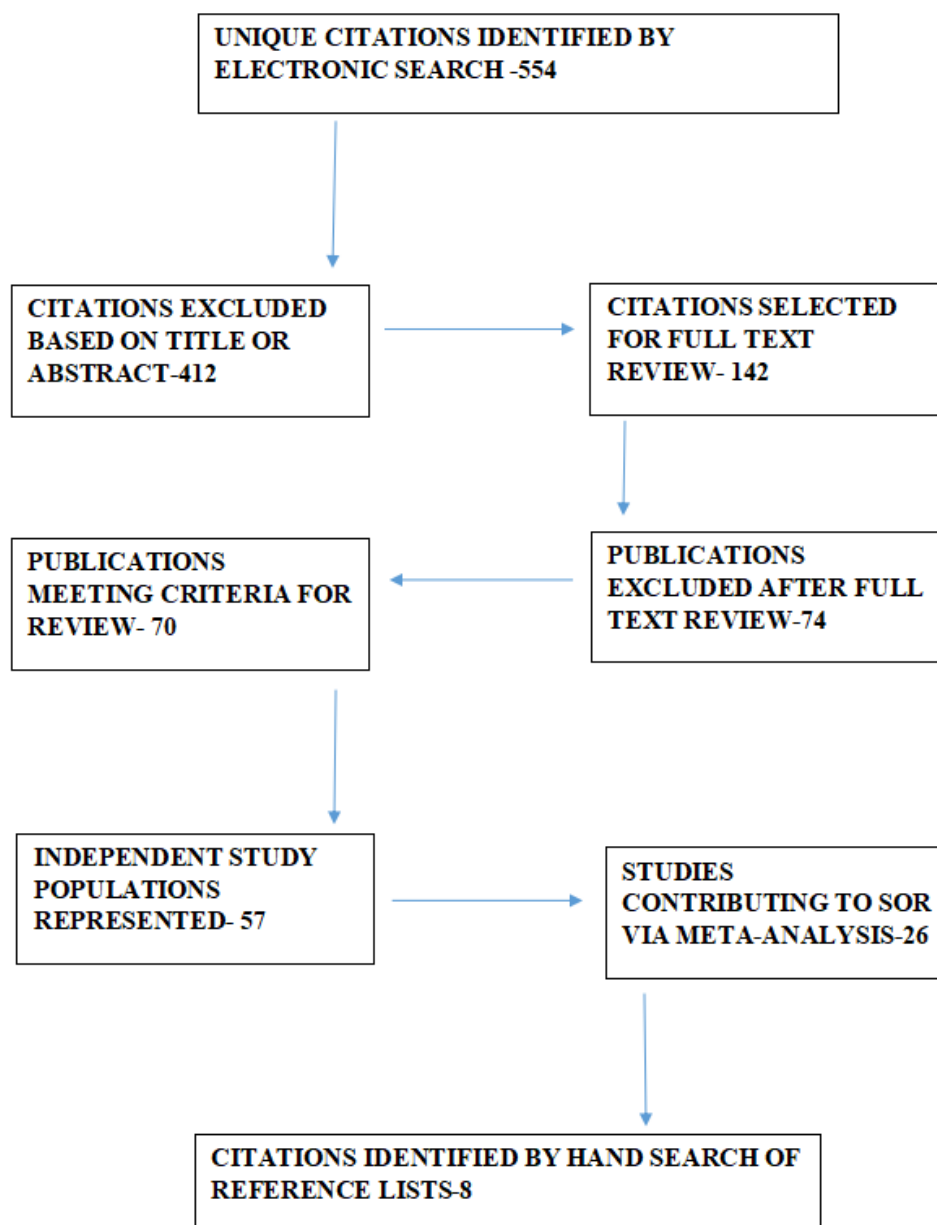
Electronic searches of the MED-LINE, SCOPUS, BIOSIS, LILACS, Cochrane Library, and Brazilian Bibliography of Dentistry databases were conducted from July 2019 onwards for publications that investigated periodontal disease and obesity. In MED-LINE, the Medical Subject Heading term periodontal disease and the Boolean connector AND were linked to the terms overweight, overnutrition, BMI, waist-hip ratio, waist circumference, body weight, and body weight changes, each joined by the connector OR with vocabulary exploding allowed to automatically query indexed subheadings under the main terms. Exclusion criteria included: nonhuman studies, no measure of periodontal disease or obesity, case series, studies of children, reviews, abstracts, or

lack of peer review. Full-text copies of the remaining potentially relevant citations were obtained. Publications were further excluded if periodontal status was only assessed by tooth loss, oral hygiene, gingival appearance, or use of a dental prosthesis. Additional publications were obtained by searching the citation listings of included studies and review articles.<sup>13-20</sup> Articles meeting the inclusion criteria were combined with the articles obtained from the electronic search. The prevalence odds ratio was the measure abstracted for the primary meta-analysis because nearly all studies were cross-sectional. When individual studies reported more than one association measure, adjusted measures were preferred over crude measures, and stratified results were pooled when possible to estimate a population-level effect. When multiple publications drew results from an identical set of participants (such as from large national surveys), only data from the study with the most inclusive study population were abstracted.

## RESULTS

The electronic search generated 864 hits, which represented 554 unique citations. A total of 142 publications were obtained as full-text copies, and 74 of these publications were later excluded on the basis of a priori criteria. Eight additional publications were identified as potentially relevant among the citation listings of included articles and review articles, and six of these articles were later excluded based on the same criteria. In total, 70 publications that represented 57 unique study populations were included for systematic review. (Table 1) For the association between prevalent periodontal disease and obesity, the overall fixed effects sOR and Shore-corrected 95% CI was 1.35 (1.23 to 1.47) with a  $\chi^2$  statistic for heterogeneity (Q) of 81.7 with 27 degrees of freedom ( $P < 0.005$ ) (Fig. 2). The DerSimonian-Laird random effects sOR was 1.48 (95% CI: 1.32 to 1.66).

**Table 1- Quality in reporting of observational studies in an epidemiology flowchart**



**DISCUSSION**

Some recent cross-sectional studies have suggested an association between body weight and periodontal disease in young subjects<sup>27</sup> however no association was detected in the study of Lundin et al.<sup>28</sup> Regarding to older subjects, no association was observed in this age group in numerous studies,<sup>29</sup> suggesting that other systemic factors, not the obesity, related to age may contribute to periodontitis, factors that possibly have not been present in elderly Japanese women because in the studies of Saito<sup>30</sup> and Saito et al.<sup>31</sup> reported an association of BMI with periodontal disease.

These conflicting findings occurred probably due the methodological heterogeneity among the studies. In the meta-analysis it was high ( $I^2 = 98\%$ ). Although

we have been chosen studies with similar methodologies in obesity and periodontal evaluations, they differ in some aspects, such as sample size, confounder variables control, age range and preliminary calibration, characterizing low homogeneity among them. Some factors determine the quality of the studies, such as sampling calculation, calibration of examiners and adjustment for potential confounders.<sup>32</sup>

The most of the studies adjusted the confounding variables by multivariate statistical analysis, especially regarding to gender, age and smoking status. Few studies reported the influence of sociodemograph factors or physical activity and few bothered to consider the presence of diabetes in the exclusion criteria and the diabetes often coexists with

obesity and periodontal infection, but the most excluded the individual that had not received systemic treatment with antibiotics.

The meta-analysis of the systematically identified results from 57 independent study populations suggested an approximate one-third increase in the prevalence odds of obesity among subjects with periodontal disease, a greater mean clinical AL among obese individuals, a higher BMI among subjects with periodontal disease, and a slight but not statistically significant linear increase in the odds of periodontal disease with increasing BMI. In total, these findings are highly unlikely due to chance and persist over studies using a multitude of measurement strategies for assessing these two health conditions.

Based on a subset of included studies, there appears to be stronger obesity–periodontitis association in women, non-smokers, and younger individuals than in the general adult population. Although smoking is a well-studied predisposing factor for periodontitis, smoking and BMI share a complex relationship, which can appear to be inverse in certain populations. For older individuals, tooth loss and impaired masticatory function might be a path through which advanced periodontal disease could impact energy balance and nutrition. Studies that linked overweight or obesity to tooth loss reported positive, negative, and equivocal results and are complicated by an association between tooth loss and underweight status.

## CONCLUSION

A positive association between periodontal disease and obesity was suggested across diverse populations. Elucidating any physiologic mechanism behind this relationship will require well-designed prospective studies.

## REFERENCES

- World Health Organization. Obesity: Preventing and managing the global epidemic. Report of a WHO consultation; World Health Organ Tech Rep Ser. 2000. p. 1-253.
- World Health Organization. Diet, nutrition and the prevention of chronic diseases; World Health Organ Tech Rep Ser. 2003. p. 1-149.backcover
- Socransky SS, Haffajee AD. The bacterial etiology of destructive periodontal disease: Current concepts. *J Periodontol.* 1992; 63 Suppl. 4:322–331. [PubMed: 1573546]
- Marsh PD. Microbial ecology of dental plaque and its significance in health and disease. *Adv Dent Res.* 1994; 8:263–271. [PubMed: 7865085]
- Pihlstrom BL, Michalowicz BS, Johnson NW. Periodontal diseases. *Lancet.* 2005; 366:1809–1820. [PubMed: 16298220]
- Scannapieco FA, Bush RB, Paju S. Associations between periodontal disease and risk for atherosclerosis, cardiovascular disease, and stroke. A systematic review. *Ann Periodontol.* 2003; 8:38–53. [PubMed: 14971247]
- Persson GR, Persson RE. Cardiovascular disease and periodontitis: An update on the associations and risk. *J Clin Periodontol.* 2008; 35 Suppl. 8:362–379. [PubMed: 18724863]
- Mealey BL, Oates TW. American Academy of Periodontology. Diabetes mellitus and periodontal diseases. *J Periodontol.* 2006; 77:1289–1303. [PubMed: 16881798]
- Khader YS, Ta'ani Q. Periodontal diseases and the risk of preterm birth and low birth weight: A meta-analysis. *J Periodontol.* 2005; 76:161–165. [PubMed: 15974837]
- Weidlich P, Cimões R, Pannuti CM, Oppermann RV. Association between periodontal diseases and systemic diseases. *Braz Oral Res.* 2008; 22 Suppl. 1:32–43. [PubMed: 19838549]
- Williams RC, Barnett AH, Claffey N, et al. The potential impact of periodontal disease on general health: A consensus view. *Curr Med Res Opin.* 2008; 24:1635–1643. [PubMed: 18452645]
- Perlstein MI, Bissada NF. Influence of obesity and hypertension on the severity of periodontitis in rats. *Oral Surg Oral Med Oral Pathol.* 1977; 43:707–719. [PubMed: 266151]
- Bezera BB, Sallum EA, Sallum AW. Obesity and periodontal disease: Why suggest such relationship? An overview. *Braz J Oral Sci.* 2007; 6:1420–1422.
- Boesing F, Patiño JS, da Silva VR, Moreira EA. The interface between obesity and periodontitis with emphasis on oxidative stress and inflammatory response. *Obes Rev.* 2009; 10:290–297. [PubMed: 19207875]
- Bullon P, Morillo JM, Ramirez-Tortosa MC, Quiles JL, Newman HN, Battino M. Metabolic syndrome and periodontitis: Is oxidative stress a common link? *J Dent Res.* 2009; 88:503–518. [PubMed: 19587154]
- Cullinan MP, Ford PJ, Seymour GJ. Periodontal disease and systemic health: Current status. *Aust Dent J.* 2009; 54 Suppl. 1:S62–S69. [PubMed: 19737269]
- Pischon N, Heng N, Bernimoulin JP, Kleber BM, Willich SN, Pischon T. Obesity, inflammation, and periodontal disease. *J Dent Res.* 2007; 86:400–409. [PubMed: 17452558]
- Ritchie CS. Obesity and periodontal disease. *Periodontol* 2000. 2007; 44:154–163. [PubMed:17474931]
- Saito T, Shimazaki Y. Metabolic disorders related to obesity and periodontal disease. *Periodontol* 2000. 2007; 43:254–266. [PubMed: 17214843]
- Stabholz A, Soskolne WA, Shapira L. Genetic and environmental risk factors for chronic periodontitis and aggressive periodontitis. *Periodontol* 2000. 2010; 53:138–153. [PubMed:20403110]
- Eckel RH, Grundy SM, Zimmet PZ. The metabolic syndrome. *Lancet.* 2005; 365:1415–1428.[PubMed: 15836891]
- Collin HL, Sorsa T, Meurman JH, et al. Salivary matrix metalloproteinase (MMP-8) levels and gelatinase (MMP-9) activities in patients with type 2 diabetes mellitus. *J Periodontal Res.* 2000; 35:259–265. [PubMed: 11005153]
- Schmidt AM, Weidman E, Lalla E, et al. Advanced glycation endproducts (AGEs) induce oxidant stress in the gingiva: A potential mechanism underlying accelerated periodontal disease associated with diabetes. *J Periodontal Res.* 1996; 31:508–515. [PubMed: 8915955]
- Sonoki K, Nakashima S, Takata Y, et al. Decreased lipid peroxidation following periodontal therapy in

- type 2 diabetic patients. *J Periodontol.* 2006; 77:1907–1913. [PubMed: 17076618]
25. Chapple IL, Brock GR, Milward MR, Ling N, Matthews JB. Compromised GCF total antioxidant capacity in periodontitis: Cause or effect? *J Clin Periodontol.* 2007; 34:103–110. [PubMed:17214737]
  26. Karthikeyan BV, Pradeep AR. Gingival crevicular fluid and serum leptin: Their relationship to periodontal health and disease. *J Clin Periodontol.* 2007; 34:467–472. [PubMed: 17451417]
  27. Kumar S, Dagli RJ, Dhanni C, Duraiswamy P. Relationship of body mass index with periodontal health status of green marble mine laborers in Kesariyaji, India. *Braz Oral Res* 2009; 23(4):365-369.
  28. Lundin M, Yucel-Lindberg T, Dahllof G, Marcus C, Mod er T. Correlation between TNFalpha in gingival crevicular fluid and body mass index in obese subjects. *Acta Odontol Scand* 2004; 62(5):273-277.
  29. Linden GJ, McClean K, Young I, Evans A, Kee F. Persistently raised C-reactive protein levels are associated with advanced periodontal disease. *J Clin Periodontol* 2008; 35(9):741-747.
  30. Saito T, Shimazaki Y, Kiyohara Y, Kato I, Kubo M, Iida M, Yamashita Y. Relationship between obesity, glucose tolerance, and periodontal disease in Japanese women: the Hisayama study. *J Periodontal Res* 2005; 40(4):346-353.
  31. Saito T. Obesity may be associated with periodontitis in elderly men. *J Evid Based Dent Pract* 2008; 8(2):97-98.
  32. Ch avarry NG, Vettore MV, Sansone C, Sheiham A. The relationship between diabetes mellitus and destructive periodontal disease: a meta-analysis. *Oral Health Prev Dent* 2009; 7(2):107-127.