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Artículo de Investigación

Periodontal status in relation to body mass index in type 2 diabetic patients: cross-sectional study

Estado periodontal en relación al índice de masa corporal en diabetes mellitus tipo 2: estudio transversal

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ABSTRACT

Background: The incidence of obesity-related comorbidities increases proportionally to body mass index, especially in diabetic patients. Periodontitis can worsen insulin resistance, which complicates metabolic control in overweight patients. That's why it is important to know whether variations in body mass index are associated with periodontal disease (PD), especially in type 2 diabetes mellitus patients.

Objective: To determine periodontal status in relation to body mass index in adult patients with type 2 diabetes mellitus.

Methods: In this cross-sectional study, 63 adult patients diagnosed with type 2 diabetes mellitus were evaluated at the General Medicine Service of the Bellavista Health Center (Trujillo, Peru) between June and July 2019. The community periodontal index was used to evaluate PS, and a scale with a stadiometer was used to assess body mass index. Spearman's correlation coefficient was used for statistical analysis, considering the significance level $p<0.05$.

Results: There was no relationship between PS and body mass index in adults with type 2 diabetes mellitus ($p=0.762$). Neither was this relationship found according to age ($p=0.999$ for 30 to 59, and $p=0.983$ for 60 and over) and gender group ($p=0.542$ for females and $p=0.768$ for males). However, it was found that most patients evaluated have periodontal pockets.

Conclusions: There is no relationship between periodontal status and body mass index in adult patients with type 2 diabetes mellitus. In addition, most of these patients presented periodontal pockets.

RESUMEN

Introducción: La incidencia de comorbilidades asociadas a la obesidad aumenta con el índice de masa corporal (IMC), especialmente en diabéticos. Dado que la periodontitis puede agravar la resistencia a la insulina y dificultar el control metabólico en personas con sobrepeso, es relevante evaluar si las variaciones del IMC se asocian con la enfermedad periodontal en pacientes con diabetes mellitus tipo 2 (DM2).

Objetivo: Determinar el estado periodontal en relación con el IMC en adultos con DM2.

Métodos: Estudio transversal realizado entre junio y julio de 2019 con 63 pacientes adultos con DM2 atendidos en el Servicio de Medicina General del Centro de Salud Bellavista (Trujillo, Perú). Se evaluó el estado periodontal mediante el índice periodontal comunitario y el IMC con báscula y estadiómetro. El análisis estadístico empleó el coeficiente de correlación de Spearman (significancia $p < 0,05$).

Resultados: No se halló relación entre el estado periodontal y el IMC en adultos con DM2 ($p = 0,762$). Tampoco se encontró asociación al estratificar por edad (30-59 años: $p = 0,999$; ≥60 años: $p = 0,983$) ni por género (mujeres: $p = 0,542$; hombres: $p = 0,768$). Sin embargo, la mayoría de los pacientes presentaron bolsas periodontales.

Conclusiones: No existe asociación entre el estado periodontal y el IMC en adultos con DM2, aunque la mayor parte de los evaluados mostró bolsas periodontales.

INTRODUCTION

Periodontal disease is a chronic disorder characterized by inflammatory destruction of periodontal tissues, leading to tooth loss.[1,2] It can be considered a systemic disease because of its ability to cause proinflammatory, prothrombotic states and immune dysregulation in the individual.[3]

The community periodontal index, or CPI (formerly CPITN), is used to detect the presence of gingival bleeding, calculus, probing depths between 3.5 and 6.0 mm, and clinical attachment loss (CAL). It is helpful in studies with large populations and preventive and treatment methods, allowing the identification of risk factors for the onset and progression of periodontal disease.[4]

Obesity is described through body mass index (BMI). The incidence of obesity-related comorbidities, such as type 2 diabetes mellitus (DM2), increases proportionally with an increase in BMI; however, the rate of growth slows and eventually stabilizes at a BMI of 35 to 37 kg/m^2.[5] An elevated BMI is related to insulin resistance, a key factor in the pathophysiology of DM2.[6,7]

Obesity and periodontitis have a bidirectional relationship that has been extensively studied.[8] Obesity is associated with elevated levels of inflammatory markers such as tumor necrosis factor-alpha (TNF-α), interleukin-6 (IL-6), and C-reactive protein (CRP), that can exacerbate inflammation in periodontal tissues. On the other hand, periodontitis also generates local inflammation that may contribute to the systemic inflammatory state in obese individuals and the insulin resistance and imbalance in metabolic hormones may predispose to an increased susceptibility to periodontitis. Obesity may also alter the composition of the oral microbiota, favoring the proliferation of periodontopathogenic bacteria, such as *Porphyromonas gingivalis* and *Tannerella forsythia*. Periodontitis can worsen insulin resistance, which complicates metabolic control in people with obesity, contributing to increased systemic inflammation and aggravating the comorbidities associated with this condition.[9]

Because it is crucial to know whether variations in BMI are associated with periodontal status (PS), especially in patients with DM2, the present study aimed to determine the relationship between PS and BMI in adult patients with DM2.

METHODS

The present study follows a cross-sectional design and was developed between June and July 2019. The sample population consisted of patients diagnosed with

DM2 who attended an outpatient consultation in the General Medicine service of the Bellavista Health Center in the district of La Esperanza (Trujillo, Peru).

The sample consisted of 63 study subjects and was calculated using the formula for the relationship of variables and with the following parameters: α=0.05 (maximum type I error), 1- α/2=0.975 (two-tailed confidence level), Zα/2=1.960 (typed value of Z at 2.5% type I error), β=0.2 (maximum type II error), 1-β=0.8 (statistical power), Zβ=0.842 (typed value of Z at 20% type II error), r=0.349 (correlation coefficient in pilot study). The sample selection method was non-probabilistic accidental without replacement.

The patients included were adults diagnosed with DM2 aged 30 years or older. Patients with systemic diseases, in addition to the diagnosis of DM2, pregnant or breastfeeding women, alcohol consumers, smokers, and those who did not agree to participate in the study, were excluded.

The Faculty of Human Medicine, the Bioethics Committee of the Universidad Privada Antenor Orrego, and the Bellavista Health Center of the district of La Esperanza (Trujillo, Peru) approved the present study. These operating units observe strict compliance with the principles established in the Declaration of Helsinki adopted by the 18th World Medical Assembly and the Peruvian General Health Law No. 26842.

Before requesting their participation, all patients received information about the purpose of the research. They were given the informed consent form to read and sign upon acceptance.

PS was determined using the 11.5B periodontal probe, using the CPI, recommended by the World Health Organization, where code 0 corresponds to healthy gingiva, code 1 to bleeding on probing, code 2 to the presence of calculus without periodontal pocket, code 3 to periodontal pocket <5.5 mm, code 4 to periodontal pocket >=5.5 mm, code X to "excluded sextant" and code 9 to "not recorded." The assessment of BMI was performed under the supervision of the nurse in chief, using a height and weight scale suitably calibrated.

The reliability of the method for measuring the PS was determined by intra- and inter-rater calibration of the principal investigator with a dental surgeon and specialist in Periodontics of the Stomatology Study Program of the Universidad Privada Antenor Orrego (Trujillo, Peru) after previous training. This evaluation was conducted with 32 patients, obtaining a Cohen's Kappa coefficient of 0.711 and 0.750, intra and inter-evaluator, respectively. The intraclass correlation coefficient (ICC) was used to evaluate the reliability of the body mass index, obtaining 0.997 and 0.998 in intra and inter-evaluator, respectively.

The data collected were processed automated using the IBM SPSS Statistics 22.0 statistical program (IBM, Armonk, NY, USA) to present the results in tables according to the proposed objectives. To determine PS in relation to BMI in adult

patients with DM2, Spearman's correlation coefficient was used. The significance level of the tests will be considered if $p<0.05$.

Because it is crucial to know whether variations in BMI are associated with PS, especially in patients with DM2, the present study aimed to determine the relationship between PS and BMI in adult patients with DM2.

RESULTS

This study evaluated 65 adult DM2 patients, 48 females and 17 males, aged between 30 and 80 ($\bar{x}$=55.3, SD=8.4).

As seen in table 1, about PS, females presented a more significant predominance of code 3 (periodontal pockets <5.5mm) with 50% prevalence. In comparison, males presented mainly the code 4 (periodontal pockets >=5.5mm) with 52.9% prevalence. Likewise, patients younger than 60 years of age presented a higher prevalence of code 3 (periodontal pockets < 5.5mm) with 52.5% prevalence, while the group aged 60 years and older presented a higher prevalence of code 4 (periodontal pockets >=5.5mm) with 44.0% prevalence. All groups presented a similar BMI (between 25.1 and 26.3), indicating overweight.

Table 1. Prevalence of periodontal status and body mass index in adult patients with type 2 diabetes at the Bellavista Health Center, according to age and gender (Trujillo, 2019)

Group	Category	n	Body Mass Index				Periodontal Status					
			Media	DE	Me	IR	Calculation		PP<5.5		PP>5.5	
							n	%	n	%	n	%
Gender	Female	48	25.1	3.1	25.1	3.8	11	22.9	24	50.0	13	27.1
	Male	17	26.3	3.0	25.9	4.2	1	5.9	7	41.2	9	52.9
Age	30 to 59	40	25.5	2.8	25.1	4.3	8	20.0	21	52.5	11	27.5
	60 and over	25	25.3	3.6	25.3	4.1	4	16.0	10	40.0	11	44.0

SD: standard deviation; Me: median; IR: interquartile range; PP: periodontal pocket.

Table 2 shows that there is no relationship between PS and BMI in 65 DM2 adult patients (p=0.762, corr=-0.038, 95% CI:-0.273-0.205).

Table 2. Periodontal status in relation to body mass index in adult patients with type 2 diabetes mellitus

Variables relationship		Corr	95% CI		P*
			LL	UL	
Periodontal status - BMI	65	-0.038	-0.273	0.205	0.762

*Spearman's correlation coefficient; CI: confidence interval; LL: lower limit; UL: upper limit.

According to age, there was no relationship between the 30 to 59 group (p=0.999) and 60 and older (p=0.983). In addition, according to gender, there wasn't a relationship between females (p=0.542) and males (p=0.768). (Table 3)

Table 3. Relationship between periodontal status and body mass index in adult patients with type 2 diabetes mellitus, according to age and gender

Group	Category	n	Corr	95% CI		P*
				LL	UL	
Age	30 to 59 years old	40	< 0.001	-0.293	0.293	0.999
	60 and over	25	0.004	-0.441	0.465	0.983
Gender	Female	48	-0.090	-0.356	0.209	0.542
	Male	17	-0.077	-0.568	0.466	0.768

*Spearman's correlation coefficient; CI: confidence interval; LL: lower limit; UL: upper limit.

DISCUSSION

Excess weight may affect the ability of the body to fight infections, including periodontal infections.[10] BMI is widely used in epidemiological studies to diagnose overweight and obesity during population-based surveillance of chronic disease risk factors because they can be quickly and inexpensively measured.[11]

Regarding PS, patients older than 60 years presented pockets larger than 5.5 mm. This is because the levels of inflammatory mediators generally show an age-related increase, even in the absence of acute infection or other sources of physiological stress,[12] and also to cumulative destruction due to aging.[13] Likewise, the prevalence of pockets larger than 5.5 mm was higher in men. This is explained by gender differences in gene regulation, particularly during aging.

Such gender differences have profound influences on susceptibility to diseases such as periodontitis. Females generate more robust and potentially protective humoral and cellular immune responses, whereas males often exhibit a more aggressive and potentially damaging inflammatory immune response to microbial stimuli. Also, males visit the dentist less frequently, mainly for oral treatment of acute problems and not so much for disease prevention, compared to females.[14]

In the present study, it was found that there is no relationship between PS and BMI in adult patients with DM2. Similar results were found by Dhaifullah, et al.,[15] who found no association between PS and BMI, and by Santos, et al.,[16] who found no association between periodontitis and overweight. However, Bhardwaj, et al.[17] found that a high BMI could be a risk factor for periodontitis in young adults. It should be noted that the patients who were evaluated in these studies did not have DM2.

In addition, Isola et al.[10] observed that poor nutritional status could aggravate periodontal health, indicating that malnutrition, whether due to a deficiency of essential nutrients or excess calories, can affect the body's ability to fight infections, including periodontal infections. Nutrients such as vitamin C, calcium, and vitamin D are crucial for periodontal health, and their deficiency may contribute to periodontal progression in diabetic patients.[10,18-20] Other research evaluating the influence of overall diet associated with the risk of periodontitis found that a diet rich in salads, fruits, and vegetables and with water or tea to drink was associated with a lower extent of clinical attachment level.[21]

Therefore, this absence of a relationship between PS and BMI in adult patients with DM2 could be because the BMI alone would not promote periodontal alterations, and other risk factors would have a more significant influence on the periodontal health status of individuals. BMI mainly reflects the ratio of total body weight to height and does not accurately reflect the distribution of body composition and the exact location of fat accumulation; furthermore, some people may have a high BMI but a low amount of abdominal fat, or vice versa. Such individual differences may lead to a decrease in the accuracy of BMI when assessing the risk of periodontitis.[22]

Periodontal disease is one of the most prevalent diseases worldwide, so it is important to continue investigating other risk factors that may alter the PS and thus be able to control them. Understanding the relationship between PS and BMI in adult patients with DM2 would allow us to update preventive and therapeutic modalities, reinforcing the importance of a multidisciplinary approach emphasizing education and support for patients with these chronic diseases. A relevant finding in the present study is the prevalence of overweight and the presence of periodontal pockets in all the groups evaluated, taking into consideration that periodontitis shares common modifiable risk factors with other diseases, such as diabetes, which contribute to the increase of systemic markers of inflammation and modify gene regulation through a variety of biological

mechanisms; the approach and control of these modifiable risk factors, such as diet and nutrition, could potentially improve the prevention, control, and prognosis of these chronic diseases.[12]

One limitation of the present study was the low sample size, which prevented us from having more homogeneous groups at the different BMI levels.

Studies with larger samples would be recommended to confirm the relationship between PS and BMI in adult patients with DM2 and to take into account all possible confounding factors that may affect periodontal health, such as socioeconomic variables, nutritional status, dietary habits, systemic health, dental visits, and oral health practices.

CONCLUSIONS

There is no relationship between PS and BMI in adult patients with DM2. In this regard, female patients and those under 60 years of age presented a more significant predominance of code 3 (periodontal pockets <5.5mm), whereas male patients and those aged 60 years and over presented preferentially code 4 (periodontal pockets ≥5.5mm). Likewise, all the groups evaluated presented periodontal pockets and were overweight.

REFERENCES

1. Inoue M, Sakanaka A, Katakami N, et al. Periodontal tissue susceptibility to glycaemic control in type 2 diabetes. Diabetes Obes Metab. 2024;26(10):4684-93. DOI: 10.1111/dom.15835.

2. AlJaafary AA, Alahmari R, AlHumaid NA. Epidemiology of periodontal diseases in individuals with diabetes in Saudi Arabia: A systematic review. Cureus. 2024;16(8):e67721. DOI: 10.7759/cureus.67721.

3. Villoria GEM, Fischer RG, Tinoco EMB, et al. Periodontal disease: A systemic condition. Periodontol 2000. 2024;96(1):7-19. DOI: 10.1111/prd.12616.

4. Bangera D, Vishwanathan K, Sreedharan J, et al. Evolution of Indices in the screening of periodontal diseases: A narrative review. Indian J Dent Sci. 2022;14(1):45-50. DOI: 10.4103/IJDS.IJDS_1_21.

5. Haam JH, Kim BT, Kim EM, et al. Diagnosis of obesity: 2022 update of clinical practice guidelines for obesity by the korean society for the study of obesity. J Obes Metab Syndr. 2023;32(2):121-9. DOI: 10.7570/jomes23031.

6. Ahmed B, Sultana R, Greene MW. Adipose tissue and insulin resistance in obese. Biomed Pharmacother. 2021;137:111315. DOI: 10.1016/j.biopha.2021.111315.

7. Liu X, Tang Y, Luo Y, et al. Role and mechanism of specialized pro-resolving mediators in obesity-associated insulin resistance. Lipids Health Dis. 2024;23(1):234. DOI: 10.1186/s12944-024-02207-9.

8. Abu-Shawish G, Betsy J, Anil S. Is obesity a risk factor for periodontal disease in adults? A systematic review. Int J Environ Res Public Health. 2022;19(19):12684. DOI: 10.3390/ijerph191912684.

9. Jepsen S, Suvan J, Deschner J. The association of periodontal diseases with metabolic syndrome and obesity. Periodontol 2000. 2020;83:125-53. DOI: 10.1111/prd.12326.

10. Isola G, Polizzi A, Iorio-Siciliano V, et al. Effectiveness of a nutraceutical agent in the non-surgical periodontal therapy: a randomized, controlled clinical trial. Clin Oral Investig. 2021;25(3):1035-45. DOI: 10.1007/s00784-020-03397-z.

11. Yang WS, Chang YC, Chang CH, et al. The association between body mass index and the risk of hospitalization and mortality due to infection: A prospective cohort study. Open Forum Infect Dis. 2020;8(1):ofaa545. DOI: 10.1093/ofid/ofaa545.

12. Reynolds MA. Modifiable risk factors in periodontitis: at the intersection of aging and disease. Periodontol 2000. 2014;64(1):7-19. DOI: 10.1111/prd.12047.

13. Van Dyke TE, Sheilesh D. Risk factors for periodontitis. J Int Acad Periodontol. 2005;7(1):3-7. Cited at PMCID; PMC: 1351013.

14. Lipsky MS, Su S, Crespo CJ, et al. Men and Oral Health: A review of sex and gender Differences. Am J Mens Health. 2021;15(3):15579883211016361. DOI: 10.1177/15579883211016361.

15. Dhaifullah E, Al-Maweri SA, Koppolu P, et al. Body mass index and periodontal health status among young Saudi adults: a cross-sectional study. Ann Saudi Med. 2019;39(6):433-40. DOI: 10.5144/0256-4947.2019.433.

16. Santos T, Cury PR, Santos E, et al. Association between severe periodontitis and obesity degree: A preliminary study. Oral Health Prev Dent. 2019;17(2):173-7. DOI: 10.3290/j.ohpd.a42374.

17. Bhardwaj VK, Sharma D, Jhingta P, et al. Assessment of relationship between body mass index and periodontal status among state government employees in Shimla, Himachal Pradesh. J Int Soc Prev Community Dent. 2013;3:77-80. DOI: 10.4103/2231-0762.122439.

18. Yan K, Lin Q, Tang K, et al. Substance P participates in periodontitis by upregulating HIF-1alpha and RANKL/OPG ratio. BMC Oral Health. 2020;20(1):27. DOI: 10.1186/s12903-020-1017-9.

19. Lee JH, Park YS, Kim YT, et al. Assessment of early discomfort and wound healing outcomes after periodontal surgery with and without enamel matrix derivative: An observational retrospective case-control study. Clin Oral Investig. 2020;24(1):229-37. DOI: 10.1007/s00784-019-02941-w.

20. Bogdan M, Meca AD, Boldeanu MV, et al. Possible involvement of vitamin C in periodontal disease-diabetes mellitus association. Nutrients. 2020;12(2):553. DOI: 10.3390/nu12020553.

21. Wright DM, McKenna G, Nugent A, et al. Association between diet and periodontitis: a cross-sectional study of 10,000 NHANES participants. Am J Clin Nutr. 2020;112(6):1485-91. DOI: 10.1093/ajcn/nqaa266.

22. Chen X, Zeng C, Chen X, et al. Relationship between three body obesity indicators, WWI, BMI, WtHR, and periodontitis. Sci Rep. 2025;15(1):697. DOI: 10.1038/s41598-024-83963-7.

Conflicts of interest

The authors declare no conflict of interest.

Author's contributions

Sheylla Geraldine Guerra-Pasapera: conceptualization, formal analysis, investigation, methodology, project administration, and resources.

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