REVISTA DE ODONTOLOGIA DA UNESP
www.revodontolunesp.com.br
Original Article

Association between periodontitis and type 2 diabetes mellitus: study in a population attended by the Brazilian Health System

Associação entre periodontite e diabetes mellitus tipo 2: estudo em uma população atendida pelo Sistema Único de Saúde Brasileiro

Flavia Bridi VALENTIM[a], Julia Saraiva de Almeida BARBOSA[a]*, Vinícius Cavalcanti CARNEIRO[a], Arthur Maciel ARAÚJO[a], Elizabeth Pimentel ROSETTI[a]

[a]UFES – Universidade Federal do Espírito Santo, Vitória, ES, Brasil

How to cite: Valentim FB, Barbosa JSA, Carneiro VC, Araújo AM, Rosetti EP. Association between periodontitis and type 2 diabetes mellitus: study in a population attended by the Brazilian Health System. Rev Odontol UNESP. 2022;51:e20220010. https://doi.org/10.1590/1807-2577.01022

Resumo

Introdução: O controle da doença periodontal auxilia na prevenção e no controle do diabetes mellitus. A compreensão dessa relação pode desencadear mudanças nas políticas públicas de saúde. **Objetivo:** O objetivo deste estudo foi investigar a associação entre a doença periodontal, o controle glicêmico e o conhecimento dessa relação. **Material e método:** Trata-se de um inquérito epidemiológico analítico transversal com 216 pacientes com diabetes mellitus tipo 2, não fumantes, que realizaram exames de sangue atuais com hemoglobina glicada (HbA1c). **Resultado:** No geral, 93,51% dos pacientes relataram escovar os dentes pelo menos duas vezes ao dia, 62,5% visitaram o dentista no último ano, 81,58% já fizeram tratamento para doença periodontal, 43,52% relataram ter periodontite e 59,72% tinham diabetes controlado. Não foi encontrada associação significativa (p=0,603) entre o controle da HbA1c e a presença de periodontite. Entre os pacientes com periodontite, não foi encontrada associação entre o controle da HbA1c e informações sobre a doença periodontal (p=0,996), e conhecer/acreditar na sua relação com o diabetes (p=0,659; p=0,973). **Conclusão:** Não foi encontrada relação entre a doença periodontal e diabetes na amostra, o que poderia ser justificado pelo atendimento por uma equipe multiprofissional de saúde no Sistema Único de Saúde Brasileiro.

Descritores: Diabetes Mellitus Tipo 2; doença periodontal; acesso aos serviços de saúde; saúde bucal; atenção à saúde; complicações do diabetes.

Abstract

Introduction: Periodontitis control helps to prevent and control diabetes mellitus and understanding of this relationship can lead to changes in health policy. **Objective:** The purpose of this study was to investigate the association between periodontitis, knowledge, and glycemic control. **Material and method**: This is a cross-sectional analytical epidemiological survey with 216 Type 2 diabetic patients, non-smokers, who had current blood screenings with glycated hemoglobin (HbA1c). **Result**: Overall, 93.51% of the patients reported brushing their teeth at least twice a day, 62.5% visited the dentist last year, 81.58% have already undergone treatment for periodontal disease, 43.52% reported having periodontitis and 59.72% had controlled diabetes. No significant (p=0.603) association between HbA1c control and the presence of periodontitis was found. Among the patients with periodontitis, no association between HbA1c control and information on the periodontal disease was found (p=0.996), and know/believe in its relationship with diabetes (p=0.659; p=0.973). **Conclusion**: No relationship between periodontitis and diabetes was found in the sample, as well as in patients with periodontitis, those with knowledge on periodontal disease and knowledge/belief in its relationship with diabetes, which could be justified by the care by a multi-professional health team.

Descriptors: Type 2 Diabetes Mellitus; periodontal diseases; health services accessibility; oral health; dental health services; diabetes complications.

INTRODUCTION

Diabetes mellitus is a chronic disease that occurs when the pancreas is unable to produce insulin or when the body cannot properly use the insulin produced. This process may lead to hyperglycemia that, in the long-term, is associated with damages to the body and failure of several organs and tissues[1]. Type 2 diabetes mellitus is responsible for at least 90% of all diabetes cases and is characterized by insulin resistance and relative insulin deficiency[1,2].

In 2017, 425 million people worldwide had diabetes, that is, about 8.8% of the adult population. In total, 12.5 million people were affected by the disease in Brazil in that year. Diabetes incidence has grown in the last three decades and is more rapidly in underdeveloped and developing countries. The World Health Organization (WHO) estimates diabetes to become the seventh cause of death worldwide in 2030[1,3,4].

If diagnosed and well-controlled with small amounts of medicines, interventions to promote healthy lifestyles, patient education to facilitate the self-care, regular control for the detection and treatment of complications early through a multidisciplinary team, people with diabetes can live long and healthy lives[3].

Within the multidisciplinary team, the dentist has a crucial role in the early diagnosis of complications related to diabetes, such as periodontitis. Located in the gingiva and the tissues supporting the teeth, this bacterial infection causes loss of attachment of periodontal ligament in the cement with subsequent formation of periodontal pockets, alveolar bone resorption, recession, hyperemia, edema, and gingival bleeding, tooth migration, halitosis, tooth mobility, abscess formation and tooth loss[5,6].

A study on the relationship between the periodontal status and the causes of death followed a cohort over 25 years, and found that, for every 20% increase in mean radiographic alveolar bone loss, the risk of death increased 51%, a value similar to the risk for smoking, justifying the importance of controlling periodontal disease[7].

Periodontitis has been regarded as the “sixth complication” of diabetes[8]. A bi-directional relationship between periodontitis and diabetes has been proved by the literature, where diabetes is a risk factor for periodontitis and periodontitis holds influence on glycemic control[9]. However, some authors did not find these results and attributed them to differences in the methods and criteria established for conducting research[10].

The understanding of the relationship between periodontitis and systemic diseases, such as diabetes, can change health policies, ensuring economic benefits. Furthermore, the medical community should be aware of the potential adverse effects of periodontal infections in systemic health. Periodontal Medicine promotes a strong collaboration between medical and dental professionals, which implies a better communication and an effective team approach in clinical practice[6].

Thus, this study aimed to describe issues related to oral health and to investigate the association between the periodontal condition self-reported by diabetic patients and glycemic control to analyze the existence of a bi-directional relationship. Moreover, we aimed to evaluate the association between glycemic control and the knowledge of the patients on periodontal disease (PD) and its relationship with DM in patients with periodontitis.

METHODS

A cross-sectional analytical epidemiologic survey was conducted with 216 patients with Type 2 DM, male and female, aged 18 years or more, registered in the Hypertension and Diabetes Program of three Health Basic Units (HBU) of the municipality of Vitória, Espírito

Santo (ES), Brazil. The estimated sample was representative of the 1,220 diabetic patients allocated in the searched HBUs. The inclusion criteria were patients with at least one tooth in the mouth and had current blood glucose testing. Smokers were excluded due to the existence of a scientific proof showing a causal relationship between smoking and periodontal disease[11,12]. This research was approved by the Ethics Committee in Research of the Federal University of Espírito Santo under number 1,749,053, and all participants signed an informed consent form voluntarily.

For data collection, a validated structured questionnaire was used[13], applied by a single previously trained examiner for nine months. Closed questions were conducted to evaluate sociodemographic and economic issues, oral hygiene habits, presence of periodontitis, access and attendance to dental treatment, and knowledge about periodontal disease and its relationship with diabetes. For the definition of the presence of periodontitis, questions were conducted about tooth mobility and migration, gingival recession, tooth loss without tooth extraction by the dentist, and bone loss, and in case of at least one positive response, the patient was regarded as having periodontitis, as well as in the studies by Jimenez et al.[14].

Patients were invited to participate in the survey during the waiting period for the medical consultation, and the time to answer the questionnaire was 5 to 10 minutes. At the end of the survey, an explanatory booklet and guidance on diabetes, periodontal disease, and their bi-directional relationship were provided to all participants.

The diabetes control of the interviewed patients was determined by the percentage of glycated hemoglobin (HbA1c) through secondary data of previous blood testing done by the patients, collected in the digital chart of the municipality of Vitória, state of Espírito Santo, Brazil, at the HBU by a single examiner. The value of 7% for HbA1c was set as a threshold to consider the patient with controlled diabetes, as recommended by the American Diabetes Association[2] (2017).

We used the IBM SPSS Statistics version 24 for statistical analysis, being initiated by descriptive statistics. To verify that factors influence the control of glycated hemoglobin, presence of periodontitis, and knowledge about periodontal disease (PD) and its relationship with DM, simple and multiple logistic regressions were used. In all analyses, the significance level was set at 5% with a confidence interval of 95%.

RESULT

The average age of the sample was 62.63 years (standard deviation = 10.86 years), being mostly female, with a monthly family income of up to three minimum wages and diagnosed with diabetes eight years ago or less. Good oral hygiene and dental consultation habits were found (Table 1).

As for periodontal health, 43.25% reported having periodontitis, and 81.48% have already received treatment for this condition. Concerning the control of diabetes, 59.72% had HbA1c ≤ 7% and, thus, they were controlled (Table 1).

Concerning the guidelines received by patients, approximately 20% reported having been informed about the relationship between PD and DM, although 63.89% believe in such a relationship (Table 1).

No statistically significant association (p=0.063; OR=1) was identified between the control of HbA1c and the presence or not of periodontitis by the simple logistic regression (Table 2). No association was found between the control of HbA1c and have received information on what is PD (p=0.996), have been oriented about the relationship between PD and DM (p=0.659), and if exists a relationship between PD and DM (p=0.973), for PD patients, by simple and multiple logistic regressions (OR=1) (Table 3).

Table 1. Characterization of the sample, oral health, glycemic control, and knowledge

		Mean	Standard Deviation
Age		**62.63**	**10.86**
		Minimum-Maximum	**Median**
		28-93	**63**
		n	**%**
Gender	Male	82	37.96
	Female	134	62.04
Monthly household income (at minimum wages*)	< 3	165	76.39
	≥ 3 to <5	27	12.50
	≥ 5	24	11.11
Diabetes-diagnosed time	≤ 8 years	130	60.19
	> 8 years	86	39.81
Toothbrushing frequency	Do not brush	0	0.00
	Once a day	14	6.48
	Twice a day	69	31.94
	Three times or more a day	133	61.57
Flossing frequency	No flossing	98	45.37
	1 to 3 times a week	33	15.28
	Daily	85	39.35
Last visit to the dentist for control or treatment	≤1 year	135	62.50
	> 1 year	81	37.50
Received medical referral for dental treatment	No	183	84.72
	Yes	33	15.28
Presence of periodontitis	No	122	56.48
	Yes	94	43.52
History of periodontal disease treatment	No	40	18.52
	Yes	176	81.48
Control of HbA_{1c}	No	87	40.28
	Yes	129	59.72
Received information on what is the periodontal disease	No	149	68.98
	Yes	67	31.02
Received explanation on the relationship between periodontal disease and diabetes	No	170	78.70
	Yes	46	21.30
Believe there is a relationship between periodontal disease and diabetes	No	78	36.11
	Yes	138	63.89

* 1 minimum wage ≈ U$290

Table 2. Association between HbA_{1c} and periodontitis

		Non-controlled HbA_{1c}		Controlled HbA_{1c}		OR*	p value
		n	**%**	**n**	**%**		
Presence of periodontitis	No	51	58.62	71	55. 04	1	-
	Yes	36	41.38	58	44.96	1.157 (0.668-2.006)	0.603

OR - *Odds Ratio*; With controlled HbA1c is a reference category of the dependent variable. *.Simple logistic regression.

Table 3. Association between HbA_{1c} and knowledge about the periodontal disease and its relationship with diabetes

		Non-controlled HbA_{1c}		Controlled HbA1c		OR*	p value
		n	%	n	%		
Received information on what is the periodontal disease [1]	No	30	55.56	19	47.50	1	-
	Yes	24	44.44	21	52.50	1.043 (0.454-2.399)	0.921
Received explanation on the relationship between periodontal disease and diabetes[1]	No	38	70.37	30	75.00	1	-
	Yes	16	29.63	10	25.00	1.244 (0.485-3.193)	0.650
Believe there is a relationship between periodontal disease and diabetes[1]	No	14	25.93	9	22.50	1	-
	Yes	40	74.07	31	77.50	1.048 (0.399-2.749)	0.925

OR – *Odds Ratio*; With controlled HbA_{1c} is a reference category of the dependent variable. [1].Only those who have periodontal disease; *.Simple logistic regression.

DISCUSSION

Studies in the literature assessing the importance of primary care establishing a bi-directional relationship between DM and periodontitis are scarce.

The relationship between the control of diabetes mellitus (DM) by the HbA1c level and the periodontitis in patients with Type 2 diabetes (Table 2) has been evaluated to assess the association between the control of diabetes, the self-report of knowledge, and received information on periodontal disease (PD) and its relationship with DM (Table 3) in periodontally compromised patients.

The null hypotheses that the glycemic control is not associated with the presence of periodontitis and that the glycemic control of periodontitis patients is not associated with the knowledge about periodontal disease and diabetes were tested. We noted that, for this sample, no statistically significant relationship among the studied factors was found.

Periodontitis and DM are common and complex chronic diseases with a bi-directional relationship. DM is associated with an increase in the prevalence and severity of periodontitis, and severe periodontitis is associated with inadequate glycemic control[9]. The data observed in this research showed the inverse situation of what would be necessary for the establishment of a bi-directional relationship, in which the majority of the sample presents adequate glycemic control and healthy periodontal status, so we understood that the chance for development or aggravation of both is lower, and the risk, according to simple logistic regression, is the same in the whole sample (OR=1).

Moreover, the literature indicates that the poorer the glycemic control and the longer duration of diabetes, the greater the prevalence and gravity of the periodontitis[15]. In this study, most of the sample shows less than eight years of diagnosed diabetes and may justify the inexistence of a

relationship, since the little time of diabetes may not have been sufficient to produce significant periodontal breakdown. Campus et al.[16] stated that long-term diabetes patients tend to neglect their oral health; however, in this study, in addition to most patients having discovered diabetes recently, as abovementioned, a report of adequate frequency of oral hygiene was observed. More than 90% of the studied population reported brushing teeth two to three times a day and more than half reported flossing at least once a week, which implies directly in a healthier periodontal condition than those with poor hygiene habits[17].

Other studies also did not find this bi-directional relationship with statistical significance and used different methods, both for determining the presence of periodontitis and for the control of HbA1c[10,11,18]. In this context uniform definitions for determining these parameters are scarce, which can lead to variations in prevalence and make difficult comparisons among studies.

The cutoff for the definition of diabetes control by HbA1c suffers major variations among the studies, ranging from 7% up to 9%[18,19], which alters the proportion of controlled diabetics or non-controlled diabetics. Meanwhile, in this study, like in the study by Kiedrowicz et al.[19], the cutoff of 7% was used for being recommended by the ADA[2] for most of the population with Type 2 diabetes, aiming to reduce the microvascular complications.

Knight et al.[10] analyzed research data to compare estimates of the power of the association between DM and periodontitis, indicated some doubts, and stated that this relationship is unclear. For identifying a periodontal disease, they used 14 different definitions, but diabetes was only associated with a higher risk of periodontitis when only two of the 14 definitions were used. A limitation of the studies is the dependency of the method used in evaluating periodontitis and the definition of diabetes.

For the determination of periodontitis, this study utilized the patient's self-report from questions about periodontitis, as well as Ahdi et al.[18], since this method has been showing us a good predictive of the clinical periodontal condition[13]. On the other hand, the studies by Knight et al.[10], Han et al.[11], Kiedrowicz et al.[19], Silva et al.[20] used clinical parameters for determining the periodontal condition, but also found no statistically significant results for the relationship between diabetes and periodontitis.

Access to healthcare is an important factor influencing the progression of PD, including dental care, oral hygiene, physical activity, and access to medicines[13]. In the organization of the attendance of patients with diabetes at the HBU where the study was held, the integrality, one of the most important principles of the Brazilian Unified Health System is respected and, therefore, the patient receives assistance by a multidisciplinary team composed of physicians, nurses, dentists, nursing technicians, pharmacists, physical educators, among other professionals. This can justify the fact that most of the population presents good hygiene habits and healthy periodontal conditions.

In this survey, more than 80% of the sample has already received some kind of periodontal treatment, whether conventional or surgical, corroborating with studies that proved that periodontal treatment, both conventional and surgical, has been associated with improvements in glycemic control in diabetic patients, with reduced levels of HbA1c[21]. In this context, the periodontal treatment associated with oral hypoglycemia medications has a significant impact on the glycemic control of patients with Type 2 DM. Therefore, these patients should receive regular periodontal treatment and monitoring so that they can reduce the incidence of diabetes-related complications[22]. This recommendation is followed by more than 60% of the patients in this study who have reported having consulted with a dentist in the last year, improving their oral health.

In this integral service environment, only the smallest part of the patients reported having received a medical referral for dental treatment, since most were already in follow-up with the dentist, which reflects the quality of access to the services provided by the HBUs and the integrality in primary care environment as a health promoter and a differentiator of outcomes with benefits to the health of the population.

Despite this, less than a third of patients reported have been informed on what is PD and about the relationship with DM, which may occur due to rapid appointments or by a lack of knowledge of the professionals, as suggested by Bahammam[23]. We emphasize the possibility of patients' memory bias, which may not remember the guidelines already received due to even the advancing age by most of the sample[23]. When the association was confirmed, we observed that the patient with periodontitis who received guidance did not present better glycemic control than those who were not oriented. The same occurs for the group that reported to believe this bi-directional relationship exists. Thus, the chance for maintaining the glycemic control of patients with periodontitis and who have already received guidance or treatment is the same as those who have not received (OR = 1), probably by this integrality in the treatment.

Even with this small portion of patients who reported have already been informed, more than half have reported believing that a bi-directional relationship between periodontitis and DM can be found, showing that the diabetic is informed by means other than the medical service, as described in the studies by Al Habashneh et al.[24], in which patients reported knowing about the relationship through television, internet, magazines, school, family and friends, in addition to traditional means: physician, dentist, and nurse. We suggest that, if these guidelines were given more frequently by healthcare professionals, patients may present better periodontal conditions and even glycemic control. Hence the importance of multi-professional and quality care, when patients are guided by all healthcare professionals and referred to prevention or treatment in various fields[5,22].

Due to their important role in managing people with diabetes, authors suggest the use of sorting tools by dentists to identify patients with high risk, since they can be referred to investigation and early diagnosis by the physicians[9]. Valuable tools for use by physicians also have been reported, such as described by Ahdi et al.[18], who suggested an oral health questionnaire to identify unsatisfactory oral health conditions in patients with DM, especially non-treated PD, which would aid in the correct referral to the dentist and early diagnosis of periodontal pathologies, and consequently, in improving control of diabetes. Thus, in the context of the integrality of care on which this study was based, we suggested the decentralization of the care and the transmission of information by the physician, dentist, and nurse triad, and the use of these screening tools by the other professionals, such as technicians and nursing assistants and oral health assistants.

In addition to the benefits already discussed for the patient, the reduction in the incidence and prevalence of periodontitis and diabetes may minimize their financial impact on health systems[13], since with fewer patients, fewer medicines will be necessary, which it reduces costs associated with clinical care and treatment. Therefore, investing in disease prevention is not only a strategy required in the health aspect but also intelligent from an economic standpoint. The importance of providing a quality health service and investment in prevention and integral attention to patients, as observed in this study, is shown as the best health care strategy, despite the shortcomings and needs of existing ones. Thus, the importance of investments in the prevention and control of chronic diseases is evident, with benefits to patient health and the health system budget.

CONCLUSION

In this study, diabetic patients had a proper frequency of oral hygiene, dental care, and treatment. We found no relationship between periodontitis and diabetes, as well as an association of the glycemic control with knowledge about periodontal disease and its bi-directional relationship with diabetes in patients with periodontitis, which may be justified by the integral care provided by a multi-professional health team in the environment where the study was performed.

ACKNOWLEDGEMENTS

We thank the Health Technical School of the Single Health System for authorizing the data collection.

REFERENCES

1. International Diabetes Federation – IDF. Diabetes Atlas [Internet]. 2017 [cited 2018 Mar 24]. Available from: https://www.idf.org/e-library/epidemiology-research/diabetes-atlas
2. American Diabetes Association – ADA. Standards of medical care in Diabetes. Diabetes Care. 2018;41(Suppl 1):S1-S2. PMid:29222369.
3. World Health Organization – WHO. Global reports on diabetes [Internet]. 2016 [cited 2018 Jan 30]. Available from: https://www.who.int/publications/i/item/9789241565257.
4. World Health Organization – WHO. Diabetes country profiles: Brazil [Internet]. 2016 [cited 2018 Feb 6]. Available from: https://cdn.who.int/media/docs/default-source/ncds/ncd-surveillance/diabetes_profiles_explanatory_notes.pdf?sfvrsn=f2a2083c_5&download=true.
5. Gurav AN. Management of diabolical diabetes mellitus and periodontitis nexus: are we doing enough? World J Diabetes. 2016 Feb;7(4):50-66. http://dx.doi.org/10.4239/wjd.v7.i4.50. PMid:26962409.
6. Igari K, Kudo T, Toyofuku T, Inoue Y, Iwai T. Association between periodontitis and the development of systemic diseases. Oral Biology and Dentistry. 2014 Jan;2(1):4. http://dx.doi.org/10.7243/2053-5775-2-4.
7. Garcia RI, Krall EA, Vokonas PS. Periodontal disease and mortality from all causes in the VA Dental Longitudinal Study. Ann Periodontol. 1998 Jul;3(1):339-49. http://dx.doi.org/10.1902/annals.1998.3.1.339. PMid:9722718.
8. Löe H. Periodontal disease. The sixth complication of diabetes mellitus. Diabetes Care. 1993 Jan;16(1):329-34. http://dx.doi.org/10.2337/diacare.16.1.329. PMid:8422804.
9. Casanova L, Hughes FJ, Preshaw PM. Diabetes and periodontal disease: a two-way relationship. Br Dent J. 2014 Oct;217(8):433-7. http://dx.doi.org/10.1038/sj.bdj.2014.907. PMid:25342350.
10. Knight ET, Leichter JW, Tawse-Smith A, Thomson WM. Quantifying the association between self-reported diabetes and periodontitis in the New Zealand population. J Periodontol. 2015 Aug;86(8):945-54. http://dx.doi.org/10.1902/jop.2015.150048. PMid:25903984.
11. Han DH, Lim S, Kim JB. The association of smoking and diabetes with periodontitis in a Korean population. J Periodontol. 2012 Nov;83(11):1397-406. http://dx.doi.org/10.1902/jop.2012.110686. PMid:22376209.
12. World Health Organization – WHO. Monograph on tobacco cessation and oral health integration [Internet]. 2017 [cited 2017 Aug 8]. Available from: https://www.who.int/publications/i/item/who-monograph-on-tobacco-cessation-and-oral-health-integration.
13. Cyrino RM, Miranda Cota LO, Pereira Lages EJ, Bastos Lages EM, Costa FO. Evaluation of self-reported measures for prediction of periodontitis in a sample of Brazilians. J Periodontol. 2011 Dec;82(12):1693-704. http://dx.doi.org/10.1902/jop.2011.110015. PMid:21563951.
14. Jimenez M, Hu FB, Marino M, Li Y, Joshipura KJ. Type 2 diabetes mellitus and 20 year incidence of periodontitis and tooth loss. Diabetes Res Clin Pract. 2012 Dec;98(3):494-500. http://dx.doi.org/10.1016/j.diabres.2012.09.039. PMid:23040240.
15. Rajhans NS, Kohad RM, Chaudhari VG, Mhaske NH. A clinical study of the relationship between diabetes mellitus and periodontal disease. J Indian Soc Periodontol. 2011 Oct;15(4):388-92. http://dx.doi.org/10.4103/0972-124X.92576. PMid:22368365.

16. Campus G, Salem A, Uzzau S, Baldoni E, Tonolo G. Diabetes and periodontal disease: a case-control study. J Periodontol. 2005 Mar;76(3):418-25. http://dx.doi.org/10.1902/jop.2005.76.3.418. PMid:15857077.

17. Newton JT, Asimakopoulou K. Managing oral hygiene as a risk factor for periodontal disease: a systematic review of psychological approaches to behaviour change for improved plaque control in periodontal management. J Clin Periodontol. 2015 Apr;42(Suppl 16):S36-46. http://dx.doi.org/10.1111/jcpe.12356. PMid:25639708.

18. Ahdi M, Teeuw WJ, Meeuwissen HG, Hoekstra JB, Gerdes VE, Loos BG, et al. Oral health information from the dentist to the diabetologist. Eur J Intern Med. 2015 Sep;26(7):498-503. http://dx.doi.org/10.1016/j.ejim.2015.06.006. PMid:26160771.

19. Kiedrowicz M, Dembowska E, Banach J, Safranow K, Pynka S. A comparison of the periodontal status in patients with type 2 diabetes based on glycated haemoglobin levels and other risk factors. Adv Med Sci. 2015 Mar;60(1):156-61. http://dx.doi.org/10.1016/j.advms.2015.01.007. PMid:25723568.

20. Silva AM, Vargas AMD, Ferreira EF, Abreu MHNG. Periodontitis in individuals with diabetes treated in the public health system of Belo Horizonte, Brazil. Rev Bras Epidemiol. 2010 Mar;13(1):118-25. http://dx.doi.org/10.1590/S1415-790X2010000100011. PMid:20683560.

21. Goel K, Pradhan S, Bhattarai MD. Effects of nonsurgical periodontal therapy in patients with moderately controlled type 2 diabetes mellitus and chronic periodontitis in Nepalese population. Clin Cosmet Investig Dent. 2017 Jul;9:73-80. http://dx.doi.org/10.2147/CCIDE.S138338. PMid:28761379.

22. Teshome A, Yitayeh A. The effect of periodontal therapy on glycemic control and fasting plasma glucose level in type 2 diabetic patients: systematic review and meta-analysis. BMC Oral Health. 2017;17(1):31. http://dx.doi.org/10.1186/s12903-016-0249-1. PMid:27473177.

23. Bahammam MA. Periodontal health and diabetes awareness among Saudi diabetes patients. Patient Prefer Adherence. 2015 Feb;9:225-33. http://dx.doi.org/10.2147/PPA.S79543. PMid:25673974.

24. Al Habashneh R, Khader Y, Hammad MM, Almuradi M. Knowledge and awareness about diabetes and periodontal health among Jordanians. J Diabetes Complications. 2010 Nov-Dec;24(6):409-14. http://dx.doi.org/10.1016/j.jdiacomp.2009.06.001. PMid:19628414.

CONFLICTS OF INTERESTS

The authors declare no conflicts of interest.

*CORRESPONDING AUTHOR

Julia Saraiva de Almeida Barbosa, UFES – Universidade Federal do Espírito Santo, Av. Marechal Campos, 1468, Maruípe, 29043-900 Vitória - ES, Brasil, e-mail: juliasaraiva.ab@gmail.com

Received: March 24, 2022
Accepted: April 26, 2022