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Obesity and periodontal disease in diabetic pregnant women

Obesidade e doença periodontal em gestantes diabéticas

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ABSTRACT: This cross-sectional study investigated the impact of pregestational overweight and obesity on periodontal status of patients with gestational diabetes *mellitus* (GDM). Sixty pregnant women with gestational diabetes *mellitus* (GDM) were recruited for the study. According to the pregestational body mass index (BMI), patients were classified into 3 groups: normal, overweight or obese. The periodontal assessment parameters were the presence of gingival bleeding (GB) and bleeding on probing (BOP) per tooth. Clinical attachment loss (CAL) was assessed per tooth and classified according to following values: 1) absence of attachment loss; 2) between 1 and 2 mm, 3) between 3 and 5 mm; and 4) CAL ≥ 6 mm. The means of individual percentage of teeth with GB and BOP and the means of the individual classified values of CAL were compared through ANOVA. Differences between the groups were established through *post hoc* Bonferroni test for multiple comparisons ($p < 0.05$). The analysis revealed significant differences between the normal group and the obese group considering GB (52.76% ± 27.99% and 78.85% ± 27.44%, respectively) and CAL (2.21 ± 0.41 and 2.61 ± 0.54, respectively). Although an increase was found in BOP as the BMI increased (ranging from 55.65% to 75.31%), no statistically significant differences were found among the groups. Patients with GDM and pregestational obesity had significantly more gingivitis and periodontal attachment loss that those with normal pregestational BMI. Periodontal treatment should be considered in the establishment of future recommendations for metabolic control for this special group of patients.

DESCRIPTORS: Diabetes, gestational; Obesity; Gingivitis; Periodontitis; Oral manifestations.

RESUMO: O objetivo do presente estudo foi examinar o efeito da massa corporal prévia à gestação (IMC - índice de massa corpórea) sobre o periodonto de pacientes com diabete *mellitus* gestacional (DMG). A amostra constituiu-se de 60 gestantes classificadas em 3 grupos segundo o IMC: normal, sobrepeso ou obeso. Os parâmetros de avaliação periodontal foram sangramento gengival (SG), sangramento à sondagem (SS) e perda de inserção clínica periodontal (PI) categorizada de acordo com os seguintes valores: 1) correspondente à ausência de perda de inserção; 2) PI entre 1 e 2 mm, 3) PI entre 3 e 5 mm; e 4) PI ≥ 6 mm. Médias das porcentagens dos dentes com SG e SS e as médias dos valores categorizados, por dente, da perda de inserção foram comparadas por meio do teste ANOVA e as diferenças entre os grupos foram estabelecidas por meio do teste *post hoc* de Bonferroni para comparações múltiplas ($p < 0,05$). Diferenças estatisticamente significantes foram identificadas entre o grupo normal e obeso com relação às médias percentuais da presença de SG (52,76 ± 27,99% e 78,85 ± 27,44%, respectivamente) e às médias da categorização da PI (2,21 ± 0,41 mm e 2,61 ± 0,54 mm, respectivamente). Embora tenha se observado aumento no percentual médio de SS à medida do incremento do IMC, não foram observadas diferenças estatisticamente significantes entre os grupos, e a variação foi de 55,65% a 75,31%. Pacientes com DMG e obesidade pré-gestacional apresentaram significativamente mais gengivite e perda de inserção periodontal que aquelas com IMC pré-gestacional normal. O tratamento periodontal deve ser considerado na determinação de futuras recomendações de controle metabólico para esse grupo especial de pacientes.

DESCRITORES: Diabetes *mellitus* gestacional; Obesidade; Gengivite; Periodontite; Manifestações bucais.

INTRODUCTION

Gestational diabetes *mellitus* (GDM) is a chronic systemic disease characterized by changes in glucose, lipid and protein metabolism. Obesity has been considered a risk factor for GDM along with age older than 25 years and family history of diabetes *mellitus*[14]. In the past decades, obesity has been considered one of the main public health problems. Its prevalence has increased, particularly in the female population. Data obtained in 1996 in Brazil showed that 10.2% of women of childbearing age (20 to 49 years) were obese[6].

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The influence of systemic conditions on the oral environment, especially on dental gingival tissues, has been shown. Pregnancy-associated gingivitis, for instance, is inflammatory changes found in pregnant women gingival tissues which happen due to the microbial challenge of the dental biofilm when facing the increased circulating hormone levels[22]. Also, an increased risk of periodontal breakdown is observed in diabetic patients in whom the condition has not been properly controlled[17,29]. As well as pregnancy-associated gingivitis, increased gingival inflammation can be found in diabetic patients who present the same amount of bacterial plaque than non-diabetic control patients[4,16]. In addition, recent epidemiological studies have shown a significant correlation between obesity and increased risk of periodontitis[3,28].

Considering their impact on systemic health, the understanding of periodontal diseases as localized entities has been questioned. Researches have shown that periodontal infections can adversely affect blood glucose levels in diabetes, increase the risk of cardiovascular diseases and negatively influence pregnancy outcomes like the increased risk of premature delivery[10,20]. In 2002, Yuli *et al.*[30] described the following oral manifestations in two patients with GDM: candidiasis, angular cheilitis, gingivitis and periodontitis[30]. Though concern over women's oral health has been voiced[22,27], specific studies relating GDM patients and oral health are not frequently observed in literature.

Therefore, the purpose of this study was to investigate the possible relation between pregestational body mass index and periodontal status of patients diagnosed with gestational diabetes.

MATERIALS AND METHODS

This cross-sectional study was carried out at the Gestational Diabetes Outpatient Unit at Fêmina Hospital (Conceição Hospital Group) in Porto Alegre, Brazil. The convenience sample consisted of gestational diabetes *mellitus* (GDM) patients who, after a physician appointment in the hospital, were guided to keep control of their diabetic state by the nutritional service. Sixty non-smoking GDM women were included in the sample.

The study was in accordance with Resolution 196/96 of Brazilian National Health Committee and its amendments, and with the Helsinki Declaration of 1975 as revised in 1983. This study was approved by the Ethics Committee of Conceição Hospital Group (protocol 44/2001). Patients received a description of the study and provided a written informed consent.

Body mass index (BMI) was calculated using patients' height from the hospital's protocols and pregestational self-reported weight. The obtained result for each patient was classified as normal, overweight or obese. The BMI reference values are 18.5 – 24.9 kg/m^2, 25.0 – 29.9 kg/m^2 and ≥ 30 kg/m^2, respectively[18]. The glucose tolerance test (75 g Oral Glucose Tolerance Test - OGTT) was used for establishing the diagnosis of GDM[24]. In order to discard previous diabetes *mellitus*, measurements of glycated protein (GHb - glycated hemoglobin) were used for monitoring glycemic control[24].

Periodontal examination included assessment of gingival bleeding (GB)[1], bleeding on probing (BOP)[5] and clinical attachment loss (CAL)[3]. Assessments of GB and BOP were carried out by two trained examiners, but only one trained and calibrated examiner performed CAL measurements. The CAL Kappa value obtained during a calibration period previous to the study utilizing 79 periodontal sites was 0.79.

GB and BOP exams were used to assess the presence of inflammatory signs linked to the presence of supra- and subgingival bacterial biofilm, respectively. Exams were considered positive for any given tooth if there was bleeding on one or more surfaces. CAL measurements were performed to the nearest 1 mm using a Williams periodontal probe (Newmar, São Paulo, Brazil). Six sites per tooth were assessed, but only the greatest measure was taken into account. After that, the CAL measure observed in each tooth was classified according to the following values: 1) corresponding to absence of attachment loss; 2) if attachment loss was between 1 and 2 mm, 3) if attachment loss was between 3 and 5 mm; and 4) if the loss was greater than or equal to 6 mm. Patients with periodontal needs were referred for periodontal treatment.

Analysis was carried out considering the individual as a data analysis unit. According to the groups, 75 g OGTT, GHb, BMI data, number of teeth and periodontal clinical measures were summarized using means and their respective standard deviations. Additionally, data related to CAL, according to the groups, were summarized by median and percentiles (25-75). The means of the percentage of teeth with GB and BOP, as well as the means of CAL were compared using ANOVA. The differences were established by the *post hoc* Bonferroni test for multiple comparisons ($p < 0.05$).

RESULTS

Mean age of the 60 patients included in the study was 32.75 ± 6.01 (19-45 years old) and the pregnancy time ranged from 16 to 40 weeks (32.98 ± 5.01). Laboratorial assays and BMI values, according to the groups, are listed in Table 1. The mean values of 75 g OGTT were 157.18 ± 21.73 mg/dL in the normal group, 187.46 ± 33.02 mg/dL in the overweight group and 160.29 ± 33.36 mg/dL in the obese group. GHb means ranged from 7.29% to 7.98%. The BMI results for normal, overweight and obese groups were 21.26 ± 2.32, 27.35 ± 1.45 and 35.09 ± 3.27, respectively.

The results of the clinical periodontal assessments are shown in Table 2. Significant differences were found only between the normal and obese groups considering GB (52.76 ± 27.99% and 78.85 ± 27.44%, respectively), and CAL (2.21 ± 0.41 mm and 2.61 ± 0.54 mm, respectively). Although an increase in BOP was found when comparing the normal and obese groups, no significant differences were found among groups. The percentage means of BOP ranged from 55.65% to 75.31%. The medians and their respective percentiles (25-75) of attachment loss classification in the normal, overweight and obese groups were 2 (2-2), 2 (2-3) and 3 (2-3), respectively. Two patients presented attachment loss median equal to four: one with BMI of 38.90 kg/m^2 and another with BMI of 26.20 kg/m^2.

DISCUSSION

In this study, patients who presented pregestational obesity showed significantly more gingivitis and attachment loss than pregnant women with normal pregestational BMI.

Diabetes *mellitus*, smoking and certain microorganisms in the dental biofilm are considered risk factors of periodontal breakdown[25]. Although other periodontitis risk indicators have been studied (for instance: stress, osteoporosis and genetic factors), few analytical epidemiological studies have been conducted establishing the relationship between obesity and periodontitis and using the clinical periodontal attachment loss parameter as the outcome factor[3,28]. Vecchia *et al.*[28] (2003), using the criteria "30% of the teeth or more presenting CAL ≥ 5 mm" to determine the presence of periodontitis found that obese women had 1.65 more chances of having periodontitis after adjustment for age and smoking (Confidence Interval 1.04-2.64)[28]. When smoking was not considered, obese women had 2.28 times more chances of having periodontitis (Confidence Interval 1.05-4.93). The authors excluded diabetic patients from the study. The biological plausibility of this association may

TABLE 1 - Means and standard deviation of 75 g oral glucose tolerance test (OGTT), glycated hemoglobin assay (GHb) and body mass index (BMI) of 60 pregnant women distributed according to normal, overweight and obese groups.

	n	75 g OGTT	GHb	BMI
Normal	18	157.18 ± 21.73 mg/dL	7.29 ± 1.55%	21.26 ± 2.32
Overweight	15	187.46 ± 33.02 mg/dL	7.88 ± 1.61%	27.35 ± 1.45
Obese	27	160.29 ± 33.36 mg/dL	7.98 ± 2.59%	35.09 ± 3.27

TABLE 2 - Clinical parameters of 60 gestational diabetes *mellitus* patients distributed according to body mass index (BMI) groups.

	n	Number of Teeth*	GB	BOP	CAL	CAL**
Normal	18	24.44 ± 6.43	52.76 ± 27.99[a]	55.65 ± 27.65	2.21 ± 0.41[a]	2 (2-2)
Overweight	15	25.27 ± 5.24	65.64 ± 23.31	71.47 ± 20.35	2.40 ± 0.53	2 (2-3)
Obese	27	26.25 ± 5.10	78.85 ± 27.44[a]	75.31 ± 30.33	2.61 ± 0.54[a]	3 (2-3)
p value		0.556	0.008	0.062	0.032	

*Mean values ± standard deviation. GB: gingival bleeding (percentual mean ± standard deviation); BOP: bleeding on probing (percentual mean ± standard deviation); CAL: clinical attachment loss (mean values in millimeters ± standard deviation); CAL**: median clinical attachment loss (percentile 25-75); Means followed by a lower-case letter in the column are significantly different (ANOVA, $p < 0.05$).

be explained by the increased levels of pro-inflammatory mediators found in obese patients[19,23].

Our study sample consisted of 60 patients with GDM, with 45% presenting pregestational obesity. In the period before delivery, obese pregnant women present a larger number of pre-existing complications. The prevalence of gestational diabetes *mellitus* ranges from 14 to 39.4% in obese patients, while in normal weight pregnant women it ranges from 1.85 and 4.3% ($p < 0.05$)[7,12]. They also may develop more medical changes when compared to normal weight controls: an increased risk of hypertension, anemia, perinatal mortality and urinary track infection.

Gingivitis is the most frequent oral manifestation associated with pregnancy. Its occurrence is reported to range from 30 to 100%[4]. In this study, a statistically significant difference was found in GB between the normal and the obese group. Vecchia *et al.*[28] (2003), when assessing the average percentage of teeth with gingival bleeding in 386 non-pregnant women according to the BMI categories, found that GB ranged from 64.1 to 69.2%, without differences between normal, overweight and obese women groups[28]. The differences found among studies could be related to changes found in the protection periodontium that take place after the second month of pregnancy. Evidence suggests that the levels of sexual hormones change the composition of the biofilm, as well as influence vascular, cellular and immune responses of the inflammatory process[4]. And although it results predominantly just in gingivitis, an increased risk of periodontitis in these patients should not be ignored. However, no differences were found in the prevalence of periodontitis when pregnant and non-pregnant women were compared[8,12].

Periodontal clinical attachment loss is considered the most adequate indicator of destructive periodontal disease[9]. The CAL observed in the study sample revealed that loss of periodontal attachment in at least one of the tooth surfaces is frequent. Unlike diabetes *mellitus*, hormone changes found in pregnancy do not represent an increased risk for the onset and progression of support periodontium destruction[8,13]. Also, to establish the diagnosis of GDM, it has to be shown that carbohydrate metabolism was completely normal before pregnancy[26]. Considering these facts, it is interesting to investigate factors that could account for the oral manifestations found in gestational diabetes patients.

When examining the relationship between periodontal disease and obesity, Al-Zahrani *et al.*[3] (2003) defined periodontal disease using CAL greater than or equal to 3 mm associated with probing depth greater than or equal to 4 mm[3]. In the present study, the values of tooth attachment loss in patients of the obese group ranged from 3 to 5 mm, while in the normal weight group it ranged from 1 to 2 mm. Losses found in the normal weight group can be linked only to gingival recession, which can be related to bacterial plaque or not. Although probing depth, like BOP, is an inflammatory parameter commonly used in studies, it is limited when determining the presence and severity of periodontal disease[1,21].

In this study, no differences were found among the groups considering the presence of BOP, a parameter that shows inflammation associated with the presence of bacterial plaque in the subgingival environment, although a trend of percentage increase with the increase of BMI could be found. This could be explained by the limits of the study sample size. Also, this could be due to the confounding factor associated with the presence of bleeding of the marginal gingiva[21]. New studies in this group of patients with separate description of parameters for free and proximal surfaces could better elucidate the patients' hygiene pattern. Additionally, the analysis of BOP after control of supragingival plaque could better define the sites with true subgingival periodontal disease activity. For now, it is clear that in the studied group there is a significant history of periodontal support loss and gingivitis.

As a whole, the results of this study showed that clinicians should assess the periodontal status of gestational diabetes patients with pregestational obesity history. It has been shown that periodontal infections can change the metabolic-endocrine status of the host, leading to difficulties in the control of blood sugar levels, which can contribute to insulin-resistance, hyperglycemia and complications in the metabolic control of diabetes *mellitus*[2,11,15]. Moreover, periodontal treatment improves diabetes control[2]. Therefore, periodontal infection control could be one additional important tool used in the metabolic control of gestational diabetes.

CONCLUSION

In conclusion, patients with GDM and a history of pregestational obesity presented significantly more gingivitis and periodontal attachment loss than those with normal pregestational body mass index. Periodontal treatment should be taken into account to determine future recommendations for this particular group of patients.

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