Association between coffee consumption and prevalence of periodontal disease: an exploratory study

Associação entre o consumo de café e a prevalência de doença periodontal: um estudo exploratório

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ABSTRACT
Scenario: Dental surface biofilm formation triggers periodontal disease (gingivitis and periodontitis), the second most frequent oral pathology, second only to caries. Studies of these diseases' prevalence in coffee consumers have shown conflicting results. Some studies correlate coffee consumption with the aggravation of the periodontal disease, while others with disease remission. Purpose: This study aimed to analyze the association between coffee consumption and the prevalence of periodontal disease using the Community Periodontal Index (CPI). Method: We developed a cross-sectional study with 127 people at a primary health care service in Baturité, Brazil, in 2022. Participants were interviewed to investigate sociodemographic data, eating habits, and coffee consumption. Then, a clinical periodontal examination was performed to obtain the CPI index. The study was approved by a Human Research Ethics Committee under opinion number 5.492.233. Data were analyzed using SPSS, and the Chi-square and Pearson's correlation were used for the statistical analysis. Results: Age influenced the CPI index (gingival bleeding, calculus, and periodontal pockets) in five of the six sextants evaluated. Older patients had a higher rate of periodontal disease. The most common pattern of coffee consumption was ≥ 2 times a day, with 240 ml (one cup) per serving. Conclusion: Coffee consumption was inversely related to the prevalence of the periodontal disease. Participants who consumed more coffee showed a lower prevalence of gingival bleeding, calculus, and periodontal pockets. This finding was more evident among young subjects. Finally, there was no association between educational level and periodontal disease.

Keywords: coffee, periodontal diseases, feeding behavior, dentistry.

RESUMO
Cenário: A formação de biofilme na superfície dentária desencadeia a doença periodontal (gengivite e periodontite), a segunda patologia bucal mais frequente, perdendo apenas para a cárie. Estudos sobre a prevalência dessas doenças em consumidores de café mostraram resultados conflitantes. Alguns estudos correlacionam o consumo de café com o agravamento da doença periodontal, enquanto outros com a remissão da doença. Objetivo: O objetivo deste estudo foi analisar a associação entre o consumo de café e a prevalência da doença periodontal usando o Índice Periodontal Comunitário (CPI). Método: Desenvolvemos um estudo transversal com 127 pessoas em um serviço de atenção primária à saúde em Baturité, Brasil, em 2022. Os participantes foram entrevistados para investigar dados sociodemográficos, hábitos alimentares e consumo de café. Em seguida, foi realizado um exame clínico periodontal para obter o índice CPI. O estudo foi aprovado por um Comitê de Ética em Pesquisa Humana sob o número de parecer 5.492.233. Os dados foram analisados com o SPSS, e o qui-quadrado e a correlação de Pearson foram usados para a análise estatística. Resultados: A idade influenciou o índice CPI (sangramento gengival, cálculo e bolsas periodontais) em cinco dos seis sextantes avaliados. Os pacientes mais velhos apresentaram uma taxa mais alta de doença periodontal. O padrão mais comum de consumo de café foi ≥ 2 vezes ao dia, com 240 ml (uma xícara) por porção. Conclusões: O consumo de café foi inversamente relacionado à prevalência da doença periodontal. Os participantes que consumiram mais café apresentaram uma menor prevalência de sangramento gengival, cálculo e bolsas periodontais. Esse achado foi mais evidente entre os jovens. Por fim, não houve associação entre o nível educacional e a doença periodontal.

Palavras-chave: café, doenças periodontais, comportamento alimentar, odontologia.

1 INTRODUCTION

The evolution of the definition of biofilm made it possible to understand periodontal diseases as an opportunistic infection since there is a dependence between the subgingival biofilm (causing periodontitis) and the supragingival biofilm (causing gingivitis). Supragingival biofilm control is essential and exerts an important modulatory action in the subgingival environment. This dynamic and interdependent process between biofilms requires greater care from the professional and the patient to control supragingival biofilm and prevent its natural evolution into bacterial plaque[1,2,3].

Periodontal diseases are common oral diseases that affect approximately 10 to 15% of adults worldwide[4]. In Brazil, gingival bleeding increases from 12 years to adulthood, and about half of adults aged 35 to 44 years have gingivitis, a condition that decreases in older persons. The most prevalent periodontal change at all ages is dental calculus, with the lower central sextant being the most affected[5]. Calculus consists of mineralized biofilm that forms on the surface of natural teeth and dental prostheses[6].

The literature demonstrates that chronic diseases such as type 2 diabetes, chronic renal failure, and risky behaviors such as poor oral hygiene, tobacco use, excessive alcohol consumption, stress, and coffee consumption influence the worsening of periodontal disease[7,8,9]. Integrated preventive strategies addressing risk factors are recommended for public and oral health practice[10-11].

Research reports are not unanimous about the relationship between coffee consumption and periodontal disease. For example, Kobayashi et al.'s study[12] showed that the continuous intake of coffee prevented alveolar bone loss in rats by decreasing oxidative stress in periodontal tissue. Based on in vitro studies, it is also known that coffee extract inhibits the proliferation of *P. gingivalis*, *P. intermedia*, and *A. actinomycetemcomitans*, pathogens frequently associated with gingivitis and periodontitis[13-14]. However, other authors concluded that periodontitis positively correlates with coffee intake[15], and this habit is linked to tooth loss in adults[16].

The main motivator for coffee consumption in Brazil is the habit, acquired since childhood as a family tradition, associated with pleasure and sociability. Because coffee consumption is a common social habit, it should be investigated as a predictor of human health in general.

Clinical or laboratory studies investigating the relationship between periodontal diseases and coffee consumption have found conflicting results, as mentioned before, concerning the relationship between benefit or harm to the prevalence of periodontal disease[12,

[13-16]. We found methodological limitations in previously published studies on this subject, such as the predominance of studies based on secondary data in which there was no direct assessment by a dentist.

2 METHOD

2.1 STUDY DESIGN

This is a cross-sectional quantitative study reported in accordance with the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines.

2.2 STUDY LOCATION

The study was conducted in a primary health care facility in Baturité, a city located in northeastern Brazil. This city has about 35 thousand inhabitants. Coffee planted in Baturité conquered the world between the mid-19th century and the beginning of the 20th century, when the temperature, rainfall, and terrain were favorable for planting. Coffee from this region was exported throughout Brazil and Europe at that time. Currently, the coffee produced in this region is mainly directed at producing and commercializing gourmet coffees[17].

2.3 ETHICAL CONSIDERATIONS AND PERIOD OF STUDY

Data collection occurred between July and September 2022 after approval of the Ethics Committee at the University for International Integration of the Afro-Brazilian Lusophony (opinion number 5.492.233). All study participants signed an informed consent form prior to participation.

2.4 STUDY PARTICIPANTS

The inclusion criteria were age above 18 years old, of both sexes, and registration at the primary care facility chosen for the study in Baturité, Brazil. Pregnant women, people with diabetes, alcoholics, and smokers were excluded from the study due to increased susceptibility to periodontal disease[10], patients who used antibiotics in the last 3 months, and subjects without teeth.

2.5 SAMPLING

The sample calculation considered the prevalence of periodontal disease (CPI Index) in the population as the outcome. Thus, we considered a prevalence of 35.4% for the outcome, the

average prevalence of periodontal alterations in the population aged between 15 and 74 years in the Northeast region of Brazil in 2010[18].

The sampling technique was carried out with the support of the free software GPower 3.1. For this purpose, we considered an error (α) of 5%, a test power (β) of 95%, and an effect size of 0.5, whose fit test family was the chi-square. The calculated sample was 80, to which we added 20% due to the possibility of collecting wrong information or withdrawals during the study. In the end, 127 participants were included in the analysis.

2.6 RECRUITMENT OF PARTICIPANTS

Patients attending dental care services were invited to join the study (convenience sampling) and received elective care during the COVID-19 pandemic.

2.7 DATA COLLECTION

Data collection was carried out in two stages. First, we interviewed the patients using an instrument about food frequency, coffee consumption, and sociodemographic information. The second stage was a clinical periodontal examination, assisted by an auxiliary oral health professional.

The oral clinical examination conducted to assess periodontal conditions followed the method employed by the SB Brasil Project in 2002, 2010, and 2020 based on the recommendations of the Manual of the World Health Organization (WHO) concerning the assessment of the Community Periodontal Index (CPI Index). The CPI Index allows assessing the periodontal condition in terms of health, gingival bleeding, dental calculus, or periodontal pockets through codes, making it possible to observe the prevalence of each condition for each sextant of the dental arch[19-20]. Chart 1 shows the teeth, the location of each sextant in the oral cavity, and the indicative code used to determine the study results. The examination was carried out as described in Chart 2.

Chart 1: Identification of the sextants assessed through the data collection

Teeth	**Location**	**Sextant code**
18 to 14	Top right	CPI_S1
13 to 23	Top center	CPI_S2
24 to 28	Top left	CPI_S3
38 to 34	Lower left	CPI_S4
33 to 43	Bottom center	CPI_S5
44 to 48	Lower right	CPI_S6

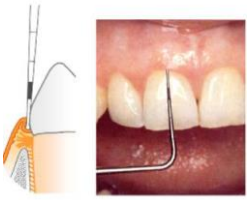
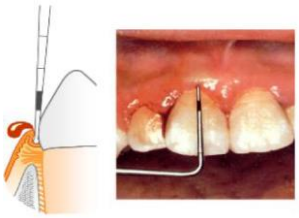
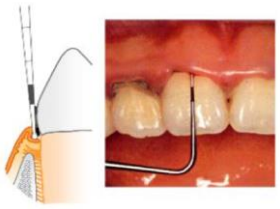
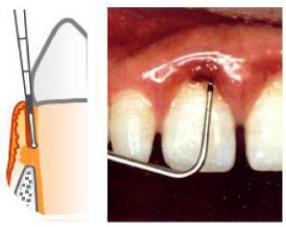
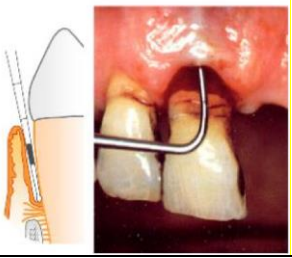
Source: Authors

The CPI index recommended by the WHO allows for assessing the degree of periodontal disease in an individual or part of a population. Periodontal diseases are classified into five grades according to severity, ranging from 0 for healthy gums and periodontium to 4, the most severe form of periodontitis with loss of tooth function[19-20] (Chart 2).

2.8 INSTRUMENTS AND MATERIALS

A specific instrument was used for the periodontal assessment, the Community Periodontal Index Probe (CPI probe or WHO probe, a reference to the World Health Organization). The instrument has a 0.5mm spherical blunt tip, with a black band between 3.5 and 5.5mm and marks at 8.5 and 11.5mm (Figure 1).

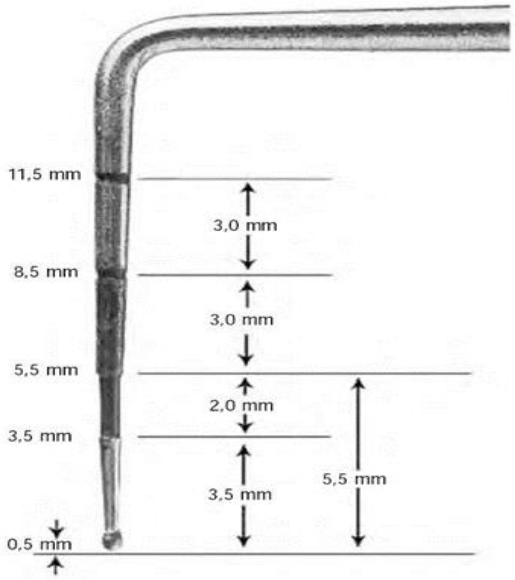
Chart 2: Codes and criteria for evaluating the CPI Index.

Score	CONDITION	CRITERION	EXAMPLE
0	Sound sextant	No sign of bleeding on examination.	
1	Bleeding	One of the index teeth of the sextant bleeds after probing.	
2	Presence of calculus	Calculus in any amount on one of the sextant index teeth, with the entire black area of the probe visible, indicating no change in probing depth.	
3	4 to 5 mm pocket	The gingival margin on one of the sextant index teeth partially covers the black probe mark.	
4	6 mm pocket or deeper	The gingival margin completely covers the black area of the probe.	

9	Sextant excluded	Less than two functional teeth are present.	

Source: Brazilian Ministry of Health (2019).

Figure 1: CPI probe (or WHO) for the Community Periodontal Index examination.



Source: World Health Organization - WHO, 2017.

2.9 DATA ANALYSIS

The primary outcome of the inferential analysis was the presence of periodontal disease (gingivitis or periodontitis) associated with coffee consumption. Data were tabulated in the Excel package and transferred to SPSS version 20. Then, we calculated measures of central tendency to explore the variables of the research subjects. Next, we performed the Chi-square test to analyze the differences in the proportions of the responses of interest adjusted for all pairwise comparisons within a row of each sub-table by using the Bonferroni correction.

The non-parametric Kruskall-Wallis test and Spearman's correlation coefficient (r) were used to compare age and the index teeth variable, allowing the analysis of correlations. We also performed multivariate analysis by logistic regression on associations with $p<.02$. In all inferential analyses, 95% confidence intervals were calculated.

2.10 PATIENT SAFETY

The minimal risks involved in the study included the possibility of embarrassment or discomfort when answering some questions or during the clinical examination. All participants were given the right not to answer questions and withdraw from the study at any time.

The physical risks included pain or discomfort and gingival bleeding in participants who had previously installed periodontal disease. Periodontal treatment (prophylaxis, cleaning, and

medication) was guaranteed for diagnosed cases. A risk of embarrassment during the clinical examination could also happen (for example, if the participant noticed that his or her toothbrushing was poor). Local gingival inflammation with bleeding after probing was also a potential risk. In this case, prophylactic procedures (cleaning) and oral hygiene guidelines were guaranteed to reverse the inflammatory condition. Mouth rinsing solution was prescribed in some cases.

3 RESULTS

3.1 PARTICIPANTS

The sample consisted mostly of females (63%) with a monthly income of up to 2 minimum wages (52.8%) with a high school level of education (47.2%). The participants lived with their parents (36.2%) or with a partner (32.3%) on paved streets (99.2%) in the urban area (100%). The predominant sociodemographic classification was C2 (82%).

Age seems to have influenced the CPI assessment, as the mean age showed statistical differences in CPI_S1 ($p<0.001$), CPI_S2 ($p<0.001$), CPI_S3 ($p<0.001$), CPI_S4 ($p<0.001$), and CPI_S6 ($p <0.001$) except for CPI_S5 ($p=0.270$) only, with was not statistically correlated with the other evaluation components (see Table 1 for a better understanding of the location of the sextants).

When comparing age with the evaluated index tooth, in those with statistically significant differences, we observed that the altered pattern (presence of bleeding, calculus, or periodontal pockets) was associated with increased age (Table 1). We used logistic regression models to analyze age and index tooth relationships, but no statistical differences were found ($p>0.05$).

Table 1: Comparison of age, according to the tooth index evaluation criteria of the participants, Baturité-CE. Brazil. 2023

CPI index		**Age (years)**					
		Average	Minimum	Median	Maximum	SD[1] (years)	p-value[2]
CPI_S1	Healthy	34	10	33	71	12	0.089
	Not healthy	38	18	40	65	13	
CPI_S2	Healthy	34	10	33	71	12	**0.003**
	Not healthy	41	18	42	65	13	
CPI_S3	Healthy	33	10	31	71	12	**0.003**
	Not healthy	40	18	40	67	13	
CPI_S4	Healthy	33	10	31	71	12	**0.001**
	Not healthy	40	20	41	65	12	
CPI_S5	Healthy	37	18	38	71	13	0.457

	Not healthy	35	10	33	65	12	
	Healthy	34	18	32	71	13	**0.015**
CPI_S6	Not healthy	39	10	40	65	12	

[1]SD= Standard Deviation
[2]Kruskall-Wallis test
Source: Authors

3.2 COFFEE CONSUMPTION AND PERIODONTAL DISEASE

Educational level was also not associated with the variables related to daily coffee consumption investigated in the sample, including coffee consumption (p=0.334), frequency of coffee consumption (p=0.191), coffee serving method (sugar/sweetener/milk/plain) (p=0.974), and coffee portion (120 ml or 240 ml) (p=0.095). Drinking coffee was significantly related to healthy CPI_S4 in about half of the sample (Table 2).

Table 2: Association between coffee consumption and index teeth assessment. Baturité, Ceará, Brazil. 2023

CPI index		**Coffee consumption**		
		Yes N (%)	No N (%)	p-value[1]
CPI_S1	Healthy	62 (48.8)	5 (3.9)	0.799
	Bleeding	20 (15.7)	3 (2.3)	
	Calculus	18 (14.1)	1 (0.7)	
	4-5 mm pocket	3 (2.3)	-	
	Sextant excluded	13 (10.2)	2 (1.5)	
CPI_S2	Healthy	83 (65.3)	6 (4.7)	0.077
	Bleeding	12 (9.4)	4 (3.1)	
	Calculus	11(8.6)	-	
	Sextant excluded	10 (7.8)	1 (0.7)	
CPI_S3	Healthy	58 (45.6)	6 (4.7)	0.853
	Bleeding	19 (14.9)	1 (0.7)	
	Calculus	17 (13.3)	1 (0.7)	
	4-5 mm pocket	2 (1.5)	-	
	Sextant excluded	20 (15.7)	3 (2.3)	
CPI_S4	Healthy	68 (53.5)	5 (3.9)	**0.018**
	Bleeding	11 (8.6)	2 (1.5)	
	Calculus	18 (14.1)	2 (1.5)	
	4-5 mm pocket	-	1 (0.7)	
	Sextant excluded	19 (14.9)	1 (0.7)	
CPI_S5	Healthy	61 (48)	4 (3.1)	0.609
	Bleeding	11 (8.6)	2 (1.5)	
	Calculus	41 (32.2)	5 (3.9)	
	Sextant excluded	3 (2.3)	-	
CPI_S6	Healthy	70 (55.1)	6 (4.7)	0.259
	Bleeding	10 (7.8)	3 (2.3)	
	Calculus	18 (14.1)	1 (0.7)	
	Sextant excluded	18(14.1)	1 (0.7)	

[1]Chi-square test
Source: Authors

Table 3: Association between frequency of coffee consumption and index teeth assessment. Baturité, Ceará, Brazil. 2023

CPI index tooth registration		Frequency of coffee consumption						
		1x a day N (%)	≥ 2x a day N (%)	5-6x a week N (%)	2-4x a week N (%)	1 x a week N (%)	1-3x a month N (%)	p-value[1]
CPI_S1	Healthy	14 (11)	43 (33.8)	2 (1.5)	3 (2.3)	-	-	0.481
	Bleeding	4 (3.1)	12 (9.4)	-	1 (0.7)	1 (0.7)	2 (1.5)	
	Calculus	3 (2.3)	13 (10.2)	1 (0.7)	1 (0.7)	-	-	
	4-5 mm pocket	1 (0.7)	2 (1.5)	-	-	-	-	
	Sextant excluded	1 (0.7)	12 (9.4)	-	-	-	-	
CPI_S2	Healthy	17 (13.3)	58 (45.6)	2 (1.5)	4 (3.1)	1 (0.7)	1 (0.7)	0.836
	Bleeding	2 (1.5)	9 (7)	-	-	-	1 (0.7)	
	Calculus	3 (2.3)	6 (4.7)	1 (0.7)	1 (0.7)	-	-	
	Sextant excluded	1 (0.7)	9 (7)	-	-	-	-	
CPI_S3	Healthy	8 (6.2)	44 (34.6)	2 (1.5)	3 (2.3)	1 (0.7)	-	0.493
	Bleeding	3 (2.3)	13 (10.2)	-	1 (0.7)	-	2 (1.5)	
	Calculus	4 (3.1)	11 (8.6)	1 (0.7)	1 (0.7)	-	-	
	4-5 mm pocket	1 (0.7)	1 (0.7)	-	-	-	-	
	Sextant excluded	7 (5.5)	13 (10.2)	-	-	-	-	
CPI_S4	Healthy	10 (7.8)	51 (40.1)	2 (1.5)	4	1 (0.7)	-	0.345
	Bleeding	5 (3.9)	5 (3.9)	-	-	-	1 (0.7)	
	Calculus	4 (3.1)	11 (8.6)	1 (0.7)	1 (0.7)	-	1 (0.7)	
	Sextant excluded	4 (3.1)	15 (11.8)	-	-	-	-	
CPI_S5	Healthy	13 (10.2)	43 (33.8)	2 (1.5)	2 (1.5)	1 (0.7)	-	0.569
	Bleeding	1 (0.7)	7 (5.5)	-	2 (1.5)	-	1 (0.7)	
	Calculus	9 (7)	29 (22.8)	1 (0.7)	1 (0.7)	-	1 (0.7)	
	Sextant excluded	-	3 (2.3)	-	-	-	-	
CPI_S6	Healthy	12 (9.4)	51 (40.1)	2 (1.5)	4 (3.1)	1 (0.7)	-	0.582
	Bleeding	3 (2.3)	6 (4.7)	-	-	-	1 (0.7)	
	Calculus	5 (3.9)	10 (7.8)	1 (0.7)	1 (0.7)	-	1 (0.7)	
	Sextant excluded	3 (2.3)	15 (11.8)	-	-	-	-	

[1]Chi-square test
Source: Authors

In numerical terms, in all strata of the CPI Index, most participants consumed 240 mL of coffee, but no significant differences were found between the group of subjects who consumed this amount and the group that consumed 120 ml (p>0.05) concerning CPI_S1 (p=0.345), CPI_S2 (p=0.452), CPI_S3 (p=0.859), CPI_S4 (p=0.176), CPI_S5 (p=0.959), and CPI_S6 (p=0.707). Regarding the frequency of coffee consumption, the highest was ≥ 2 times a day. However, this difference was not statistically significant (p>0.05) concerning the subjects' CPI Index (Table 3)

The sample substantially consumed coffee with sugar. In the CPI_S2 stratum, this difference was statistically significant (p=0.044), followed by coffee with milk (and often with sugar). On the other hand, less than 5% of the participants used sweeteners. The comparison of response proportions did not show statistically significant differences (p>0.05) (Table 4).

The frequency of coffee consumption was inversely and significantly correlated (p=0.037) with the evaluation of teeth index CPI_S3 (Rho Sperman = -0.194). However, we found no statistically significant association between diagnosis of periodontal disease and coffee consumption (p=0.746), frequency of coffee consumption (p=0.617), amount of coffee (p=0.741), or consumption of sugar or sweetener in coffee (p=0.351).

Table 4: Association between coffee serving method and index teeth assessment. Baturité, Ceará, Brazil. 2023

CPI index tooth registration		**Coffee serving method**				p-value[2]
		Black[1] N (%)	With sugar N (%)	With sweetener N (%)	With milk N (%)	
CPI_S1	healthy	5 (3.9)	45 (35.4)	-	12 (9.4)	0.128
	bleeding	-	13 (10.2)	-	7 (5.5)	
	Calculus	1 (0.7)	10 (7.8)	1 (0.7)	6 (4.7)	
	4-5 mm pocket	1 (0.7)	1 (0.7)	-	1 (0.7)	
	sextant excluded	-	12 (9.4)	-	1 (0.7)	
CPI_S2	healthy	7 (5.5)	56 (44)	-	20 (15.7)	**0.044**
	bleeding	-	9 (7)	-	3 (2.3)	
	Calculus	-	6 (4.7)	1 (0.7)	4 (3.1)	
	sextant excluded	-	10 (7.8)	-	-	
CPI_S3	healthy	3 (2.3)	42 (33)	-	13 (10.2)	0.579
	bleeding	1 (0.7)	12 (9.4)	-	6 (4.7)	
	Calculus	1 (0.7)	10 (7.8)	1 (0.7)	5 (3.9)	
	4-5 mm pocket	-	1 (0.7)	-	1 (0.7)	
	sextant excluded	2 (1.5)	16 (12.5)	-	2 (1.5)	
CPI_S4	healthy	3 (2.3)	49 (38.5)	-	16 (12.5)	0.064
	bleeding	1 (0.7)	6 (4.7)	-	4 (3.1)	
	Calculus	1 (0.7)	9 (7)	1 (0.7)	7 (5.5)	
	sextant excluded	2 (1.5)	17 (13.3)	-	-	
CPI_S5	healthy	4 (3.1)	47 (37)	-	10 (7.8)	0.665

	bleeding	-	8 (6.2)	-	3 (2.3)	
	Calculus	3 (2.3)	24 (18.8)	1 (0.7)	13 (10.2)	
	sextant excluded	-	2 (1.5)	-	1 (0.7)	
	healthy	5 (3.9)	50 (39.3)	-	15 (11.8)	0.111
CPI_S6	bleeding	1 (0.7)	7 (5.5)	-	2 (1.5)	
	Calculus	1 (0.7)	8 (6.2)	1 (0.7)	8 (6.2)	
	sextant excluded	-	16 (12.5)	-	2 (1.5)	

[1]Black coffee without sugar
[2]Chi-square test
Source: Authors

4 DISCUSSION

We identified that the CPI_S5 was the sextant most affected by calculus regardless of age. In 2010, Brazil's most frequent periodontal alteration was precisely the presence of calculus, mainly in the inferior central sextant [21-22]. This result is due not only to poor brushing or the presence of biofilm but also due to the location of the opening of the ducts of the submandibular salivary glands, which secrete saliva close to the lingual surface of the lower anterior teeth. The biofilm becomes mineralized due to the precipitation of mineral salts in saliva [3].

The findings of the SB Brasil Project [21-22] show that the superior central sextant (CPI_S2) is usually the most healthy, although a progressive reduction of the health of this sextant is expected throughout life. Generally, there is a trend toward an increase in periodontal alterations with age [23], similar to what this study reports.

We identified statistically significant findings regarding the influence of age on the presence of periodontal diseases. Although there is no clear proof of the direct relationship between aging and the onset of periodontal diseases, some systemic (chronic diseases) and tissue alterations, as well as biofilm retentive factors (prostheses or extensive restorations) and limitations of the elderly's motor capacity (poor brushing) can lead to aggravation [23]. It is known that the changes that occur in the oral cavity with aging reflect the changes in the body [24]. Issues such as inflammatory or degenerative clinical conditions partially explain the vulnerability of the elderly to periodontitis. Elucidating the causal mechanisms of innate immune dysfunction in old age may help understand the role of aging in periodontal disease [25].

Aging modulates the proliferative activity of cells. Periodontal ligament cells from older persons exhibit a less differentiated phenotype and a reduced response to parathyroid hormones, suggesting a compromised ability to maintain tissue homeostasis and a limited possibility of action in periodontal repair processes [26]. However, periodontal diseases should not be seen as

something restricted to old age. Periodontitis begins in youth or early adulthood, and takes years or decades to evolve, presenting chronic features with cyclical patterns of exacerbation and remission. The assumption that periodontitis is a disease of aging has been challenged, with the greater periodontal destruction seen in the elderly reflecting a lifetime of disease accumulation rather than an age-specific condition [27].

In our study, the frequency of coffee consumption was inversely correlated with periodontal disease (p=0.037) in five of the six sextants assessed. In 2022, Rhee et al. [28] published a self-described "first meta-analysis to investigate the relationship between coffee consumption, periodontitis, and tooth loss". Six studies were analyzed out of a total of 46 found in databases. Of these, two cohort studies and four cross-sectional studies. The authors did not find a relationship between coffee consumption and periodontal diseases but emphasized that it is important to interpret their results cautiously and that new large-scale studies were needed.

Hang et al.'s. [29] investigation of the association of coffee with plasmatic biomarkers indicates that coffee consumption is associated with a favorable profile in terms of metabolic and inflammatory pathways. In other words, coffee can modulate metabolic and inflammatory pathways. However, the association between high coffee consumption and some biomarkers seems relatively small.

Machida et al.'s [15] cross-sectional study found a relationship between coffee consumption and the improvement of periodontal disease during the treatment period. The group that consumed amounts ≥ 1 time a day had a lower prevalence of periodontitis than those who consumed less than one cup of coffee daily, indicating a direct relationship between coffee consumption and reduced incidence of periodontitis. Further, this result was not observed in patients with moderate periodontitis. Even though regular coffee consumption can prevent the progression of the periodontitis, it may have little effect on its initial stage. The frequency of coffee consumption found in this study was ≥ twice a day, usually in the morning (breakfast) and the late afternoon. Of the 127 participants, only 5 coffee drinkers had periodontal pockets of 4 to 5mm, and none had pockets greater than 6mm.

Most participants reported consuming coffee sweetened with sugar or with sugar and milk. It is not easy to assess the correlation between sugar consumption and periodontal health because the amount and frequency of other meals of the day are variable. Even if strongly related, sugar consumption also occurs between meals, making parameterization difficult [30]. In addition to the fact that we did not measure sugar consumption throughout the day, another limitation is that we did not investigate the daily intake of other foods that could act as agonists or antagonists of the bioactive principles of coffee.

Periodontitis is one of the main health problems in patients with diabetes and a risk factor for glycemic control in decompensated patients (with excessively high glycemic biomarkers). Thus, the close relationship between periodontal disease and diabetes has been a concern among dentists [31]. Considering these aspects, to minimize a confounding factor in the statistical analysis, we chose not to include people with diabetes in our research.

Studies evaluating the relationship between periodontal diseases and coffee consumption have found divergent results. While in some published articles, coffee consumption has a therapeutic effect on periodontal diseases [12-15, 32], in others, it potentializes this condition [16, 33-35]. Finally, a recent systematic review did not find any relationship (either beneficial or deleterious) between these two variables [28]. Thus, with the prospects of building more robust epidemiological evidence to support decision-making in health, further studies must be conducted.

Coffee is rich in antioxidants, which would delay aging and, thus, the loss of responsiveness to tissue damage. The coffee grain has 1% to 2.5% caffeine, minerals, sugars, fats, amino acids, and a B-complex vitamin — Vitamin PP [36]. Kobayashi et al.'s [12] study, the first investigating the effects of continuous coffee consumption and gingival and alveolar bone oxidative stress in rats, found that oxidative stress in periodontal tissue increases with aging and that total antioxidant capacity was significantly higher in the coffee-consuming group, thus increasing its systemic antioxidant capacity.

There is ample evidence of coffee's antioxidant and anti-inflammatory effects and caffeine [32, 33, 37-39]. Although a prior study has supported an association of higher levels of coffee consumption with periodontal health, the actual magnitude of the benefit was small and may not be considered clinically significant [32, 40]. Our study also supports that the younger the individual is, the higher the coffee/tea intake and the healthier the CPI Index. However, this may also reflect an expected pattern of healthy youth (with little incidence of periodontal disease) and chronic disease accumulation in older people.

5 CONCLUSION

Coffee consumption was inversely related to the prevalence of the periodontal disease. Participants who consumed more coffee showed a lower prevalence of gingival bleeding, calculus, and periodontal pockets.

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