

AVALIAÇÃO DOS FATORES DE RISCO, CONHECIMENTO E MANIFESTAÇÕES CLÍNICAS DO TABAGISMO EM ACADÊMICOS DE ODONTOLOGIA DE UMA UNIVERSIDADE NO CENTRO-OESTE DO PARANÁ, BRASIL

ASSESSMENT OF RISK FACTORS, KNOWLEDGE, AND CLINICAL MANIFESTATIONS OF SMOKING AMONG DENTAL STUDENTS AT A UNIVERSITY IN CENTRAL-WESTERN PARANÁ, BRAZIL

EVALUACIÓN DE LOS FACTORES DE RIESGO, EL CONOCIMIENTO Y LAS MANIFESTACIONES CLÍNICAS DEL TABAQUISMO ENTRE ESTUDIANTES DE ODONTOLOGÍA DE UNA UNIVERSIDAD EN LA REGIÓN CENTRO-OESTE DE PARANÁ, BRASIL

Beatriz Barbosa Montanher¹
Ellen Caroline Teófilo Campos²
Amanda Scherer Mattjie³
Francielle Baptista de Souza⁴
Flávio Roberto Machado Justo⁵
Saulo Ancelmo de Souza Júnior⁶

RESUMO: Este estudo teve como objetivo analisar fatores de risco associados ao tabagismo, conhecimento dos estudantes sobre seus efeitos na saúde e presença de sinais clínicos inflamatórios orais entre estudantes de odontologia de uma instituição de ensino superior no Paraná, Brasil. Este estudo transversal, quantitativo e descritivo utilizou um questionário estruturado e um exame clínico periodontal. Participaram 121 estudantes, dos quais 24,8% relataram uso atual de tabaco/produtos com nicotina; entre estes, 83% utilizavam dispositivos eletrônicos para fumar. O tabagismo apresentou associação significativa com halitose ($p < 0,001$), e a duração do tabagismo correlacionou-se positivamente com a profundidade de sondagem periodontal, particularmente nos dentes anteriores inferiores, sugerindo um efeito cumulativo dos danos do tabagismo no periodonto. Alterações gengivais foram identificadas em 50% dos participantes examinados, com predominância de gengivite localizada. Os estudantes demonstraram alto nível de conhecimento sobre os riscos associados ao tabagismo, particularmente o câncer bucal, embora ainda existam lacunas no reconhecimento clínico das lesões associadas ao tabagismo. Essas descobertas ressaltam a importância de estratégias educacionais que integrem o conhecimento teórico à prática clínica, políticas públicas voltadas para a prevenção do tabagismo entre jovens e uma regulamentação mais rigorosa do acesso a produtos de tabaco e cigarros eletrônicos.

Palavras-chave: Tabagismo. Saúde Bucal. Estudantes de Odontologia. Doença Periodontal. Prevenção.

Research project funded by the Fundação Araucária de Apoio ao Desenvolvimento Científico e Tecnológico do Estado do Paraná (FA), notice nº 6994.

¹ Cirurgiã-dentista, mestranda em Ciências Odontológicas pela Universidade do Chile, Santiago, Chile.

² Cirurgiã-dentista, Centro Universitário Integrado, Campo Mourão - PR, Brasil.

³ Acadêmica do curso de Medicina, Centro Universitário Integrado, Campo Mourão - PR, Brasil.

⁴ Bióloga, mestre e doutora em Ciências Biológicas, Docente do curso de Odontologia e Coordenadora de Pesquisa do Centro Universitário Integrado, Campo Mourão - PR, Brasil.

⁵ Cirurgião-dentista, especialista e mestre em Periodontia, Docente do curso de Odontologia do Centro Universitário Integrado, Campo Mourão - PR, Brasil.

⁶ Cirurgião-dentista, especialista em Implantodontia, mestre em Ciências Biológicas, doutor em Odontologia Integrada e Docente do curso de Odontologia do Centro Universitário Integrado, Campo Mourão - PR, Brasil.

ABSTRACT: This study aimed to analyze risk factors associated with smoking, students' knowledge of its health effects, and the presence of inflammatory oral clinical signs among dental students at a higher education institution in Paraná, Brazil. This cross-sectional, quantitative, descriptive study used a structured questionnaire and a periodontal clinical examination. A total of 121 students participated, of whom 24.8% reported current tobacco/nicotine product use; among these, 83% used electronic smoking devices. Smoking was significantly associated with halitosis ($p < 0.001$), and smoking duration was positively correlated with periodontal probing depth, particularly in the mandibular anterior teeth, suggesting a cumulative effect of smoking-related damage on the periodontium. Gingival alterations were identified in 50% of the clinically examined participants, with localized gingivitis predominating. Students demonstrated a high level of knowledge regarding smoking-related risks, particularly oral cancer, although gaps remained in the clinical recognition of smoking-associated lesions. These findings underscore the importance of educational strategies that integrate theoretical knowledge with clinical practice, public policies aimed at preventing smoking among young people, and stricter regulation of access to tobacco and electronic smoking products.

Keywords: Smoking. Oral Health. Dental Students. Periodontal Disease. Prevention.

RESUMEN: Este estudio analizó factores de riesgo del tabaquismo, conocimientos sobre sus efectos y signos clínicos inflamatorios orales en 121 estudiantes de odontología en Paraná, Brasil. La investigación transversal, cuantitativa y descriptiva empleó un cuestionario estructurado y un examen clínico periodontal. El 24,8% reportó consumo actual de nicotina, con un 83% de preferencia por cigarrillos electrónicos. El tabaquismo se asoció significativamente con la halitosis ($p < 0,001$), y la duración del hábito se correlacionó positivamente con la profundidad de sondaje periodontal, sobre todo en los dientes anteriores inferiores, evidenciando un efecto dañino acumulativo. Se hallaron alteraciones gingivales en el 50% de los examinados, con predominio de gingivitis localizada. Aunque los estudiantes mostraron alto conocimiento teórico sobre las consecuencias del tabaquismo, especialmente el cáncer oral, persistieron brechas en el reconocimiento clínico de lesiones vinculadas. Los hallazgos subrayan la necesidad de integrar la teoría con la práctica clínica, impulsar políticas públicas preventivas en jóvenes y aplicar una regulación más estricta a los productos de tabaco y cigarrillos electrónicos.

Palabras-clave: Tabaquismo. Salud bucal. Estudiantes de odontología. Enfermedad periodontal. Prevención.

INTRODUCTION

Smoking is a major global public health problem because, according to the World Health Organization (2025), it is directly associated with the development of oral diseases such as periodontitis, gingivitis, and oral cancer. Major constituents of conventional and electronic cigarettes, including nicotine and conine, are highly toxic and can impair immune function, thereby increasing susceptibility to periodontal disease (Serqueira et al., 2020).

In addition, nicotine acts as a vasoconstrictor in the oral mucosa, which may mask signs and symptoms of inflammation and facilitate the proliferation of intraoral pathogens, thereby favoring the development of oral diseases. Tar, a highly toxic coal-derived substance also present in conventional cigarettes, may alter the color of the oral mucosa and teeth, reduce salivary secretion, and contribute to halitosis (Costa et al., 2022). Thus, smoking directly affects oral health in both aesthetic and functional terms.

Despite the harmful effects of smoking on oral and systemic health, studies indicate that cigarette use, particularly electronic cigarette use, has increased among young people (Brasil, 2024). During the transition to adulthood, biological and social changes may increase young people's vulnerability to smoking initiation and experimentation with electronic devices, a process further facilitated by marketing strategies and the mistaken perception that these products are less harmful (Ríos et al., 2018).

According to Leite et al. (2023), university students use cigarettes for several reasons, including peer influence and curiosity and, in the case of electronic cigarettes, the availability of multiple flavors and more pleasant odors. Taken together, these factors make cigarette use a public health concern in Brazil and in several other countries because it causes irreversible harm to health and increases healthcare expenditures associated with treatment and procedures (Alcaraz and Riviere, 2023).

Data from the Brazilian Surveillance System for Risk and Protective Factors for Chronic Diseases by Telephone Survey (2024) indicate that 9.3% of the Brazilian population aged 18 years or older currently smokes (10.2% of men and 7.2% of women) (Brasil, 2024).

Within this context, the objective of this study was to comparatively analyze risk factors associated with smoking, the level of knowledge regarding its health effects, and the prevalence of inflammatory oral clinical signs among dental students at a university center located in central-western Paraná, Brazil.

METHODS

This study was designed as a descriptive epidemiological investigation with a quantitative approach and cross-sectional design. Data were collected from July to September 2025 among undergraduate dental students aged 18 years or older at an educational institution located in the state of Paraná, Brazil. The study was approved by the institutional Research Ethics Committee for studies involving human participants under Certificate of Presentation for Ethical Review (CAAE) No. 86913125.4.0000.0092, in accordance with Resolution No. 466/2012 of the Brazilian National Health Council.

A total of 176 students were enrolled in the Dentistry program. The sample size was calculated for a finite population, assuming a 95% confidence level and a 5% margin of error, resulting in a minimum required sample of 121 participants. Participants completed a self-administered structured questionnaire developed on the basis of previous studies and comprising 29 questions (Appendix 1). The instrument addressed sociodemographic

characteristics; prevalence and frequency of tobacco/nicotine product use; duration of use; reasons for and type of consumption; knowledge of the harmful effects of smoking; and self-reported clinical signs.

Subsequently, students who agreed to participate were scheduled at random, without prior stratification or allocation into smoker and non-smoker groups, and underwent an oral clinical examination and periodontal probing. Clinical examinations and periodontal charting were performed by a single examiner who was a specialist in Periodontology. A No. 5 dental mirror and a PC-15 periodontal probe (GOLGRAN) were used. The examiner was unaware of participants' smoking status, characterizing a single-blind approach intended to minimize bias during clinical assessment.

After the clinical examination, volunteers completed a second questionnaire (Appendix 2) addressing medical and dental history, including pre-existing diseases, medication use, and oral hygiene practices. The instrument also included the six items of the Fagerström Test for Nicotine Dependence. Blood pressure and heart rate were also measured.

Statistical analyses were performed using JAMOV[®] version 2.6 (The JAMOV Project, Sydney, Australia), with a significance level of 5% ($p < 0.05$). Descriptive analyses included frequencies, means, and standard deviations, followed by inferential analyses. Pearson's chi-square test of independence was used for nominal variables, Spearman's rank correlation for ordinal variables, and Welch's *t* test (when the assumption of homogeneity of variances was violated) and analysis of variance (ANOVA) for continuous variables, as appropriate to the statistical assumptions.

4

RESULTS AND DISCUSSION

Sociodemographic and smoking profile of the sample

Of the 121 dental students who participated in the study, 78.5% were female ($n = 95$) and 21.5% were male ($n = 26$). Thirty participants (24.8%) reported current tobacco/nicotine product use. Distribution by semester showed the highest concentration of students in the 10th semester (28.1%). Of the 121 respondents, 27 agreed to undergo an intraoral clinical examination, and 22 attended at the scheduled date and time. This group underwent dental and periodontal assessment according to the criteria described in the Methods section.

Among the 30 participants who reported current tobacco/nicotine product use, 25 were women (26.3% of all female participants) and five were men (19.2% of all male participants).

Of these, five (16%) used conventional cigarettes and 25 (83%) used electronic cigarettes. Pearson's chi-square test was used to assess the association between sex and smoking status. No significant association was observed ($p = 0.459$), suggesting that, in this sample, smoking behavior did not differ significantly between men and women.

In addition to sociodemographic and behavioral characteristics, the study investigated reasons for smoking. Responses were diverse; the most frequently reported reasons included "to relieve anxiety and stress" (4.132%), "for distraction" (3.306%), and "because of the variety of pleasant flavors and odors" (0.826%).

Smoking duration and consumption pattern

Most participants (76.03%) reported no smoking habit, which may be interpreted as a positive indicator of awareness regarding the risks associated with tobacco-derived products. This finding is consistent with recent studies indicating a downward trend in smoking among university students enrolled in health-related programs, where access to information and critical education regarding the harmful effects of tobacco is broader (Silva et al., 2022; Almeida-da-Silva et al., 2021).

Nevertheless, despite this trend, most students (77.69%) did not consider smoking-
prevention campaigns effective, suggesting a possible disconnect between the information available and the actual effectiveness of awareness strategies. This contrast highlights the need to redesign educational approaches so that they are more engaging, context-sensitive, and aligned with the realities of university students.

This critical perception of prevention campaigns becomes even more relevant when duration of tobacco exposure is considered. Among participants who smoked, 10.74% reported smoking for 1–3 years, 5.8% for 3–5 years, and 5.8% for more than 5 years (Table 1). The literature indicates that smoking duration is a major determinant of the progression of smoking-related conditions, including periodontal disease, cardiovascular diseases, and oral neoplasms (Chaffee et al., 2021; Medeiros and Dias, 2018). In addition, duration of tobacco exposure is directly related to the degree of nicotine dependence and difficulty with cessation (World Health Organization, 2021).

Consistent with these findings, the statistical analyses demonstrated a significant association between smoking duration and nicotine dependence score. The Fagerström test revealed different levels of dependence among participants who smoked, with 44.4% presenting high or very high dependence (score ≥ 7). Spearman's correlation between the Fagerström score

and the number of cigarettes or daily vaping sessions was significant ($\rho = 0.479$; $p = 0.024$). Participants with more than 5 years of smoking history had significantly higher scores than the other groups, indicating a direct relationship between smoking duration and degree of nicotine dependence.

Table 1 – Distribution of dental students according to smoking duration

Smoking duration	n	% of total
Does not smoke	92	76.0%
6 months to 1 year	2	1.7%
1 to 3 years	13	10.7%
3 to 5 years	7	5.8%
More than 5 years	7	5.8%

Source: Montanher et al., 2026.

Extending this analysis, 11.6% of participants who smoked reported consuming more than 10 cigarettes or vaping sessions per day, whereas 9.9% consumed fewer than five units per day. This daily consumption pattern may represent a clinically relevant risk to oral and systemic health. Studies have shown that frequent and heavier use is associated with more severe clinical alterations, including greater periodontal probing depth, alveolar bone loss, and disruption of the oral microbiota (Almeida-da-Silva et al., 2021; Chaffee et al., 2021).

Perceptions of the health effects of smoking

The effects of smoking on oral health were widely recognized by the students: 98.347% stated that smoking affects oral health. In addition, most participants (89.256%) considered electronic cigarettes to be as harmful to oral health as conventional cigarettes. This broad perception of smoking-related oral health effects extended to other relevant dimensions, including the risks associated with different forms of use and their clinical implications.

Reinforcing this perception, 71.1% of participants believed that smoking without inhaling does not reduce oral health risks. This finding suggests a more comprehensive understanding of the mechanisms through which tobacco affects the oral cavity, particularly its direct local effects. The literature supports this interpretation by demonstrating that, even without deep inhalation, direct contact between toxic substances and the oral mucosa is sufficient to trigger cellular and inflammatory alterations (Arora, Mishra and Chugh, 2014; Narde and Pereira, 2021).

Awareness of the local effects of tobacco also extended to its relationship with malignant lesions. Most participants (59.50%) identified smoking as one of the main risk factors for oral cancer, and 38.02% recognized that the duration and frequency of the habit favor the development of cancerous lesions. These findings indicate that students had a consistent understanding of the dose-response relationship, in agreement with studies by Khan et al. (2016) and Costa et al. (2022). This perception is particularly relevant and is also consistent with Bezerra de Oliveira et al. (2013), who identify tobacco as a major etiological factor for oral cancer, especially when combined with alcohol consumption.

In addition to its association with malignant lesions, participants demonstrated knowledge of the effects of smoking on periodontal structures. This understanding of the local effects of tobacco was also reflected in their perceptions of periodontal clinical manifestations associated with smoking. Among respondents, 55.4% reported that smoking inflames the gingiva and makes it more fibrotic, whereas 20.7% mentioned tooth mobility and 9.9% identified alveolar bone loss.

The literature shows that nicotine is rapidly absorbed through the oral mucosa, affecting fibroblasts, reducing gingival blood flow, and masking clinical signs of inflammation (Bizzarro et al., 2013). Medeiros and Dias (2018) and Costa et al. (2022) also highlight the vasoconstrictive effect of nicotine as a factor contributing to reduced clinical signs of inflammation. This feature can hinder the early diagnosis of periodontal diseases because classic signs such as gingival bleeding and edema may be attenuated by reduced blood flow in the affected region.

Expanding the analysis of tobacco-related effects, students also demonstrated awareness of structural damage to dental tissues. Among respondents, 22.3% reported multiple simultaneous effects, including tooth-surface staining, increased enamel porosity, and tooth wear. This combination of changes indicates that the impact of smoking extends beyond dental aesthetics, potentially compromising tooth structure and creating conditions that may favor caries and infection.

More specifically, students identified tooth-surface staining (28.1%), increased enamel porosity (1.6%), and tooth-surface wear (0.8%) as smoking-related effects. Tar in conventional cigarettes contributes to dark tooth pigmentation, whereas reduced salivary flow and contact with acidic substances may favor enamel erosion and increased porosity. In addition to aesthetic impairment, these alterations may increase susceptibility to caries and infection (Bertoni and Szklo, 2021).

Association between smoking and clinical manifestations

The chi-square test indicated a statistically significant association between smoking and self-reported halitosis attributed to smoking ($\chi^2 = 88.5$; $df = 3$; $p < 0.001$). Most participants who smoked reported smoking-related halitosis or uncertainty regarding its presence, whereas absence of this complaint predominated among non-smokers. These findings reinforce the influence of tobacco exposure on breath quality, potentially through alterations in the oral microbiota and the formation of volatile sulfur compounds.

The literature identifies smoking as a factor directly associated with alterations in the oral microbiota, reduced salivary flow, and accumulation of volatile sulfur compounds, which are major contributors to oral malodor (Bertoni and Szklo, 2021). In addition, tar and nicotine may contribute to biofilm formation and pigmentation, potentially aggravating halitosis (Costa et al., 2022).

In contrast to the findings for halitosis, no significant associations were observed between smoking and gingival bleeding ($p = 0.889$), impaired healing ($p = 0.162$), persistent oral lesions ($p = 0.913$), or diagnosis/suspicion of oral cancer ($p = 1.00$). The absence of gingival bleeding may be partly explained by nicotine-induced vasoconstriction, which reduces gingival blood flow and may hinder the clinical diagnosis of gingivitis and periodontitis (Costa et al., 2022).

This phenomenon is widely described in the literature as a major challenge in the clinical monitoring of patients who smoke, because the gingiva may appear clinically healthy even in advanced stages of periodontal disease (Medeiros and Dias, 2018).

Clinical and dental data

Clinical findings from the intraoral examinations complemented participants' self-reported perceptions and enabled a broader assessment of the effects of smoking on oral health. Of the 22 participants who underwent clinical examination, 45.5% were smokers. Age ranged

from 19 to 37 years, with young adults aged 19–24 years predominating (68.2%), reflecting a profile of young adults who may be more exposed to risk factors such as tobacco and alcohol (Bezerra de Oliveira et al., 2013).

Regarding medical conditions, 22.7% reported conditions such as asthma, epilepsy, anxiety, and fibromyalgia, and 54.5% regularly used medications, including anxiolytics, antidepressants, oral contraceptives, and asthma medications. Medeiros and Dias (2018) reported that smoking can impair immune function and wound healing, which may worsen clinical outcomes in patients with chronic diseases or those receiving continuous pharmacotherapy.

Although all participants had heart rates within the normal range, blood pressure showed greater variability among smokers, with 27.3% classified within hypertensive ranges. This finding suggested a possible association between smoking and elevated blood pressure ($\chi^2 = 8.69$; $p = 0.069$). Although the p value did not reach the conventional threshold for statistical significance, it indicates a potentially relevant trend. According to Barroso et al. (2020), smoking is a modifiable factor that contributes to systemic arterial hypertension, particularly through sympathetic nervous system activation and endothelial dysfunction. Nicotine may also increase blood pressure through vasoconstrictive mechanisms and adrenergic stimulation (Costa et al., 2022).

9

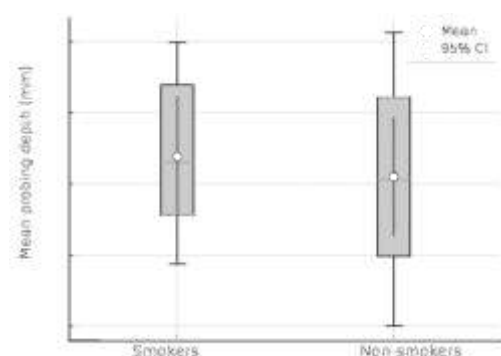
Regarding dental care, 90.9% reported attending preventive dental appointments and 86.4% reported daily flossing. Nevertheless, oral alterations were detected in 50% of participants, including gingival inflammation (18.2%), ulcers or lesions (9.1%), and melanotic pigmentation (4.5%). These findings are compatible with the deleterious effects of tobacco described by Arora, Mishra and Chugh (2014) and Narde and Pereira (2021), who emphasize the toxic effects of nicotine on periodontal tissues and its ability to mask clinical signs of inflammation.

Periodontal charting showed a predominance of localized gingivitis (40.9%) and gingivitis on a reduced periodontium (22.7%), supporting the literature on the role of smoking in modulating the gingival inflammatory response. According to Bizzarro et al. (2013) and Coretti et al. (2017), smokers have a higher prevalence of gingivitis and periodontitis, with changes in the subgingival microbiota and greater tissue destruction.

Comparison between smokers and non-smokers

Mean probing depths were compared between smokers and non-smokers using Welch's t test because the assumption of homogeneity of variance was violated. No statistically significant differences were observed between groups (Figure 1). The bleeding index also did not differ significantly between groups ($t = 0.650$; $p = 0.526$).

Figure 1 – Comparison of mean periodontal probing depth (mm) between smokers and non-smokers. The graph shows the distribution of values, including the median, quartiles, minimum, and maximum values.



Source: Montanher et al., 2026.

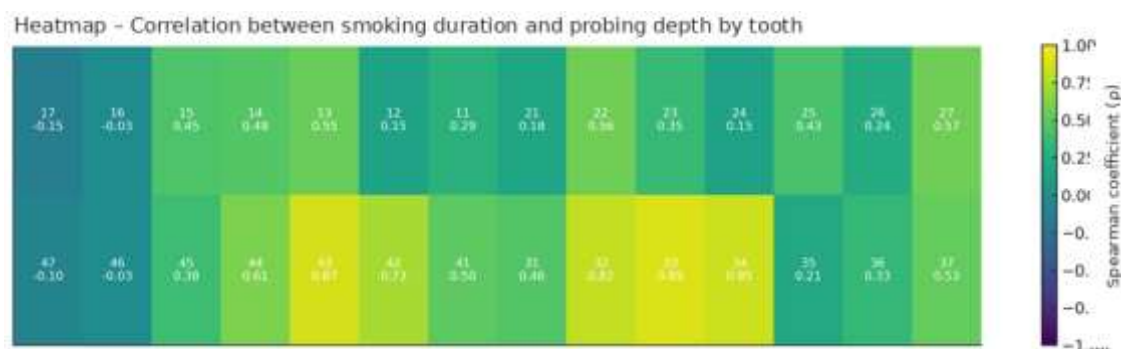
Although no statistically significant differences in mean probing depth were observed between smokers and non-smokers, a more complex pattern emerged when duration of tobacco exposure was considered. When smokers were stratified into three groups according to smoking duration (Group 1: 0–3 years; Group 2: 3–5 years; Group 3: >5 years), significant differences in periodontal parameters were identified, suggesting that the effect of smoking on periodontal tissues may be cumulative and intensify over time.

To investigate this hypothesis, two complementary analytical approaches were used: (a) comparative analysis by group and region and (b) tooth-by-tooth correlation analysis. In the first approach, analysis of variance (ANOVA) showed a statistically significant difference in mean probing depth in the mandibular right region (teeth 47–41) ($p = 0.041$), with a borderline difference between recent smokers (0–3 years) and those with an intermediate duration of smoking (3–5 years) ($p = 0.056$), suggesting possible early progression of periodontal tissue destruction.

In the second approach, Spearman's correlation analysis identified positive associations between smoking duration and probing depth in the mandibular anterior teeth—particularly teeth 32, 33, 34, 42, and 43—with correlation coefficients ranging from $\rho = 0.73$ to $\rho = 0.89$ ($p <$

0.05). These findings were reinforced by a heatmap visualization, which highlighted the mandibular anterior region as the most affected (Figure 2).

Figure 2 – Graphical representation of the strength and direction of Spearman's correlation (ρ) between smoking duration and periodontal probing depth, presented by tooth according to the FDI tooth-numbering system.



Source: Montanher et al., 2026.

This more refined analytical approach demonstrated that smoking duration is an important variable in periodontal risk assessment and more clearly reveals the progressive effects of tobacco exposure on periodontal integrity. The findings indicate that the effect of smoking on the periodontium is cumulative and becomes more apparent with longer exposure.

Recent smokers may not exhibit marked differences compared with non-smokers because nicotine-induced microvascular, inflammatory, and tissue effects are progressive and depend on both dose and duration of exposure. Studies such as Khan et al. (2016) support this dose-response relationship, showing that the risk of chronic periodontitis increases proportionally with the duration and intensity of smoking.

The anatomical distribution of these findings is unlikely to be random. The predominance of significant correlations in the mandibular anterior region may be related to specific pathophysiological mechanisms associated with smoking. During smoking, heated airflow and particles containing nicotine, tar, and other cytotoxic substances may be deposited directly on oral tissues. Such localized exposure can reduce gingival vascularization, alter the inflammatory response, and favor tissue damage. Nicotine-induced vasoconstriction may also mask inflammatory signs such as gingival bleeding, thereby complicating clinical recognition despite ongoing tissue injury (Chaffee and Cheng, 2021; Silva et al., 2021).

Smoking may exert site-specific effects on periodontal tissues. Previous studies have described asymmetric patterns of periodontal destruction among smokers (Anil et al., 2008). Anatomical and behavioral factors may also contribute to localized involvement. Mandibular

anterior teeth are prone to calculus accumulation, and the interaction between local deposits and tobacco-related effects may intensify inflammation and tissue damage. This region is also exposed to smoking-related salivary alterations, including reduced flow and changes in salivary composition, which may modify the oral microenvironment and favor the growth of anaerobic bacteria (Zhang et al., 2021).

Overall, the findings underscore the complexity of the relationship between smoking and oral health, revealing both subtle clinical changes and a critical level of awareness among students. Integrating self-reported data, clinical assessment, and statistical analysis made it possible to identify consistent patterns—such as the association with halitosis and increased probing depth at specific sites—that suggest cumulative and potentially clinically silent effects of smoking. Together with participants' knowledge of tobacco-related risks, these results indicate that, although academic training has advanced, important gaps remain that could be addressed through more practical and sustained educational strategies.

FINAL CONSIDERATIONS

This study provided an integrated analysis of risk factors associated with smoking, the level of knowledge regarding its health effects, and the prevalence of inflammatory oral clinical signs among dental students. Although most participants were non-smokers, a substantial proportion reported current use, predominantly through electronic smoking devices. Smoking-related effects—including halitosis and localized periodontal alterations—were identified in both self-reported data and clinical examinations, and longer exposure was associated with a higher prevalence of periodontal alterations. The absence of statistically significant associations with more evident inflammatory manifestations, such as gingival bleeding, supports the role of nicotine in modulating the vascular response and masking clinical signs, potentially complicating early diagnosis. Conversely, the high level of student awareness regarding smoking-related risks, particularly oral cancer, represents an important strength of academic training, although gaps remain in the clinical recognition of smoking-associated oral lesions. The most frequently reported risk factors for smoking in this population were anxiety and stress-related motivations, followed by peer influence and the availability of appealing flavors and odors, suggesting that social and contextual aspects of university life may contribute to smoking initiation during youth. These findings support strengthening educational strategies throughout dental training that integrate theoretical knowledge and clinical practice and foster more sensitive recognition of tobacco-related oral alterations. They

also reinforce the need for public policies aimed at smoking prevention and cessation among young people and for stricter regulation of access to tobacco and electronic smoking products.

ACKNOWLEDGMENTS AND FUNDING

The authors thank Fundação Araucária de Apoio ao Desenvolvimento Científico e Tecnológico do Estado do Paraná (FA) for supporting and funding this study.

REFERENCES

ALCARAZ, A.; RIVIERE, A. P. El control del tabaco en América Latina: logros, pendientes y nuevos desafíos. *Revista Peruana de Medicina Experimental y Salud Pública*, Lima, v. 40, n. 3, p. 264–266, 2023.

ALMEIDA-DA-SILVA, C. L. C. et al. Effects of electronic cigarette aerosol exposure on oral and systemic health.

ANIL, S.; ALAGARSAMY, V.; GUNASHEELA, B. Study of the patterns of periodontal destruction in smokers. *Indian Journal of Dental Research*, New Delhi, v. 19, n. 2, p. 124–129, 2008.

ARORA, N.; MISHRA, A.; CHUGH, S. Microbial role in periodontitis: have we reached the top? Some unsung bacteria other than red complex. *Journal of Indian Society of Periodontology*, Mumbai, v. 18, n. 3, p. 9–13, 2014.

BARROSO, W. K. S. et al. Diretrizes Brasileiras de Hipertensão Arterial. *Arquivos Brasileiros de Cardiologia*, Rio de Janeiro, v. 116, n. 3, p. 516–658, 2020. Disponível em: <<https://doi.org/10.36660/abc.20201238>>. Acesso em: 20 out. 2025.

BERTONI, N.; SZKLO, M. Dispositivos eletrônicos para fumar nas capitais brasileiras: prevalência, perfil de uso e implicações para a Política Nacional de Controle do Tabaco. *Cadernos de Saúde Pública*, Rio de Janeiro, v. 37, n. 7, e00261920, 2021. Disponível em: <<https://doi.org/10.1590/0102-311X00261920>>. Acesso em: 20 out. 2025.

BEZERRA DE OLIVEIRA, J. M. et al. Câncer de boca: avaliação do conhecimento de acadêmicos de Odontologia e Enfermagem quanto aos fatores de risco e procedimentos de diagnóstico. *Revista Brasileira de Cancerologia*, Rio de Janeiro, v. 59, n. 2, p. 211–218, 2013.

BIZZARRO, S. et al. Subgingival microbiome in smokers and non-smokers in periodontitis: an exploratory study using traditional targeted techniques and next-generation sequencing. *Journal of Clinical Periodontology*, Oxford, v. 40, n. 4, p. 483–492, 2013.

BRASIL. Ministério da Saúde. Ministério da Saúde e INCA lançam campanha de prevenção ao uso de cigarros eletrônicos. Brasília, DF: MS, 2024. Disponível em: <<https://www.gov.br/saude/>>. Acesso em: 20 out. 2025.

BRASIL. Ministério da Saúde. Secretaria de Vigilância em Saúde e Ambiente. Vigitel Brasil 2006–2023: vigilância de fatores de risco e proteção para doenças crônicas por inquérito

telefônico: tabagismo e consumo abusivo de álcool. Brasília, DF: Ministério da Saúde, 2024. Disponível em: <<https://www.gov.br/saude/pt-br/assuntos/saude-de-a-a-z/v/vigitel>>. Acesso em: 20 out. 2025.

CHAFFEE, B. W.; CHENG, J. The oral and periodontal implications of tobacco and nicotine products. *Periodontology 2000*, Copenhagen, v. 87, n. 1, p. 36–46, 2021.

CORETTI, L. et al. Subgingival dysbiosis in smoker and non-smoker patients with chronic periodontitis. *Molecular Medicine Reports*, Athens, v. 15, n. 1, p. 207–214, 2017.

COSTA, C. M. S. et al. A relação das substâncias do tabaco na doença periodontal. *Research, Society and Development*, Vargem Grande Paulista, v. 11, n. 16, e223111638279, 2022.

KHAN, S. et al. Chronic periodontitis and smoking: prevalence and dose-response relationship. *Saudi Medical Journal*, Riyadh, v. 37, n. 8, p. 889–894, 2016.

LEITE, A. M. et al. Uso de cigarros eletrônicos entre estudantes. *Revista Científica Integração*, [s. l.], v. 4, n. 1, p. 59–70, 2023.

MEDEIROS, G. V. P.; DIAS, K. S. P. A. A influência do tabagismo na doença periodontal: uma revisão de literatura. *Revista Psicologia e Saberes*, Maceió, v. 12, n. 40, p. 470–479, 2018.

NARDE, B.; PEREIRA, B. O tabagismo aplicado às patologias periodontais – causa e efeito: revisão de literatura. 2021. Trabalho de Conclusão de Curso (Graduação em Odontologia) – Universidade Facig, Manhuaçu, 2021.

ORGANIZAÇÃO MUNDIAL DA SAÚDE (OMS). Tabaco. Genebra: OMS, 2025. Disponível em: <<https://www.who.int/es/news-room/fact-sheets/detail/tobacco>>. Acesso em: 20 out. 2025.

ORGANIZAÇÃO MUNDIAL DA SAÚDE (OMS). WHO report on the global tobacco epidemic, 2021: addressing new and emerging products. Geneva: World Health Organization, 2021.

RÍOS, L. A. R. et al. Diferencias en el consumo de tabaco en estudiantes según el sexo universitarios. *Revista Cubana de Enfermería*, La Habana, v. 34, n. 3, p. 612–623, 2018.

SERQUEIRA, S. C. et al. Perfil periodontal de pacientes tabagistas do centro Hiperdia. *HU Revista*, Juiz de Fora, v. 45, n. 4, p. 396–401, 2020.

SILVA, F. J. et al. Tobacco use and periodontal disease – the role of oral microcirculation. *Biology*, Basel, v. 10, n. 5, p. 441, 2021.

SILVA, L. R. S. et al. Efeitos do uso de cigarros eletrônicos na saúde bucal: revisão de literatura. *Research, Society and Development*, Vargem Grande Paulista, v. 11, n. 13, e552111335539, 2022.

ZHANG, Y. et al. The impact of smoking on subgingival plaque and the oral microecology. *Frontiers in Oral Health*, Lausanne, v. 2, n. 751099, p. 1–9, 2021.

APPENDICES

Appendix 1: Self-administered structured questionnaire addressing sociodemographic characteristics, prevalence and frequency of tobacco/nicotine use, duration of use, reasons for and type of consumption, level of knowledge regarding the harmful effects of smoking, and self-reported clinical signs.

1. Which semester of the program are you currently enrolled in?

☐ 2nd semester

☐ 4th semester

☐ 6th semester

☐ 8th semester

☐ 10th semester

2. What is your age group?

☐ Under 18 years

☐ 18 to 23 years

☐ 24 to 29 years

☐ 30 to 35 years

☐ 36 years or older

3. Sex:

☐ Female

☐ Male

4. Do you use any of the following products? (Select all that apply.)

☐ Conventional cigarettes

☐ Electronic cigarettes (vape/pod)

☐ Snuff/chewing tobacco

☐ Waterpipe/hookah ☐ I do not use any ☐ Other:

5. How long ago did you start smoking/vaping?

☐ Less than 6 months

☐ 6 months to 1 year

☐ 1 to 3 years

☐ 3 to 5 years

- ☐ More than 5 years
- ☐ I do not smoke/vape
6. How often do you smoke/vape?
- ☐ Less than once a week
- ☐ 1 to 3 times per week
- ☐ Every day
- ☐ I do not smoke/vape
7. How many cigarettes or vape/pod sessions do you use per day?
- ☐ Fewer than 5
- ☐ 5 to 10
- ☐ More than 10
- ☐ I do not smoke/vape
8. Why do you smoke/vape? (Select all that apply.)
- ☐ To relieve anxiety and stress
- ☐ Because of peer influence
- ☐ For distraction
- ☐ To try to quit conventional cigarettes (for pod/vape users)
- ☐ Because of social media influence
- ☐ Because of the university environment
- ☐ Because of the variety of pleasant flavors and odors (for pod/vape users)
- ☐ Because I feel like smoking/vaping after drinking alcohol
- ☐ Because I feel like smoking/vaping after using other drugs
- ☐ Because of family influence ☐ I do not smoke/vape
- ☐ Other: _____
9. Do you think smoking-prevention campaigns in Brazil are effective?
- ☐ Yes
- ☐ No
- ☐ I do not know
10. Do you believe that smoking affects oral health?
- ☐ Yes

☐ No

☐ I do not know

11. Which oral health problems can smoking cause? (Select all options you consider correct.)

☐ Periodontal disease (problems involving the gums and supporting bone)

☐ Dental caries

☐ Halitosis

☐ Oral cancer

☐ Tooth discoloration

☐ Oral candidiasis

☐ None of these

☐ I do not know

12. Do you believe that electronic cigarettes are harmful to oral health?

☐ Yes, as harmful as conventional cigarettes

☐ Yes, but less harmful than conventional cigarettes

☐ No, they are not harmful to oral health

☐ I do not know

17

13. Do you believe that smoking without inhaling reduces oral health risks?

☐ Yes

☐ No

☐ I do not know

14. Can smoking cause oral cancer?

☐ Yes

☐ No

☐ I do not know

15. What is the relationship between smoking and oral cancer?

☐ Smoking is one of the risk factors that may cause the disease

☐ Nicotine in these products provides oxygen to oral tissues

☐ The duration and frequency of smoking favor the development of cancerous lesions

16. What is the relationship between smoking and periodontal disease? (Select all options you consider correct.)

- ☐ It inflames the gums and makes them more fibrotic (firm)
- ☐ It improves the health of the oral mucosa
- ☐ It makes the teeth firmer
- ☐ It reduces alveolar bone height
- ☐ It causes tooth mobility (loose teeth)
- ☐ It causes teeth to change position
- ☐ I do not know

17. What damage can smoking cause to the teeth? (Select all options you consider correct.)

- ☐ It stains the tooth surfaces
- ☐ It makes the teeth warmer
- ☐ It makes dental enamel more resistant
- ☐ It makes dental enamel more porous
- ☐ It makes the teeth whiter
- ☐ It causes wear of the tooth surfaces
- ☐ It makes dental enamel smoother ☐ I do not know

18

18. What are the immediate benefits of quitting smoking? (Select all options you consider correct.)

- ☐ Heart rate and blood pressure begin to return toward normal
- ☐ It reduces the risk of oral cancer
- ☐ Tooth stains disappear spontaneously
- ☐ The progression of periodontal disease (bone and gingiva) slows
- ☐ The individual feels more tired
- ☐ I do not know

19. Should a person diagnosed with oral cancer be concerned about quitting smoking?

- ☐ Yes
- ☐ No
- ☐ I do not know

20. Do you currently have, or have you ever had, yellowish or dark tooth staining attributable to smoking?

- ☐ Yes

☐ No

☐ I do not know

☐ I do not smoke/vape

21. Do you currently have, or have you ever had, halitosis attributable to smoking?

☐ Yes

☐ No

☐ I do not know

☐ I do not smoke/vape

22. Have you ever experienced delayed healing in the mouth after tooth extraction or other dental procedures?

☐ Yes

☐ No

☐ I do not know

23. Have you ever had bleeding, inflammation, gingival recession, or other clinical signs of periodontal disease affecting the gums and supporting bone?

☐ Yes

☐ No

☐ I do not know

24. Have your gums ever bled when brushing or flossing?

☐ Yes

☐ No

☐ I do not know

25. Do you currently have, or have you ever had, difficulty tasting foods or detecting odors?

☐ Yes

☐ No

☐ I do not know

26. Do you currently have, or have you ever had, oral lesions or sores that take a long time to heal?

☐ Yes

☐ No

☐ I do not know

27. Have you had oral infections, such as oral candidiasis, since you started smoking/vaping?

☐ Yes

☐ No

☐ I do not know

☐ I do not smoke/vape

28. Have you ever had a diagnosis of, or suspected, oral cancer?

☐ Yes

☐ No

☐ I do not know

29. In addition to estimating the proportion of dental students who smoke/vape, this study also aims to investigate the main oral manifestations found among students who use tobacco/nicotine products. Would you agree to participate in a subsequent clinical oral examination?

☐ Yes

☐ No

20

If your answer to the previous question is yes, please provide your full name and telephone number below.

Appendix 2: Medical and dental history questionnaire.

Anamnesis and clinical examination form.

1. Full name:

2. Age (numbers only):

3. Are you a smoker/vaper?

☐ Yes

☐ No

Fagerström Test for Nicotine Dependence.

4. How soon after waking do you smoke/vape?

☐ Within 5 minutes

☐ 6–30 minutes

☐ 31–60 minutes

☐ After 60 minutes

☐ N/A

5. Do you find it difficult to refrain from smoking/vaping in places where it is prohibited?

☐ Yes

☐ No

☐ N/A

6. Which cigarette/puff of the day gives you the greatest satisfaction?

☐ The first one in the morning

☐ Other

☐ N/A

7. How many cigarettes/vaping sessions do you use per day?

☐ Fewer than 10

☐ 11 to 20

☐ 21 to 30

☐ More than 31

☐ N/A

8. Do you smoke/vape more frequently in the morning?

☐ Yes

☐ No

☐ N/A

9. Do you smoke/vape even when you are ill and need to remain in bed for most of the day?

☐ Yes

☐ No

☐ N/A

Medical history (data recorded by the examiner).

10. Heart rate (beats per minute): _____

11. Blood pressure: _____

12. Do you have any disease or medical condition (e.g., depression, hypertension, diabetes, asthma)?

☐ Yes

☐ No

13. If yes, which disease(s)/condition(s)?

14. Do you use any medication?

☐ Yes

☐ No

15. If yes, which medication(s)?

22

Dental history

16. Are you satisfied with the appearance of your teeth?

☐ Yes

☐ No

17. When was your most recent dental visit?

☐ Less than 1 year ago

☐ 1 to 2 years ago

☐ 2 to 3 years ago

☐ 3 to 5 years ago

☐ More than 5 years ago

18. How often do you visit a dentist?

☐ Regularly

☐ At least once a year

☐ Only when I have pain

☐ Rarely

19. In general, what is the main reason for your dental visits?

☐ Prevention/routine care

☐ Toothache

☐ Orthodontic treatment

☐ Other: _____

20. How many times a day do you brush your teeth?

☐ Once a day

☐ Twice a day

☐ Three times a day

☐ Four or more times a day

21. Has a dentist ever instructed you on toothbrushing technique?

☐ Yes

☐ No

22. Do you use dental floss/interdental brushes daily?

☐ Yes

☐ No

23. Do your gums usually bleed during toothbrushing or flossing?

☐ Yes

☐ No

☐ Sometimes

24. Do you have tooth sensitivity to cold, heat, or sweet foods?

☐ Yes

☐ No

☐ Maybe

Intraoral clinical examination (completed by the examiner).

25. Oral alterations present:

Select all that apply.

☐ Melanotic pigmentation

☐ Halitosis

☐ Xerostomia

☐ Clinical signs of inflammation

☐ Leukoplakia

☐ Oral candidiasis

☐ Hairy tongue

☐ Ulcers and/or lesions

☐ Dental pigmentation and discoloration

☐ No alterations

☐ Other: _____