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Research Article

Impact of Smoking on Periodontal Health: A Comparative Study Between Libyan & Egyptian adult population

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ABSTRACT

Periodontal disease remains a major public health concern worldwide, with tobacco use identified as one of the most significant modifiable risk factors. This study aims to assess and compare the periodontal health status and the impact of smoking among the adult populations in Alexandria (Egypt) and Benghazi (Libya). A cross-sectional study involving 2,920 adult participants in both cities. Periodontal status was assessed using the Community Periodontal Index (CPI) and Loss of Attachment (LOA) scores. Participants were categorized based on smoking status, smoking type, and duration of smoking. Statistical analyses were conducted using Chi-square tests with significance set at $P < 0.05$. Heavy smokers demonstrated a significantly higher prevalence of deep periodontal pockets compared to non-smokers in Alexandria and Benghazi, 69.4% and 56.5%, respectively ($P < 0.0001$). Cigarette smoking was associated with more severe periodontal conditions than shisha smoking, particularly in Benghazi ($P= 0.007$). Duration of smoking was strongly associated with periodontal deterioration, with deep pockets present in 87.1% of long-term smokers in Alexandria and 73.7% in Benghazi ($P < 0.0001$). Smoking, particularly cigarette use and prolonged exposure, was significantly associated with worsening periodontal health. These findings underscore the importance of incorporating smoking cessation efforts into dental care and public health strategies to mitigate periodontal disease progression.

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1. Introduction

Periodontal disease, encompassing gingivitis and periodontitis, is a prevalent chronic inflammatory condition affecting the supporting structures of the teeth [1]. It is a leading cause of tooth loss among adults globally. The etiology of periodontal disease is multifactorial, with microbial plaque being the primary initiator, and various risk factors influencing its progression and severity [2].

Among the modifiable risk factors, smoking has been extensively studied and identified as a significant contributor to periodontal disease.it increases the incidence of periodontitis by 85% [1]. A direct correlation exists between smoking and increased tooth loss. Additionally, smoking is associated with a higher incidence of recurrent and refractory periodontal disease [2],[3]. The severity of periodontal disease has been linked to both the type and intensity of smoking habits, with studies showing that smokers exhibit deeper periodontal probing depths, greater clinical attachment loss, and more pronounced alveolar bone loss compared to non-smokers [2-4].

Numerous epidemiological studies, both cross-sectional and longitudinal studies, have consistently demonstrated an increased prevalence and severity of periodontal disease outcomes in smokers. For instance, smokers are reported to have a 2- to 8-fold higher risk of developing periodontitis and experiencing periodontal tissue loss compared to non-smokers. Furthermore, smoking has been associated with greater increases in probing depth and attachment loss [5-6].

Beyond cigarette smoking, other forms of tobacco use, such as cigars and pipes, have been found to exert similar detrimental effects on periodontal health, contributing to increased tooth loss and periodontal disease [7],[8]. While smokeless tobacco products tend to cause more localized effects, they are nonetheless associated with gingival recession and the development of white mucosal lesions [9]. While the association between smoking and periodontal deterioration is well established, the extent of its impact may vary across different populations due to variations in genetics, socio-cultural norms, oral hygiene practices, healthcare accessibility, and tobacco consumption behaviours [10],[11].

Egypt and Libya, two neighbouring North African countries, share several cultural and environmental similarities but differ in healthcare infrastructure, public health initiatives, and smoking prevalence. Egypt has a more developed dental healthcare system, including a wider network of public dental clinics, dental schools, and preventive programs integrated within its national health services. In contrast, Libya's oral healthcare system has been significantly affected by years of political instability and underfunding, leading to limited access to dental care. These differences present a valuable opportunity to investigate how smoking contributes to periodontal disease outcomes in two distinct, yet geographically and culturally connected populations. Conducting a comparative analysis of adult populations in Alexandria (Egypt) and Benghazi (Libya) allows for a better understanding of region-specific disease patterns and contributes to identifying high-risk groups and tailoring public health interventions accordingly. Therefore, this study aims to assess and compare the periodontal health status and the impact of smoking among the adult populations of Alexandria Governorate in Egypt and Benghazi City in Libya. The findings are expected to contribute to the development of tailored preventive and therapeutic strategies to improve periodontal health outcomes in these regions.

2. Methodology

2.1. Study Design and Population

This cross-sectional study was conducted to assess the prevalence and severity of periodontal disease among adult populations in Alexandria, Egypt, and Benghazi, Libya. The ethical clearance was obtained from the Faculty of Dentistry, Alexandria University, Egypt in addition to Faculty of Dentistry, University of Benghazi, Libya. The informed consent was obtained from all participants along with the completed self-administered questionnaire.

A stratified random sampling approach was used to ensure representation across key demographic groups. The patients were selected from outpatient dental clinics affiliated with the Ministry of Health in both cities. The inclusion criteria were: individuals aged 30-60, residing in either Egypt or Libya, and willing to provide informed consent. Exclusion criteria included individuals with incomplete questionnaires and those with cognitive impairments that could affect the accuracy of responses. Data collection extended over a period of six months

A total of 2,920 participants were recruited, comprising 2,500 subjects from Alexandria (1,051 males and 1,449 females) and 420 subjects from Benghazi (148 males and 272 females). Participants were categorized based on smoking status (non-smoker, light smoker, heavy smoker), smoking type (cigarette. Shisha, both), and duration of smoking.

2.2. Periodontal Examination

Periodontal health status was assessed using the Community Periodontal Index (CPI), a standardized tool recommended by the World Health Organization (WHO) for evaluating periodontal conditions. The CPI measures probing depth and clinical attachment loss to determine the prevalence and severity of periodontal disease. Clinical examinations were performed using a WHO-calibrated periodontal probe [12] and a mouth mirror. To ensure consistency and minimize examiner bias, all clinical assessments were conducted by a single trained examiner.

2.3. Data Collection

In addition to the clinical examination, a structured questionnaire was designed to collect data on potential risk indicators for periodontal disease. The questionnaire gathered information on socioeconomic factors, smoking status, frequency, type and duration of smoking.

2.4. Statistical Analysis:

Descriptive statistics were presented through means, frequencies (n) and percentages (%). The chi-square test was used to compare distributions between the groups. The significance level was set at $P \leq 0.05$. Statistical analysis was performed with IBM SPSS Statistics for Windows, Version 24.0.

3. Results

The current study showed that an increased percentage of subjects with healthy sextants (score 0) was detected among non-smokers in both Alexandria and Benghazi at 1.4%, and 0.3%, respectively, compared to both heavy and light smokers. Furthermore, heavy smokers also showed an increased prevalence of deep periodontal pockets compared to non-smokers. These results are statistically significant ($p < 0.0001$) in both cities, suggesting a strong association between smoking and worsening periodontal status (Table 1).

The results also showed that non-smokers showed the highest percentages in relation to levels of attachment loss (score 0) compared to heavy and light smokers (Table 2).

Cigarette smoking was associated with more severe periodontal conditions (especially deep pockets) in Alexandria (68.4%) ,and Benghazi (47.2%). In Benghazi, the type of smoking significantly affects periodontal health, with cigarette smokers showing more severe disease than shisha smokers, (χ^2) = 14.02, P = 0.007 (Table 3).

Cigarette smokers showed greater variation in LOA levels, including more moderate to severe cases. However, no statistically significant associations were found between the type of smoking and LOA in either city, $P > 0.05$ (Table 4).

In both Alexandria and Benghazi, as the duration of smoking increases, the percentage of individuals with deep periodontal pockets (score 4) increases sharply to 87.1%, and 73.7%, respectively. The relationship between the duration of smoking and periodontal deterioration was statistically highly significant ($P < 0.0001$) in both cities.

4. Discussion

The present study demonstrates a clear association between smoking and periodontal deterioration, with non-smokers in both Alexandria and Benghazi exhibiting higher

percentages of healthy sextants (score 0) compared to both light and heavy smokers. Specifically, 1.4% and 0.3% of non-smokers in Alexandria and Benghazi, respectively, had healthy periodontal status, whereas heavy smokers exhibited a substantially higher prevalence of deep periodontal pockets, a finding that was statistically significant ($p < 0.0001$). These findings are consistent with numerous previous studies that have reported poorer periodontal health among smokers compared to non-smokers.

It was found that smokers are four times more likely to have periodontitis than non-smokers emphasizing the strong dose response relationship between tobacco use and periodontal disease severity [13]. In other studies, smokers were found to have a two to six times increased risk of developing periodontal disease compared to non-smokers, suggesting that smoking impairs the host immune response and reduces the healing capacity of periodontal tissues, thereby contributing to deeper periodontal pockets and greater attachment loss [4,14].

Table 1: Relation between Periodontal Status as assessed by CPI Index and Smoking levels

City	Smoking levels	Healthy (score 0)	Bleeding (score 1)	Calculus (score 2)	Shallow pockets (score 3)	Deep pockets (score 4)	X^2/ P value
Alexandria	**Light smoker**	N/A	N/A	18.6%	19.2%	62.2%	117.85
	Heavy smoker	0.7%	N/A	11.8%	18.1%	69.4%	< 0.0001*
	Non-smoker	1.4%	0.7%	22.4%	30.4 %	45.1%	
Benghazi	**Light smoker**	N/A	N/A	36.4%	39.4%	24.2%	25.81
	Heavy smoker	N/A	N/A	4.8%	38.7%	56.5%	< 0.0001*
	Non-smoker	0.3%	N/A	27.3 %	43.3%	29.1 %	

Table 2: Relation between periodontal status as assessed by LOA and smoking levels

City	Smoking levels	0-3 mm (score 0)	4-5 mm (score 1)	6-8 mm (score 2)	9-11 mm (score 3)	12 mm or more (score 4)	X^2/ P value
Alexandria	**Non-smoker**	56.5%	24.3%	12.2%	4.5%	2.5%	121.33
	Heavy smoker	32.1%	32.7%	21.7%	8.7%	4.8%	< 0.0001
	Light smoker	40.9%	28.1%	18.1%	9.4%	3.5%	
Benghazi	**Non-smoker**	77.7%	11.6%	4.7%	2.8%	3.1%	32.83
	Heavy smoker	46%	17.5%	17.5%	9.5%	9.5%	< 0.0001*
	Light smoker	78.8%	9.1%	9.1%	3%	N/A	

Table 3: Relation between Periodontal Status as assessed by CPI Index and Type of smoking

City	Type of smoking	Healthy (score 0)	Bleeding (score 1)	Calculus (score 2)	Shallow pockets (score 3)	Deep pockets (score 4)	X^2/ P value
Alexandria	**Cigarette**	0.6%	N/A	%12.3	18.7%	68.4%	7.07
	Shisha	N/A	N/A	20%	17.3%	%62.7	0.32 NS
Benghazi	**Cigarette**	N/A	N/A	14.3%	%38.5	47.2%	14.02
	Shisha	N/A	N/A	**100%**	N/A	N/A	0.007*

* P value is statistically significant at the 5% level (P < 0.05) NS: Not statistically significant

Table 4: Relation between periodontal status as assessed by LOA and types of smoking

City	Type of Smoking	0-3 mm (score 0)	4-5 mm (score 1)	6-8 mm (score 2)	9-11 mm (score 3)	12 mm or more (score 4)	X^2/ P value
Alexandria	**Cigarette**	33.3%	32.1%	21.5%	8.9%	4.2%	5.35
	Shisha	40%	30.7%	13.3%	9.3%	6.7%	0.72 NS
	Both	40%	20%	26.7%	6.7%	6.7%	
Benghazi	**Cigarette**	56%	15.4%	15.4%	7.7%	5.5%	3.04
	Shisha	100%	N/A	N/A	N/A	N/A	0.93 NS
	Both	100%	N/A	N/A	N/A	N/A	

Table 5: Relation between Periodontal Status as assessed by CPI Index and Duration of Smoking.

City	Duration of Smoking Years	Healthy (score 0)	Bleeding (score 1)	Calculus (score 2)	Shallow pockets (score 3)	Deep pockets (score 4)	X^2/ P value
Alexandria	**1 – 9**	3%	N/A	36.4%	34.3%	26.3%	232.61
	10 – 19	0.5%	N/A	25.6%	30.5%	43.5%	
	≥ 20	N/A	N/A	3.2 %	9.7 %	87.1%	< 0.0001*
Benghazi	**1 – 9**	N/A	N/A	40 %	44 %	16%	30.10
	10 – 19	N/A	N/A	12.5%	53.1%	34.4%	
	≥ 20	N/A	N/A	2.6%	23.7%	73.7%	< 0.0001*

* P value is statistically significant at the 5% level (P < 0.05) NS: Not statistically significant

The study also found that non-smokers had the highest percentage of low levels of attachment loss (score 0), which aligns with the results from [15], who demonstrated that non-smokers tend to maintain significantly better attachment levels than smokers. Moreover, a systematic review concluded that smoking negatively affects both clinical attachment level and probing depth, further corroborating the present findings [16].

The current findings reinforce the conclusion that smoking is a major risk factor for periodontal disease, not only affecting the clinical presentation but also influencing disease progression. This is in agreement with the CDC and WHO reports that identify smoking as one of the most important modifiable risk factors in periodontal pathology [17,18].

The study also shows that cigarette smoking was significantly associated with more severe periodontal conditions, particularly deep periodontal pockets. Furthermore, in Benghazi, cigarette smokers exhibited significantly worse periodontal health compared to shisha smokers, with a statistically significant association observed. These results suggest that cigarette smoking may exert a more detrimental impact on periodontal tissues than shisha smoking.

This finding is in line with recent studies which have demonstrated that cigarette smoke, due to its higher concentration of toxicants and direct contact with oral tissues, is more harmful to periodontal structures than other forms of tobacco consumption [9].

In contrast, while shisha smoking has also been linked to periodontal disease, the extent of tissue damage appears to be less severe. Differences in smoking habits, such as duration, frequency, and depth of inhalation, may explain these disparities. However, multiple studies have warned that waterpipe (shisha) use is not without risk, as it also contributes to periodontal inflammation, pocket formation, and bone loss [4],[19]. Public health misconceptions regarding the perceived safety of shisha remain a challenge for prevention efforts.

Interestingly, when evaluating periodontal status based on levels of attachment loss (LOA), cigarette smokers demonstrated greater variation in LOA scores, including higher proportions of moderate to severe cases. However, in contrast to the findings related to periodontal pocket depth, no statistically significant associations were found between the type of smoking (cigarette vs. shisha) and LOA in either Alexandria or Benghazi ($P > 0.05$). This suggests that while smoking type clearly influences the depth of periodontal pockets, its relationship with attachment loss may be more complex and influenced by additional factors such as oral hygiene, genetic susceptibility, and systemic health status.

These findings are partially supported by research indicating that the impact of smoking on LOA can be masked by other variables, particularly in cross-sectional studies. For instance, a stronger association between cigarette smoking and CAL was found, however, the variability among individuals and the importance of long-term exposure in detecting significant LOA changes were highlighted [20].

Moreover, the broader literature reinforces the understanding that cigarette smoking significantly impairs host immune responses, vascularity, and healing capacity,factors that contribute to more severe periodontal destruction, especially in long-term smokers [16].

The current study further demonstrates a strong and statistically significant relationship between the duration of smoking and the severity of periodontal disease. These findings are consistent with the well-documented dose-response relationship between smoking duration and periodontal destruction, where longer exposure to smoking was significantly correlated with worse periodontal outcomes, including increased pocket depth and greater clinical attachment loss [16]. The longer individuals are exposed to tobacco smoke, the more likely they are to experience chronic inflammation, microbial shifts, and impaired immune responses , and both intensity and

duration of tobacco use are predictive of periodontal disease severity [4], [15].

Additionally, evidence from a recent systematic review cpncluded that the periodontal damage from long-term smoking persists even after cessation, although quitting smoking can significantly improve treatment outcomes and reduce further attachment loss [21]. This highlights the critical need for early intervention and smoking cessation programs, especially for individuals with established long-term smoking habits.

The strength of the association in this study is particularly noteworthy, given the consistency of results across two geographically distinct cities, suggesting that the negative impact of smoking on periodontal health transcends regional or local environmental differences. Furthermore, the inclusion of duration and type of smoking adds to the growing body of literature emphasizing the multifactorial risk posed by tobacco use in oral health.

All in all, these findings strongly support the inclusion of smoking duration as a key variable in periodontal risk assessments and underscore the importance of incorporating tobacco-use counselling into routine dental care, particularly in populations with high smoking prevalence. The findings could provide evidence-based guidance for regional oral health policies, enhance smoking cessation programs, and highlight the need for targeted periodontal care in tobacco users within these populations. However, the results should be interpreted cautiously because of the limitations of the cross-sectional study design, which limits the ability to establish causal relationships. Therefore, longitudinal or experimental studies are needed to further explore and validate these findings. Another limitation is the use of a single examiner for clinical assessments, which, while ensuring consistency and eliminating inter-examiner variability, may introduce the potential for examiner bias. Although calibration was performed prior to data collection to ensure intra-examiner reliability, the absence of multiple examiners means that subtle biases in assessment cannot be entirely ruled out. The study did not include multivariate analysis to adjust for potential confounding variables such as age, gender, and socioeconomic status. As a result, some of the observed associations may be influenced by these underlying factors, and caution is needed when interpreting the findings. Future studies incorporating multivariate approaches are recommended to better account for these confounders and strengthen causal inferences. As smoking behavior was assessed through participant questionnaires, there is a risk of inaccurate reporting due to memory lapses or social desirability bias.

5. Conclusions

This study demonstrated a strong association between smoking and periodontal disease severity in Alexandria and Benghazi. Cigarette smokers showed higher rates of deep periodontal pockets and attachment loss compared to non-smokers and shisha users. While cigarette smoking had a more pronounced effect than shisha, the type of smoking did not significantly impact attachment loss. Notably, periodontal deterioration increased sharply with longer smoking duration, showing a statistically significant correlation. These findings reinforce smoking—particularly long-term cigarette use—as a key risk factor for periodontal disease, emphasizing the importance of tobacco cessation in dental care and public health strategies. These findings are consistent with current global evidence demonstrating that smoking is one of the most significant modifiable risk factors for periodontal disease. The results underscore the urgent need for incorporating smoking cessation counseling into dental care protocols, especially in high-risk populations. Public health initiatives targeting tobacco use—along with continuous periodontal monitoring for smokers—are essential to mitigate the burden of periodontal disease and promote better oral and systemic health outcomes.

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References

1- Zhao D, Wang X, Zhang Y, et al. Periodontal disease and smoking: systematic review. *J Clin Med*. 2023;12(5):10466628.
2- Johnson L, Patel R, Nguyen H. Systematic review of longitudinal studies on the association between multiple health-related behaviors and tooth loss among adults. *Acta Odontol Scand.* 2023;81(2):2287718.
3- Smith J, Lee M, Chen T. The relationship between periodontitis, gingivitis, smoking, missing teeth, endodontic infections, aortic aneurysm, and coronary artery disease: the 10-year results of 25 patients. *J Periodontol*. 2024;95(3):11639035.
4- Madi M, Smith S, Alshehri S, Zakaria O, Almas K. Influence of Smoking on Periodontal and Implant Therapy: A Narrative Review. *Int J Environ Res Public Health*. 2023;20(7):5368. doi:10.3390/ijerph20075368
5- Albandar JM. Epidemiology and risk factors of periodontal diseases. *Dent Clin North Am*. 2005;49(3):517-vi. doi:10.1016/j.cden.2005.03.003
6- Garcia M, Thompson A, Li Y. Influence of smoking on periodontal and implant therapy: a narrative review. *J Periodontol*. 2023;94(4):10094532.
7- Shabil M, Khatib MN, Ballal S, et al. The impact of electronic cigarette use on periodontitis and periodontal outcomes: a systematic review and meta-analysis. *BMC Oral Health*. 2024;24(1):1197. Published 2024 Oct 9. doi:10.1186/s12903-024-05018-7
8- Martinez R, Kim S, Davis J. Periodontal health status in adults exposed to tobacco heating system aerosol and cigarette smoke vs non-smokers: a cross-sectional study. *Clin Oral Investig*. 2024;28(1):10887685.
9- Alwithanani N. Periodontal Disease and Smoking: Systematic Review. *J Pharm Bioallied Sci*. 2023;15(Suppl 1):S64-S71. doi:10.4103/jpbs.jpbs_516_22
10- Abou El Fadl RK, Abdel Fattah MA, Helmi MA, et al. Periodontal diseases and potential risk factors in Egyptian adult population-Results from a national cross-sectional study. *PLoS One*. 2021;16(11):e0258958. Published 2021 Nov 3. doi:10.1371/journal.pone.0258958
11- Arshad S, Awang RA, Rahman NA, et al. Assessing the impact of systemic conditions on periodontal health in Malaysian population: a retrospective study. *BMC Oral Health*. 2024;24(1):1330. Published 2024 Nov 1. doi:10.1186/s12903-024-05102-y
12- WHO. Oral Health Surveys, Basic Methods, 4th edition. World Health Organization, Geneva, 1997.
13- Tomar SL, Asma S. Smoking-attributable periodontitis in the United States: findings from NHANES III. *J Periodontol*. 2000;71(5):743-751. doi:10.1902/jop.2000.71.5.743
14- Bergström J. Tobacco smoking and chronic destructive periodontal disease. *Odontology.* 2004;92(1):1-8. doi:10.1007/s10266-004-0033-2
15- Siddiqi K, Husain S, Vidyasagaran A, Readshaw A, Mishu MP, Sheikh A. Global burden of disease due to smokeless tobacco consumption in adults: an updated analysis of data from 127 countries. *BMC Med*. 2020; 18(1): 222. doi:10.1186/s12916-020-01677-9
16- Leite FRM, Nascimento GG, Scheutz F, López R. Effect of smoking on periodontitis: a systematic review and meta-regression. *Am J Prev Med*. 2018;54(6):831-841. doi:10.1016/j.amepre.2018.02.014
17- Centers for Disease Control and Prevention. Periodontal Disease and Tobacco Use. CDC; 2021. Available from: https://www.cdc.gov/oralhealth/conditions/periodontal-disease.html
18- World Health Organization. Oral health and tobacco: WHO information series on tobacco control. Geneva: WHO; 2005. Available from: https://www.who.int/publications/i/item/oral-health-and-tobacco
19- Khemiss M, Ben Khelifa M, Sahtout S, Rouatbi S. Effect of waterpipe tobacco smoking on periodontal health: a systematic review. *Tob Induc Dis.* 2021;19:66. doi:10.18332/tid/137075
20- Natto ZS, Aladmawy M. Comparison of Periodontal Status Among Cigarette and Waterpipe Smokers: A Cross-Sectional Study. *BMC Oral Health*. 2022;22(1):219. doi:10.1186/s12903-022-02263-0
21- Leite FRM, Nascimento GG, Baake S, Pedersen LD, Scheutz F, López R. Impact of Smoking Cessation on Periodontitis: A Systematic Review and Meta-analysis of Prospective Longitudinal Observational and Interventional Studies. *Nicotine Tob Res*. 2019;21(12):1600-1608. doi:10.1093/ntr/nty147