Brazilian Dental Science
Ciência Odontológica Brasileira
unesp
UNIVERSIDADE ESTADUAL PAULISTA "JÚLIO DE MESQUITA FILHO"
Instituto de Ciência e Tecnologia
Campus de São José dos Campos

ORIGINAL ARTICLE

doi: 10.14295/bds.2020.v23i1.1861

Association of Khat chewing, smoking, age and sex with periodontal status among Yemeni adults

Associação da mastigação de Khat, tabagismo, idade e gênero com a condição periodontal entre adultos iemenitas

Wadhah AL-HAJJ[1,2], Hisham HWAITI[2], Anas SHAMALA[2], Hamza AL-AZAZI[2], Mohammed ALWESABI[2]

1 – Department of Periodontology – Faculty of Dentistry – Thamar University – Dhamar – Yemen.

2 – Department of Biological and Preventive Sciences – Faculty of Dentistry – University of Science and Technology – Sana'a – Yemen.

ABSTRACT

Objective: Periodontal diseases are very common dental disease. Many risk factors may play significant role in the periodontal disease initiation and progression. This study was performed to evaluate the effects of khat chewing, smoking, age and gender on periodontal status among Yemeni adults. **Material and Methods:** This cross-sectional study was performed on 1231 patients attending the outpatient dental polyclinics of University of Science and Technology during the academic years 2017/2018. All completed sheets were collected throughout the year by the supervisors. Data cleaning, descriptive statistics, and inferential statistics were then performed. **Results:** Khat chewers were more frequent than non-chewers counterparts (60.7% vs. 39.3%). The prevalence of smoking was 25.5% (297 patients). Study results indicated that periodontitis is more associated with female gender and participants aged more than 35 years old. Results also showed that female and age older participants aged more than 35 years were significantly associated with gingival recession. Mean number of the teeth with gingival recession in male patients were higher than in females. Male gender and patients aged more than 35 years old were significantly associated with furcation involvement. **Conclusion:** The present study has shown females gender and age older than 35 seem to be risk factors of periodontal diseases. Males has more teeth affected by gingival recession and more furcation involvement.

KEYWORDS

Periodontal disease; Catha chewing; Smoking; Yemen; Risk factors.

RESUMO

Objetivo: As doenças periodontais são patologias dentárias com alta prevalência. Diversos fatores de risco podem desempenhar papel significativo no início e progressão das doenças periodontais. Este estudo foi realizado para avaliar os efeitos da mastigação de khat, tabagismo, idade e gênero na condição periodontal de adultos iemenitas. **Material e Métodos:** Este estudo transversal foi realizado em 1231 pacientes atendidos nas policlínicas odontológicas ambulatoriais da Universidade de Ciência e Tecnologia durante os anos acadêmicos de 2017/2018 através de um questionário para coleta de dados pré-estabelecido. Todas os questionários preenchidos foram coletados ao longo do ano pelos supervisores. A apuração dos dados, estatística descritiva e estatística inferencial foram realizadas. **Resultados:** os mastigadores de Khat foram mais frequentes do que as não-mastigadores (60,7% vs. 39,3%). A prevalência de tabagismo foi de 25,5% (297 pacientes). Os resultados do estudo indicaram que a periodontite está mais associada ao gênero feminino e aos participantes com mais de 35 anos de idade. Os resultados também mostraram que participantes do gênero feminino e acima de 35 anos foram significativamente associadas à recessão gengival. O número médio de dentes com recessão gengival em pacientes do gênero masculino foi maior que no feminino. O gênero masculino e os pacientes com mais de 35 anos de idade foram significativamente associados ao envolvimento da furca. **Conclusão:** O presente estudo mostrou que o gênero feminino e a idade acima de 35 anos parecem ser fatores de risco para doenças periodontais. Pacientes do gênero masculino têm mais dentes afetados pela recessão gengival e mais envolvimento de furca.

PALAVRAS-CHAVE

Doença periodontal; Catha, mastigação; Tabagismo; Iémen; Fatores de risco.

INTRODUCTION

The American academy of periodontology defines periodontal diseases, as a serious infection that if left untreated, can lead to tooth loss. Periodontal diseases involve an inflammation and/or infection that results in the destruction of the supporting tissues of the teeth, including the gingiva, the periodontal ligaments, the cementum, and the alveolar bone [1]. American Academy of Periodontology (AAP) and the European Federation of Periodontology (EFP) workshop presented a new scheme for classification of periodontal and peri-implant diseases and also reorganized the broad spectrum of non-plaque induced gingival diseases and conditions based on primary etiology [2].

Periodontal diagnosis and monitoring rely upon clinical parameters to a large extent. Clinical diagnosis directly affects decisions to initiate therapy and to select methods. Dentists also evaluate the outcome of therapy and attempt long-term prognosis based on clinical parameters. The primary parameters assessed by periodontal probing are probing pocket depth (the distance between the gingival margin and the bottom of the sulcus / pocket), gingival recession (the distance between the cementoenamel junction and the gingival margin), and clinical attachment level (the distance between the cementoenamel junction and the bottom of the sulcus/pocket) [3].

Khat (Catha edulis) is a natural stimulant from the Catha edulis plant, found in the flowering evergreen tree which grows mainly in Yemen, Ethiopia, Somalia, Kenya, Saudi Arabia, and at high altitude areas in South Africa and Madagascar. A high proportion of the population habitually chews its fresh leaves and twigs for their amphetamine-like effects [4,5]. The active ingredient of khat responsible for its psychostimulant effect is an alkaloid chemical known as cathinone, which is structurally and chemically similar to damphetamine, and cathine, a milder form of cathinone. Cathinone is a highly potent stimulant, which produces sympathomimetic and central nervous system stimulation analogous to the effect of amphetamine [6].

In Yemen, khat is commonly used for social recreation. Workers such as motor vehicle drivers and truck drivers; building establishment workers also use it under a variety of other conditions. A significant number of students chew khat to be Attentive especially during exams periods. Although largely viewed as a social habit, long-term heavy chewing has been recently reported to cause degree of dependence [7,8].

Khat leaves, which are generally placed in the mouth in the lower distal mucobuccal fold, are usually chewed during sociocultural meetings where the chewing process may take up to 6 hours. Since the process of khat chewing has a drying effect on the oral mucosa, its users tend to consume a great quantity of fluids. Some of the khat users also supplement their chewing practice with smoking habits [9,10]. Khat is usually chewed into a large bolus that is kept in one side of the mouth for several hours, which raises a clinically relevant question about the effect of this habit on periodontal health. Unfortunately, existing literature doesn't provide a clear view on this matter. Comparative cross-sectional clinical studies have reported conflicting results [11-16].

While comparisons between chewers and non-chewers indicate that khat chewing is detrimental to the periodontium, some comparisons between khat chewing and non-chewing sides suggest the opposite. Obviously, a sound conclusion cannot be made before controlled, longitudinal in vivo studies are carried out to evaluate the effect of khat chewing on microbial and clinical periodontal parameters. In general, much of the claims about the adverse health effects of khat chewing are either anecdotal or based on inadequate evidence [17,18] With respect to tobacco smoking, there is clear evidence that smoking may negatively affect the results of periodontal treatment. Tobacco smoking is a known risk factor that affects the oral environment and ecology, vascularization of the periodontium, immune and inflammatory responses and the healing potential of the periodontal connective tissues [19,20].

Large epidemiologic surveys reveal a higher prevalence and severity of destructive

periodontal disease in men than women [21-23]. Gender differences in the development and progression of periodontitis can be attributed to underlying variations in genetic or environmental mechanisms [24,25]. Numerous authors have attributed the higher risk for periodontal breakdown in men to a differential exposure to modifiable environmental risk factors. [26,27] It was asserted that susceptibility to periodontitis increased with age, resulting in tooth loss seen predominantly after 35 years of age. The prevalence of periodontal disease is expected to increase with age as a result of cumulative disease progression over time, not susceptibility [28,29]. The aim of this study was to evaluate the effects of khat chewing, smoking, age and gender on periodontal status among Yemeni adults.

MATERIAL AND METHODS

This cross-sectional study was carried out on patients recruited from the outpatient dental polyclinics at the department of periodontology, Faculty of Dentistry, University of Science and Technology (UST). Preformed case sheets, approved from the department, were used as tools of data collection in the clinical sessions. All patients attended those sessions during the academic years 2017, 2018 were surveyed. The data sheet contained four main parts; personal and demographic data, medical and dental history of the patient, gingival and periodontal scoring indices and diagnosis, and the last part contained questions related to khat chewing ("Yes" or "No"), and smoking ("Yes" or "No"). All data concerning this study were revised carefully by the supervisors during data collection.

The sample population were all the outpatient attended the dental polyclinics at the department of periodontology, diagnosed as having gingivitis or periodontitis and were free or controlled systemic conditions were included in the study. Patients were diagnosed as having gingivitis or periodontitis according to 2017 World Workshop on the Classification of Periodontal and Peri-Implant Diseases and Conditions [30] where patients diagnosed having gingivitis if they had the classical signs of gingivitis i.e. erythema, edema, bleeding and tenderness without clinical attachment loss. Gingiva surrounding the tooth divided into 4 scoring units- mesio-facial papilla, facial marginal gingiva, disto- facial papilla and lingual marginal gingiva [31,32]. Periodontitis was considered if there was clinical attachment loss (Periodontal pockets, gingival recession and furcation involvement) [33]. Gingival recession was considered as the distance from the cemento-enamel junction to the free gingival margin and was measured using a Michigan O periodontal probe with William's markings. All measurements were made in millimeters and were rounded to the lower whole millimeter. All permanent, fully erupted teeth, excluding third molars, were examined [34]. Gingival recession was considered on the basis of its presence or absence. Also, the number of teeth affected with gingival recession for each patient. Similarly, furcation involvement was recorded as present or absent.

Participants were considered Khat chewers if they had a history of chewing khat for more than 3 years, not less than 4 days per week and not less than 4 hours per day [7]. All completed sheets were collected throughout the year by the supervisors, then the data were managed using SPSS® statistical package version 20. Descriptive statistics were performed in terms of means, frequencies, and percentages. Chi-square test was utilized for inferential statistics along with odds ratio and 95% confidence interval with P value < 0.05 as a significant level for all tests.

RESULTS

The overall study sample was consisted of 1231 dental outpatients, (Male= 493 (40.0%); Female= 738 (60.0%). Their age ranged from 17 to 81 years (mean age was 35.1 years; SD ± 13.8). Khat chewers were higher among the study sample than non-chewers counterparts (60.7% vs. 39.3%). Regarding smoking, prevalence of smoking among the study sample was 25.5% (297 patients). As seen from the Table 1, analysis of the risk factors with periodontitis among the study sample showed that khat chewing was associated

with periodontitis with 78.3% prevalence in comparison to 21.7% although data did not show significant difference between khat chewers and non-chewers regarding this point. Similarly, data showed that 79.5% of smokers had periodontitis and 20.5% had not with no significant difference between both groups. Regarding gender, females showed more prevalence for periodontitis than males with significant difference (OR= 1.64; P= 0.003). Patients with age > 35 years had much higher prevalence of periodontitis with 91.6% compared to 68.5% among patients with age ≤ 35 years with highly significant difference (OR= 5.01; P< 0.001). These results indicated that periodontitis are more associated female gender and age older than 35 years old with highly significant difference. While khat chewers and smokers had high rates of association with periodontitis but with no significant difference than khat non-chewers and non-smokers.

Table 1 - Risk factors associated with periodontitis among the study patients

	Periodontitis		Odds Ratio (95% CI)	P
	Yes	No		
Kat Chewing (N= 1231)				
Yes	585 (78.3)	162 (21.7)	1.28 (0.90 - 1.82)	0.177
No	373 (77.1)	111 (22.9)		
Smoking (N= 1164)				
Yes	236 (79.5)	61 (20.5)	0.77 (0.53 - 1.12)	0.173
No	667 (76.9)	200 (23.1)		
Gender (N= 1231)				
Male	368 (74.6)	125 (25.4)	1.64 (1.18 - 2.29)	0.003
Female	591 (80.1)	147 (19.9)		
Age (N= 1222)				
≤ 35 yrs	495 (68.5)	228 (31.5)	5.01 (3.52 - 7.13)	< 0.001
> 35 yrs	457 (91.6)	42 (8.40)		

Table 2 showed that gingival recession was present in 75.4% of khat chewers with non-significant difference (P= 0.513) when compared to non-chewers (73.8%). Similar results were found with smoking in which 74.7% of smokers and 74.3% of non-smokers had gingival recession (P= 0.314). Regarding gender, females had more prevalence of gingival recession (79.8%) than males had (67.3%) with highly significant difference (OR= 0.41; P< 0.001). Similarly, age group with > 35 years old had more gingival recession (89.6%) than patients with ≤ 35 years old (64.7%) (OR= 0.213; P< 0.001).

Comparison between mean of teeth with gingival recession between khat chewers and non-chewers is shown in Table 3. Khat chewers had more teeth with gingival recession compared to non-khat chewers (6.97 ± 7.06 compared to 5.51 ± 5.86), respectively) with statistically significant difference (P< 0.001). Male patients had more teeth with gingival recession (7.03 ± 7.8) with gingival recession compared to their female counterparts (5.99 ± 5.66), this difference was also significant (P< 0.001).

Furcation involvement appeared to be more prevalent in khat chewers in comparison with non-chewers (15.8% compared to 9.3%) but with no significant difference (OR= 0.79; P= 0.257). Regarding smoking, also no significant difference was found between smokers and non-smokers (17.5% and 11.6%, respectively) (OR= 0.81; P= 0.305). Males showed more furcation involvement than females with significant difference (17.4% and 10.7%, respectively). Similarly, age > 35 years old had more furcation involvement than patient with age ≤ 35 years old with highly significant difference (P< 0.001). Accordingly, male gender and patients aged more than 35 years old were significantly associated with furcation involvement (Table 4).

Table 2 - Association of the risk factors with gingival recession

	Gingival recession		Odds Ratio (95% CI)	P
	Yes	No		
Kat Chewing (N= 1231)				
Yes	563 (75.4)	184 (24.6)	1.11 (0.81 - 1.53)	0.513
No	357 (73.8)	127 (26.2)		
Smoking (N= 1164)				
Yes	222 (74.7)	75 (25.3)	1.20 (0.84 - 1.71)	0.314
No	644 (74.3)	223 (25.7)		
Gender (N= 1231)				
Male	332 (67.3)	161 (32.7)	0.41 (0.30 - 0.56)	< 0.001
Female	589 (79.8)	149 (20.2)		
Age (N= 1222)				
≤ 35 yrs	468 (64.7)	255 (35.3)	0.21 (0.15 - 0.30)	< 0.001
> 35 yrs	447 (89.6)	52 (10.4)		

Table 3 - Mean number of teeth with gingival recession among the study patients.

	Mean of teeth number	Std. Deviation	Std. Error of Mean	P
Kat Chewing (N= 1231)				
Yes (N= 747)	6.97	7.06	0.26	< 0.001
No (N= 484)	5.51	5.86	0.27	
Gender (N= 1231)				
Male (N=493)	7.03	7.88	0.35	0.007
Female (NO 738)	5.99	5.66	0.21	

Table 4 - Association between study parameters with furcation involvement

	Furcation involvement		Odds Ratio (95% CI)	P
	Yes	No		
Kat Chewing (N= 1231)				
Yes	118 (15.8)	629 (84.2)	0.79 (0.52 - 1.19)	.257
No	45 (9.30)	439 (90.7)		
Smoking (N= 1164)				
Yes	52 (17.5)	245 (82.5)	0.81 (0.54 - 1.22)	.305
No	101 (11.6)	766 (88.4)		
Gender (N= 1231)				
Male	86 (17.4)	407 (82.6)	0.640 (0.44 - 0.93)	0.001
Female	77 (10.4)	661 (89.6)		
Age (N= 1222)				
≤ 35 yrs	37 (5.10)	686 (94.9)	5.72 (3.84 - 8.53)	< 0.001
> 35 yrs	125 (25.1)	374 (74.9)		

DISCUSSION

Periodontal diseases are inflammatory diseases that have two main forms. Gingivitis which is reversible with oral care and individual's motivation and limited to the gingiva, and periodontitis which affect the supporting tissues of teeth causing destruction of periodontal ligaments and alveolar bone leading to clinical attachment loss by specific microorganisms [1]. This cross-sectional study examined the association of periodontal status with main risk factors such as Khat chewing, smoking, age and gender among a large sample of Yemeni patients.

Khat chewing is considered as a risk factor of periodontal diseases. An exploring the association between periodontal diseases and Khat habit showed a higher periodontitis among khat chewing sides compared to non-chewing sides[35]. According to Al-hebshi and Al-akhali, comparisons between chewers and non-chewers indicate that khat chewing is harmful to the periodontium, but conversely comparisons between khat chewing and non-chewing sides suggest the opposite [36]. The results of this study showed that female and age more than 35 are significant determinants of periodontitis. Khat chewers and smokers had high rates of periodontitis although these results don't show significant differences than non-khat-chewers and non-smokers, but this can be explained that this is a cross-sectional study and other risk factors for periodontitis didn't excluded. This is in agreement with, a cross-sectional hospital study among Yemeni khat and non khat-chewers which revealed that khat chewing caused many lesions to the supporting structures of the teeth, namely gingivitis, periodontal pocket formation, gingival recession, tooth mobility and tooth mortality [11]. On the other hand, other studies reported a positive effect of khat chewing as anti-plaque, showed a higher probing pocket depth among non-chewing sides compared to chewing side and did not show any significant differences of periodontal status between Khat chewers and non – chewers. Another study considered the khat chewing has no negative effect [7,36,37].

Many researchers have evaluated the relationship between habitual khat chewing and its adverse effect on periodontal tissues, which is still controversy issue. However, continuing mechanical movement is considered as causative factor of gingival recession in many studies, another researcher documented that as mechanical cleaner or anti-plaque [38]. As gingival recession is considered an important parameter for periodontitis, we assessed gingival recession with association with risk factors. In this study, female gender and age more than 35 showed more prevalence for gingival recession. Results showed no significant difference between khat chewers and non-chewers also smokers and non-smokers, but as we said before for periodontitis, there is no exclusion for other factors which may lead for recession. So, other case control studies are recommended to assess the effects of these factors. In the same context, in a study conducted on Khat chewers, the clinical attachment loss was significantly higher among the chewers where 37.9% of daily khat chewers had higher probing pocket depth in contrary to 18.6% of once weekly habit chewers [39].

In this study, the number of teeth with gingival recession was higher in Khat chewers compared to non-chewers. These results are consistent with Amran et al. who found that khat chewing is considered as a risk factor of gingival recession with 60.5% of people had gingival recession and 42.5% of them had GR > 4 mm. The authors referred that to continuous mechanical forces on the chewing side of khat as well as the chemical contents of Khat plant [40]. Another risk factor of periodontal diseases and tooth loss is smoking habit. Previous study documented that the Yemeni smokers had higher mean tooth loss compared to non-smokers groups [41]. The results of the present study showed no significant differences among the smokers compared to non-smokers regarding gingivitis, periodontitis and gingival recession which revealed inconsistent to previous studies that showed highly significant of gingival recession , most likely to have clinical attachment loss 1.17 times related to smokers compared to none [40,42].

Regarding age, the data of the present study showed that the prevalence of periodontitis, and gingival recession were significantly more among the age group older than 35 years old which is agreed with another study conducted by Al-Sharabi AK, et al. [35]. This also was in agreement with Hill and Gibson who observed that effects on oral and dental tissue among Yemeni males with an average age of 35 years who chewed khat for of 20 years increased periodontal pocket depth on the khat-chewing side compared with the non-khat chewing side [12]. Regarding gender, the results of present study showed that the number of teeth with gingival recession among male more than female group. This may be due to this social habit are more common in males than females and high proportion of Khat chewers are male compared to female [35,42].

In a surprising topic, our results showed that the female group had more periodontitis and gingival recession compared to male group which may be seemed unlogical and inconsistent with previous studies [42,43]. This surprisingly data can be explained that females have more motivation toward oral care and follow up in dental clinics especially that our sample was from Yemeni dental patients not Yemeni whole population. This explanation is supported by the results of this study which showed that the number of teeth with gingival recession among male more than female group males for each case. In addition that males usually have more advanced periodontitis and more advanced other miller classes II, III, and IV which may indicated for extraction as published in other studies due to their more habitual khat chewing [40]. Furcation involvement also considered as important indicator for periodontitis, so, in this study, the results showed that the furcation involvement was higher among khat chewers, smokers, males and patients aged more than 35 years compared to other subdivided groups, but khat chewing and smoking showed no significant difference. This agreed with Al-Sharabi et al.

who documented that habitual khat chewing as independent risk factor of periodontitis that caused by mechanical trauma in the posterior vestibule which leading to furcation involvement [35].

As a limitation of this study, there is no valid and reproducible tool to record Khat chewing and smoking status regarding the binary level (Yes-No), hours or number of cigarettes, onset and duration of these habits. Despite of that, the researchers used easy, valid, and non-time-consuming indices to diagnose and evaluate the prevalence of the periodontal diseases among the sample. Also, we compare the effects of smoking and khat chewing on periodontal status without excluding some other risk factors. So, we recommended that other studies should be done with exclusion of these factors. Also use more precise parameters such as miller classification in evaluation of gingival recession.

CONCLUSIONS

Within the limitation of this study, it can be concluded that:

1- Periodontitis are significantly associated female gender and age older than 35 years old.

2- Male gender and age older than 35 years are significantly associated furcation involvement.

3- Females has more prevalence for gingival recession and periodontitis but males have more teeth affected by gingival recession. Also, males have more association with furcation involvement.

REFERENCES

1. Armitage GC: Development of a classification system for periodontal diseases and conditions. Ann Periodontol. 1999 Dec;4(1):1-6.
2. Caton JG, Armitage G, Berglundh T, Chapple IL, Jepsen S, Kornman KS, et al: A new classification scheme for periodontal and peri implant diseases and conditions--Introduction and key changes from the 1999 classification. J Periodontol. 2018 Jun;89 Suppl 1:S1-S8. doi: 10.1002/JPER.18-0157.
3. Mombelli A: Clinical parameters: biological validity and clinical utility. Periodontol 2000. 2005;39:30-9.
4. Weir S: Qat in Yemen: consumption and social change. British Museum Publications for the Trustees of the British Museum; 1985
5. Kalix P: Catha edulis, a plant that has amphetamine effects. Pharm World Sci. 1996 Apr;18(2):69-73.
6. Gebissa E: Leaf of Allah: khat & agricultural transformation in Harerge, Ethiopia 1875-1991: Ohio State University Press; 2004.
7. Al-Kholani AI: Influence of khat chewing on periodontal tissues and oral hygiene status among Yemenis. Dent Res J (Isfahan). 2010 Winter;7(1):1-6.
8. Kassim S, Islam S, Croucher R: Validity and reliability of a Severity of Dependence Scale for khat (SDS-khat). J Ethnopharmacol. 2010 Dec 1;132(3):570-7. doi: 10.1016/j.jep.2010.09.009. Epub 2010 Sep 15.
9. Giannini AJ, Miller NS, Turner CE. Treatment of khat addiction. Journal of substance abuse treatment. J Subst Abuse Treat. 1992 Fall;9(4):379-82.
10. Elmi AS: The chewing of khat in Somalia. J Ethnopharmacol. 1983 Aug;8(2):163-76.
11. Alsharabi AKK. Oral and para-oral lesions caused by takhzeen al-qat. (qat chewing) [Thesis]. University of Khartoum; 2002.
12. Hill C, Gibson A: The oral and dental effects of q'at chewing. Oral Surg Oral Med Oral Pathol. 1987 Apr;63(4):433-6.
13. Jorgensen E, Kaimenyi J. The status of periodontal health and oral hygiene of Miraa (catha edulis) chewers. East Afr Med J. 1990 Aug;67(8):585-90.
14. Mengel R, Eigenbrodt M, Schünemann T, Florès de Jacoby L. Periodontal status of a subject sample of Yemen. J Clin Periodontol. 1996 May;23(5):437-43.
15. Al-Akhali M: The periodontal health status of qat chewers in Yemen-Sana'a. PhD, Baghdad, Iraq 2002.
16. Ali AA. Qat habit in Yemen society: a causative factor for oral periodontal diseases. Int J Environ Res Public Health. 2007 Sep;4(3):243-7.
17. Al-Hebshi N, Skaug N. Khat (Catha edulis)--an updated review. Addict Biol. 2005 Dec;10(4):299-307.
18. Kennedy JG, Teague J, Rokaw W, Cooney E. A medical evaluation of the use of qat in North Yemen. Soc Sci Med. 1983;17(12):783-93.
19. Johnson GK, Guthmiller JM. The impact of cigarette smoking on periodontal disease and treatment. Periodontol 2000. 2007;44:178-94.
20. Palmer RM, Wilson RF, Hasan AS, Scott DA: Mechanisms of action of environmental factors--tobacco smoking. J Clin Periodontol. 2005;32 Suppl 6:180-95.
21. Albandar J, Kingman A. Gingival recession, gingival bleeding, and dental calculus in adults 30 years of age and older in the United States, 1988 1994. J Periodontol. 1999 Jan;70(1):30-43.
22. Brown LF, Beck JD, Rozier RG. Incidence of attachment loss in community-dwelling older adults. J Periodontol. 1994 Apr;65(4):316-23.
23. Shiau HJ, Reynolds MA. Gender differences in destructive periodontal disease: a systematic review. J Periodontol. 2010 Oct;81(10):1379-89. doi: 10.1902/jop.2010.100044.
24. Fish EN. The X-files in immunity: gender-based differences predispose immune responses. Nat Rev Immunol. 2008 Sep;8(9):737-44. doi: 10.1038/nri2394.
25. Fairweather D, Frisancho-Kiss S, Rose NR. Gender differences in autoimmune disease from a pathological perspective. Am J Pathol. 2008 Sep;173(3):600-9. doi: 10.2353/ajpath.2008.071008. Epub 2008 Aug 7.
26. Bertea PC, Staehelin K, Dratva J, Stutz EZ. Female gender is associated with dental care and dental hygiene, but not with complete dentition in the Swiss

adult population. J Public Health. 2007;15(5):361-7. doi: 10.1007/s10389-007-0126-0.

27. Burt B; Research, Science and Therapy Committee of the American Academy of Periodontology. Position paper: epidemiology of periodontal diseases. J Periodontol. 2005 Aug;76(8):1406-19.

28. Locker D, Slade GD, Murray H. Epidemiology of periodontal disease among older adults: a review. Periodontol 2000. 1998 Feb;16:16-33.

29. Beck JD. Periodontal implications: older adults. Ann Periodontol. 1996 Nov;1(1):322-57.

30. Papapanou PN, Sanz M, Buduneli N, Dietrich T, Feres M, Fine DH, et al. Consensus report of workgroup 2 of the 2017 World Workshop on the Classification of Periodontal and Peri Implant Diseases and Conditions. J Periodontol. 2018 Jun;89 Suppl 1:S173-S182. doi: 10.1002/JPER.17-0721.

31. Murakami S, Mealey BL, Mariotti A, Chapple IL. Dental plaque–induced gingival conditions. J Clin Periodontol. 2018 Jun;45 Suppl 20:S17-S27. doi: 10.1111/jcpe.12937.

32. Löe H, Silness J. Periodontal disease in pregnancy I. Prevalence and severity. Acta Odontol Scand. 1963 Dec;21:533-51.

33. Tonetti MS, Greenwell H, Kornman KS. Staging and grading of periodontitis: Framework and proposal of a new classification and case definition. J Clin Periodontol. 2018 Jun;45 Suppl 20:S149-S161. doi: 10.1111/jcpe.12945.

34. Susin C, Haas AN, Oppermann RV, Haugejorden O, Albandar JM. Gingival recession: epidemiology and risk indicators in a representative urban Brazilian population. J Periodontol. 2004 Oct;75(10):1377-86.

35. Al-Sharabi AK, Shuga-Aldin H, Ghandour I, Al-Hebshi NN. Qat chewing as an independent risk factor for periodontitis: a cross-sectional study. Int J Dent. 2013;2013:317640. doi: 10.1155/2013/317640. Epub 2013 Feb 21.

36. Al-hebshi NN, Al-Ak'hali M. Experimental gingivitis in male khat (Catha edulis) chewers. J Int Acad Periodontol. 2010 Apr;12(2):56-62.

37. Yarom N, Epstein J, Levi H, Porat D, Kaufman E, Gorsky M. Oral manifestations of habitual khat chewing: a case-control study. Oral Surg Oral Med Oral Pathol Oral Radiol Endod. 2010 Jun;109(6):e60-6. doi: 10.1016/j.tripleo.2010.02.022.

38. Al-Akhali M, Al-Moraissi E. Khat chewing habit produces a significant adverse effect on periodontal, oral health: A systematic review and meta-analysis. J Periodontal Res. 2017 Dec;52(6):937-945. doi: 10.1111/jre.12468. Epub 2017 Jun 18.

39. Dhaifullah E, Al-Maweri SA, Al-Motareb F, Halboub E, Elkhatat E, Baroudi K, et al. Periodontal health condition and associated factors among University Students, Yemen. J Clin Diagn Res. 2015 Dec;9(12):ZC30-3. doi: 10.7860/JCDR/2015/16435.6964. Epub 2015 Dec 1.

40. Amran AG, Ataa MAS. Statistical analysis of the prevalence, severity and some possible etiologic factors of gingival recessions among the adult population of Thamar city, Yemen. RSBO (Online). 2011 Jul-Sep;8(3):305-13

41. Amran A, Alhajj M, Amran A. Prevalence and Risk Factors for Clinical Attachment Loss in Adult Yemenis: A Community-Based Study in the City of Dhamar. Am J Public Health Res. 2016;4(3):56-61. doi: 10.11648/j.ajhr.20160403.14.

42. Amran AG, Alhajj MN. Assessment of Gingival Health Status among a Group of Preclinical and Clinical Dental Students at Thamar University, Yemen. IOSR J Dent Med Sci. 2016 Feb;15(2):69-75.

43. Amran AG, Alhajj MN, Madfa AA. Social Characteristics and Oral Self-care Practices Associated with Periodontal health status among a Sample of Yemeni Dental Students. IOSR J Dent Med Sci. 2015;14(12):28-35.

Wadhah Abdul-Nasser Al-Hajj
(Corresponding address)
Department of Periodontology
Faculty of Dentistry, Thamar University, Dhamar, Yemen.
E-mail: waddah.alhaj@gmail.com

Date submitted: 2019 Sep 11

Accept submission: 2019 Nov 19