

Original article

# Prevalence and Severity of Plaque-Induced Gingivitis in A Sample of Adult Libyan Population

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## ABSTRACT

**Background and aims.** Plaque-induced gingivitis is the most common form of periodontal disease. Gingivitis prevalence in Libyan population in Tripoli city is not documented; therefore, the aim of this study was to evaluate the prevalence and severity of plaque-induced gingivitis among a sample of adult Libyan population. **Methods.** In this cross-sectional study Three hundred and twenty participants were recruited from routine dental patients attending the Periodontic clinic at Faculty of dentistry, University of Tripoli, Libya from October 2022 to May 2023. A clinical examination was performed by 2 dentists to measure the gingival and plaque indices of Löe and Silness for each subject. **Results.** The prevalence of gingivitis was 97.5% among adult subjects aged between 18-45 years old. Moreover, the mean gingival index was  $1.08 \pm 0.52$ , which indicates a mild gingival inflammation. In fact, males showed more severe signs of gingival inflammation compared with females ( $p=0.029$ ). In addition, the mean plaque index was  $0.96 \pm 0.44$ , which indicates a good plaque status of the participants. However, males were more affected than females ( $p=0.003$ ). **Conclusion.** The results of this study showed that plaque-biofilm accumulation is strongly associated with high prevalence of moderate to severe gingivitis among Libyan subjects.

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## INTRODUCTION

Plaque-induced gingivitis is the most prevalent form of periodontal disease which is a reversible type of periodontal disease in which inflammation is limited to the gingiva without destruction of deep tooth supporting structures [1,2]. Dental plaque is considered the primary etiological factor causing gingivitis, but other factors may also influence the development of periodontal disease. Experimental studies of gingivitis indicate that host response plays an important role in the development and extent of gingival inflammation [3]. Dental professionals recommended an effective oral health regimen for maintaining optimal oral health with the aim of controlling bacterial plaque biofilm and managing inflammatory products released during the inflammatory reaction between pathogenic micro flora and host response [4]. Gingivitis regarded as the second main disease affecting oral tissues following dental caries [5,6]. Epidemiological studies have shown that plaque-induced gingivitis starts in early childhood, and becomes more frequent and severe with age and widely spreads among all ages [7,8]. Gingivitis can be manifested as change in color (redness), edema (swollen of gingival tissue), drainage of GCF from gingival sulcus, bleeding on gentle probing, changes in gingival texture and contour without radiographic changes of crestal bone level [9]. The prevalence of gingivitis is evident worldwide. Epidemiological studies show that more than 82% of adolescents in the United States have overt signs of gingivitis and bleeding gingiva. Similar or greater prevalence of gingivitis in children and adolescents has been reported in other parts of the world [10].

## METHODS

### *Study design and sampling*

Prior to initiating this study, the study protocol was approved by the high scientific committee of college of dentistry, university of Tripoli. By convenience sampling method, three hundred and twenty eligible subjects aged between (18-45) were recruited from the routine dental patients who attended the periodontic clinic at the dental college in Tripoli, Libya, from October 2022 to May 2023.

After explaining all the study procedures, the patients who approved to contribute in this study were asked to sign an informed consent form. The dental and medical history of each participant were taken at the time of examination by using a special recording sheet. We excluded all subjects who were wearing orthodontic appliances, fixed or removable prosthesis, smokers, pregnant women or those who were using oral contraceptives, subject who was on antibiotics or non-steroidal anti-inflammatory drugs (NSAIDS) or any other systemic disease that are known to exaggerate gingival inflammation were not allowed to participate. To be included in this study, all subjects had to have a minimum of 20 permanent teeth present.

### *Data collection procedure*

Examination of periodontal parameters was performed by two dentists for all subjects in a dental chair, using a mouth mirror, and a calibrated periodontal probe. Inter-operator reproducibility was assessed employing kappa statistics ( $k=0.82$ ). Periodontal charting was done for all participants, and the data was recorded and collected in a special diagnostic form. Gingival health was defined as the absolute absence of symptoms and signs of gingivitis at any site, and gingivitis was defined as inflammation of the gingiva in at least one site with an absence of loss of clinical attachment [11]. Gingival index (gi) by löe and silness used for assessment the gingival health status [12] and dental plaque status for all subjects was evaluated using plaque index (pi) by löe and silness [13]. To obtain gingival index and plaque index for the entire dentition, "ramfjord" teeth were used. Periodontal pocket depth was also measured using graduated williams' probe to exclude the presence of periodontitis.

In regards to gi, the severity of gingivitis can be categorized as the following: healthy, non-inflamed gingiva ( $<0.1$ ); mild inflammation (0.1–1.0); moderate inflammation (1.1–1.9); and severe inflammation (2–3) [12]. In accordance with the pi score, the subject's personal oral hygiene status was evaluated as the following: excellent ( $<0.1$ ); good (0.1–0.9); fair (1.0–1.9); and poor (2.0–3.0) [13].

### *Statistical analysis*

The collected data were sorted, coded, then entered and analyzed using SPSS, version 25.0 statistical software. Simple descriptive statistics were used (mean  $\pm$  standard deviation for quantitative variables and frequency with percentage for categorized variables) and to test the association between dependent and independent variables the chi-square test was used. The independent t-test was used to test the significance of the difference in mean whole mouth gingival index and dental plaque status between sexes. Appropriate inferential statistics were done with a (0.05) chosen level of significance

## RESULTS

### *Demographic characteristics of participants.*

Out of 320 participants, 183 (57.3%) were female and 137 (42.7%) were male. The age ranged from 18 to 45 years old, with a mean age of  $29.59 \pm 6.82$  years. The mean age for male subjects was  $30.91 \pm 6.71$  years, which is not statistically significant compared to females ages of  $29.60 \pm 6.65$  ( $p = 0.000$ ). Regarding the age group of participants. 133 (41.6%) participants were between the ages of 18 and 35 years old; a third (30.3%) were between 26 and 35 years old; and ninety (28.1%) participants were between 36 and 45 years old. A summary of participant descriptive statistics can be found in table 1.

*Table 1. Demographic criteria for subjects participated in this study*

Age group	Male		Female		Total	
	n	%	N	%	N	%
18 - 25 years	39	28.5%	94	51.4%	133	41.6%
26 -35 years	50	36.5%	47	25.7%	97	30.3%
36 -45 years	48	35.0%	42	23.0%	90	28.1%
Total	137	42.8%	183	57.2%	320	100.0%

**Clinical measurements**

**Dental plaque status**

The average dental plaque of the entire population and among male and female subjects is shown in table 2. The average dental plaque index scores for the entire population were  $0.96 \pm 0.44$ , which reflects the good plaque status of the participants. The mean plaque index of male and female subjects was  $1.04 \pm 0.43$  and  $0.96 \pm 0.44$ , respectively, with analyses demonstrating significant differences between genders ( $p = 0.003$ ).

**Table 2. Plaque index among males and females (Mean  $\pm$  SD)**

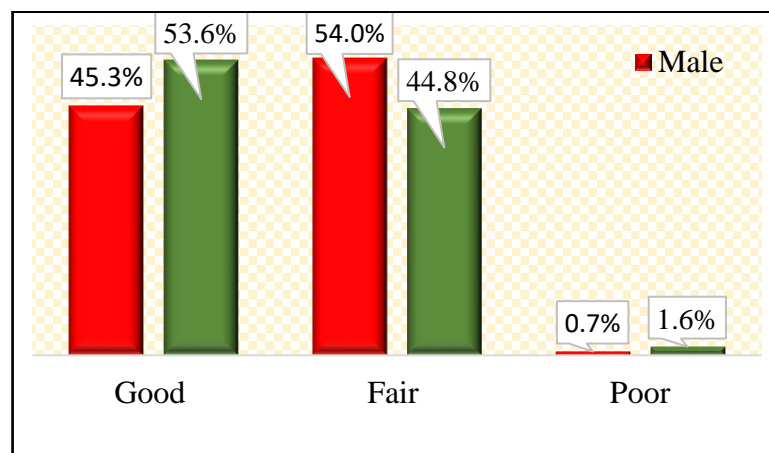
Patients	Plaque index	P value
Male	1.04 $\pm$ 0.43	< 0.003*
Female	0.90 $\pm$ 0.44	
All subjects	0.96 $\pm$ 0.44	

\*Independent t- test.

Oral health hygiene among the study participants is presented in table 3 and figure 1. Females reported a higher level of good oral hygiene than males. Only 0.7% of males had poor oral hygiene, and just three females had poor hygiene.

**Table 3. The plaque grade of the subjects included in this study.**

Plaque status	Male		Female		Total		P- value
	n	%	N	%	N	%	
Good	62	45.3 %	98	53.6 %	160	50.0 %	0.119
Fair	74	54.0 %	82	44.8 %	156	48.8 %	0.228
Poor	1	0.7%	3	1.6 %	4	1.3 %	0.583
Total	137	42.8%	183	57.2%	320	100%	



**Figure 1. Plaque scores among males and females.**

**Gingival health status**

The whole-mouth gingival index scores among male and female subjects are shown in table 4. Average gingival index scores for the entire population were  $1.08 \pm 0.52$ , which reflect almost mild inflammation as a slight change in color and little change in texture. Furthermore, male participants had more gingival inflammation ( $1.15 \pm 0.48$ ) in comparison to females ( $1.03 \pm 0.54$ ), and the difference was significant ( $p = 0.029$ ).

**Table 4. Gingival index among males and females (Mean ± SD)**

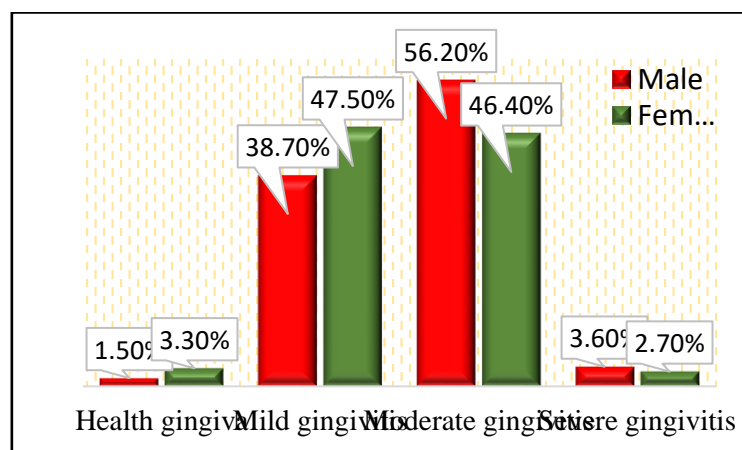
Patients	Gingival index	P value
Male	1.15 ± 0.48	< 0.029*
Female	1.03 ± 0.54	
All subjects	1.08 ± 0.52	

\*Independent t test.

This study revealed a high prevalence of gingivitis, as 97.5% of individuals had different types of inflammation and only 8 participants (2.5%) had healthy gingiva. Females display mild gingivitis and fewer signs of gingival inflammation compared to males, as revealed in table 5 and figure 2.

**Table 5. The gingival health status of the subjects included in this study**

Plaque status	Male		Female		Total		P- value
	n	%	N	%	N	%	
Healthy gingiva	2	1.5 %	6	3.3 %	8	2.5 %	0. 241
Mild gingivitis	53	38.7 %	87	47.5 %	140	43.8 %	0. 248
Moderate gingivitis	77	56.2 %	85	46.4%	162	50.6 %	0. 229
Severe gingivitis	5	3.6%	5	2.7%	10	3.1%	0.470
Total	137	42.8%	183	57.2%	320	100%	



**Figure 2. Gingival health status among males and females.**

**DISCUSSION**

In general, gingivitis begins in early childhood, and becomes more prevalent and severe with age [7,8]. Periodontal disease was the 11<sup>th</sup> most prevalent disease in the world according to the 2016 global burden of disease survey [14]. Studies conducted in Egypt and Saudi Arabia, showed a prevalence of plaque induced gingivitis in 100% of population [15,16]. Another study on the prevalence and severity of plaque-induced gingivitis in three Latin-American cities: Mexico City-Mexico, great metropolitan area-Costa Rica and Bogota Colombia reported prevalence of plaque induced gingivitis in 99.6% of population [17]. Furthermore, a study done by Opperman, et al. In America, a study showed prevalence of plaque induced gingivitis in 93.9% [18]. Our study findings were very similar to a study conducted in Chinese adult population done by Zhang, et al, which showed a prevalence of plaque induced gingivitis in 97.9% [19]. This variation in the prevalence of gingivitis between different studies and different countries as a result of variations in the procedure of defining and diagnosing this type of disease, sample size and age of subjects participating in the study [7].

The striking results of this study demonstrate that mean average of dental plaque and gingival scores for this population were 0.96 and 1.08, respectively. The average results for whole gingival scores for this population was 1.08 which had very similarity to those documented in previous studies conducted on the prevalence of dental plaque and gingivitis

among Indian adults which reported gingival score of 1.19 [20], 1.23 from Swiss recruits [21], 1.05 from USA [22], 1.2 from the Gambia [23], and 1.1 from China [19]. In our study higher prevalence of gingivitis has been reported in male compared with female, this is on the same line to the studies conducted on Saudi Arabia and Sweden population which reported male were affected more as compared to female [16,24]. An elevated prevalence of gingival inflammation in male was also reported in Australia in 2009 [25]. A possible explanation for this higher prevalence is explained by factors such as poor attitude towards oral health behavior likes fewer visits to dental clinic, lower awareness of personal hygiene and poor oral hygiene care among men compared to women [26].

Regarding dental plaque, males reported a slightly higher mean plaque score than females. The clearly positive results confirm that the higher the plaque index, the higher the gingival index, and this explains a significant association in the current study between plaque accumulation and gingival inflammation in male subjects. Our results are consistent with many previous studies that revealed a significant association of male gender with gingival diseases and plaque accumulations [22]. This is consistent with the direct-promoting association between the presence of bacterial plaque and gingivitis reported in the literature [7,11,19,22,27].

## CONCLUSION

In this study, we found that gingivitis is highly prevalent in our sample population. Bacterial plaque accumulation, inappropriate oral hygiene behavior, and poor oral health awareness in our population sample are related with the prevalence of gingivitis. The study suggests that the professional guidance and regular preventive care are essential to maintaining oral health in adult therefore oral hygiene instructions should be emphasized and patients should be educated in gingivitis awareness. However, future studies on the prevalence of gingivitis in Libyan population should be conducted on a larger sample size included all age groups to establish the prevalence of the disease.

## Conflict of interest

There are no financial, personal, or professional conflicts of interest to declare

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## مدى انتشار وشدة التهاب اللثة الناجم عن البلاك في عينة من السكان الليبيين البالغين

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### المستخلص

**الخلفية والأهداف.** التهاب اللثة الناجم عن البلاك هو الشكل الأكثر شيوعاً لأمراض اللثة. لم يتم توثيق انتشار التهاب اللثة بين السكان الليبيين في مدينة طرابلس؛ ولذلك، كان الهدف من هذه الدراسة هو تقييم مدى انتشار وشدة التهاب اللثة الناجم عن البلاك بين عينة من السكان الليبيين البالغين. **طرق الدراسة.** في هذه الدراسة المقطعية، تم اختيار ثلاثمائة وعشرين مشاركاً من مرضى الأسنان الروتينيون الذين يراجعون عيادة اللثة بكلية طب الأسنان، جامعة طرابلس، ليبيا في الفترة من أكتوبر 2022 إلى مايو 2023. تم إجراء فحص سريري بواسطة طبيب أسنان لقياس اللثة ومؤشرات لوحة **Löeand Silness** لكل موضوع. **النتائج.** بلغ معدل انتشار التهاب اللثة 97.5% بين الأشخاص البالغين الذين تتراوح أعمارهم بين 18-45 سنة. علاوة على ذلك، كان متوسط مؤشر اللثة  $1.08 \pm 0.52$ ، مما يدل على وجود التهاب بسيط في اللثة. في الواقع، أظهر الذكور علامات أكثر شدة لالتهاب اللثة مقارنة بالإناث (قيمة الاحتمال = 0.029). بالإضافة إلى ذلك، كان متوسط مؤشر البلاك  $0.96 \pm 0.44$ ، مما يشير إلى حالة البلاك الجيدة للمشاركين. ومع ذلك، كان الذكور أكثر تأثراً من الإناث (قيمة الاحتمال = 0.003). **الخاتمة.** أظهرت نتائج هذه الدراسة أن تراكم البلاك والأغشية الحيوية يرتبط بقوة بارتفاع معدل انتشار التهاب اللثة المعتدل إلى الشديد بين الأشخاص الليبيين.

**الكلمات الدالة.** التهاب اللثة، لوحة الأسنان، انتشار، السكان البالغين