ORIGINAL RESEARCH

Evaluation of Gingival Health Status among 6- and 12-years-old Children in Dhamar City, Yemen: A Cross-sectional Study

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ABSTRACT

Introduction: Epidemiological data on gingivitis in children are important for understanding the natural course of the disease, identifying its risk factors, and predicting its time trends. The objective of this study was to evaluate the prevalence and severity of gingivitis among 6- and 12-year-old school children in Dhamar city, Yemen.

Materials and methods: A total of 663 children (310 children of 6 years old and 353 children of 12 years old) were examined from 10 public primary schools. Gingival health status was assessed using the plaque index (PI), calculus index (CI), and gingival index (GI) on the six Ramfjord teeth. The latter index was used to categorize gingivitis severity at the subject level. Data were analyzed using independent *t*-test, chi-squared test, and Spearman's correlation. A p-value of < 0.05 was considered significant.

Results: Both age groups had high mean of PI and GI with nonsignificant difference. The 12-year-old children had calculus deposits much higher than the 6-year-old group with significant difference. There was a significant correlation between age and gender of the whole sample with CI [(odds ratio, OR = 1.65, p = 0.003) and (OR = 0.74, p = 0.05) respectively]. Most of the participants presented with gingival inflammation, which was less in 12-year-old females.

Conclusion: Poor oral hygiene and mild gingivitis were highly prevalent among Yemeni school children.

Clinical significance: The early assessment and intervention of gingivitis and periodontitis will minimize the chance of tooth loss. It has been reported that marginal gingivitis begins early in childhood, increases in prevalence and severity at puberty, and then subsides slightly to the remainder of the second decade of life.

Keywords: Calculus index, Gingivitis, Plaque index, School children, Yemen.

INTRODUCTION

Gingivitis of varying severity is nearly a universal oral disease in children and adolescents. It is a nonspecific inflammatory reaction to dental biofilm bacterial challenge, characterized by the presence of gingival inflammation without detectable bone loss.[1-3] With the improvement of oral hygiene and professional treatment, this disease can be reversible.[3] However, untreated gingival inflammation can progress to gradual irreversible destruction of supporting soft and hard tissues of the teeth.[4] The main cause of gingival inflammation is dental plaque .Therefore, poor oral hygiene is the most important local predisposing factor for gingivitis in children and adults.[5] However, other factors, such as systemic diseases, hormonal changes, sex, age, and economic conditions may also influence the response of gingival tissues to dental plaque.[6] The early assessment and intervention of gingivitis and periodontitis will minimize the chance of tooth loss.[7] It has been reported that marginal gingivitis begins early in childhood, increases in prevalence and severity at puberty, and then subsides slightly to the remainder of the second decade of life.[8] Epidemiological

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data on gingivitis in children are important for understanding the natural course of the disease, identifying its risk factors, and predicting its time trends.[3,4] They are also of paramount importance for developing and, later, assessing community preventive programs. Several studies in developing countries showed poor oral hygiene and gingival inflammation among children and young populations, especially in those residing in the rural and remote areas and in those of low socioeconomic strata.[5,6] Other epidemiological surveys indicated that the incidence of tooth-supporting bone destruction and periodontal attachment loss increases in adolescents aged 12 to 17 years when compared with children aged 5 to 11 years.[9,10]

The previous epidemiological studies for the periodontal health status among Yemeni children are still less than the minimum.[11,12] Therefore, the aim of this study was to evaluate the gingival health status among 6- and 12-year-old children from Dhamar city, Yemen.

MATERIALS AND METHODS

A total of 663 children (378 females and 285 males) were randomly selected from 10 government school children in Dhamar city and examined between December 2013 and May 2014. In this cross-sectional study, a two-stage sampling method was used. At the first stage, a random sample of 10 public schools was selected from the schools of the city of Dhamar. In the second stage, total coverage of children of age 6 or 12 was done. The sample size was estimated to have significant numbers for statistical analysis and was divided into two age groups:
1. 6-year-old group: composed of 310 subject (174 females and 136 males)
2. 12-year-old group: composed of 353 subject (204 females and 149 males)

Children were selected from two classes in each public primary school (grade 1 for the 6-year-old group and grade 6 for the 12-year-old group). Age was confirmed by checking school records. Prior to visiting the selected schools, an approval letter from the Administration of Education in Dhamar Governorate was obtained with the consent of teachers and parents. Study was cleared by the Institutional Ethics Committee of Faculty of Dentistry – Thamar University. The purpose of the study was, subsequently, explained to both school authorities and students. Once the participation of the students in the study was approved, they were sent to the prepared room for interview and examination by the researcher himself.

Clinical Examination

Children with previous periodontal treatment, ongoing or previous orthodontic treatment, under current or with history of any systemic diseases were excluded from the study. Clinically, each child's gingival condition was assessed using the plaque index (PI) according to Silness and Loe,[13] the calculus index (CI), the presence or absence of supra- and/or sub-gingival calculus was determined by visual or tactile examination using a mouth mirror and dental explorer,[14] and the gingival index (GI) described by Loe and Silness,[15] on the six Ramfjord teeth. The mean GI was used to determine the categorical gingival status according to Loe[16] as follows: 0 healthy; 0.1–1 mild gingivitis; 1.1–2 moderate gingivitis; and 2.1–3 severe gingivitis. All examinations were performed by the same periodontist to avoid any interexaminer variability. Mouth mirror and UNC-15 probe were used in the examination. Instruments were disinfected with an antiseptic solution after every use and antiseptic solutions were changed frequently between the examinations.

Statistical Analysis

The collected data were analyzed using Statistical Package for the Social Sciences (SPSS) package version 22. The data were summarized as mean ± standard deviation (SD) or percentages as needed. Independent *t*-test for continuous variables, chi-square test for categorical data, and Spearman's rho test were used to examine the relationship between the age groups with GI, PI, and CI. A p-value of ≤ 0.05 was considered statistically significant.

RESULTS

Descriptive statistics of the study parameters are summarized in Table 1. Children at the age of 12 were relatively higher than those at 6 years (53.2 and 48.8% respectively). Female subjects were also higher than male subjects (57 and 43% respectively). Similarly, female subjects among each age group were higher than males. The means of PI and GI among the total sample were 1.37 ± 0.54 and 0.98 ± 0.51 respectively. Children with calculus deposits were obviously less than those without calculus deposits (26.4 and 73.6% respectively). The presence of calculus was found in 30.9% of the 12-year-old group; the mean GI was 1.02 ± 0.53; and the mean PI was 1.41 ± 0.57 for the same age group. These results were higher than those found in the 6-year-old group (Table 1). The difference between both age groups was significant with regard to calculus deposits. However, this difference was not significant in relation to GI and PI (Table 2). Furthermore, correlation coefficient test revealed very weak correlation between age with GI and PI (Table 3). Again, this correlation was significant with regard to CI, with OR = 1.65, and p = 0.003. In comparison between

Table 1: Descriptive statistics of the study parameters (%)

Variables		All (n = 663)	6 years (n = 310)	12 years (n = 353)
			Frequency	
Gender	Male	285 (43)	136 (43.9)	149 (42.2)
	Female	378 (57)	174 (56.1)	204 (57.8)
Calculus index	Not present	488 (73.6)	244 (78.7)	244 (69.1)
	Present	175 (26.4)	66 (21.3)	109 (30.9)
Gingival index	(mean ± SD)	(0.98 ± 0.51)	(0.95 ± 0.48)	(1.02 ± 0.53)
Plaque index	(mean ± SD)	(1.37 ± 0.54)	(1.34 ± 0.49)	(1.41 ± 0.57)

Table 2: Comparison between age groups in relation to GI, PI, and CI (%)

Variable	Age (N)	Mean ± SD	Mean diff.	p-value
Gingival index	6 (310)	0.95 ± 0.48	–0.07	0.680
	12 (353)	1.02 ± 0.53		
Plaque index	6 (310)	1.34 ± 0.49	–0.07	0.108
	12 (353)	1.41 ± 0.57		
		Not present	Present	
Calculus index	6 (310)	244 (79)	66 (21)	0.003
	12 (353)	244 (69)	109 (31)	

Table 3: Correlation between age with GI, PI, and CI for all participants (%)

	Gingival index	Plaque index	Calculus index
Age	Rho = 0.089[§]	Rho = 0.078[§]	OR = 1.65[Ŧ]
	p-value = 0.021	p-value = 0.045	p-value = 0.003
Gender	Rho = –0.014[§]	Rho = –0.052[§]	OR = 0.74[Ŧ]
	p-value = 0.724	p-value = 0.180	p-value = 0.05

[Ŧ]Chi-squared test; [§]Spearman correlation test

Table 4: Independent t-test for comparison between males and females in relation to GI and PI (%)

6-year-old group		Mean ± SD	Mean diff.	Sig.
Gingival index	Male (136)	0.91 ± 0.50	–0.06	0.251
	Female (174)	0.97 ± 0.47		
Plaque index	Male (136)	1.34 ± 0.49	0.01	0.882
	Female (174)	1.33 ± 0.50		
		Not present	Present	
Calculus index	Male (136)	108 (79)	28 (21)	0.451
	Female (174)	136 (78)	38 (22)	
12-year-old group		Mean	Mean diff.	Sig.
Gingival index	Male (149)	1.06 + 0.52	0.07	0.210
	Female (204)	0.99 + 0.54		
Plaque index	Male (149)	1.47 + 0.60	0.10	0.099
	Female (204)	1.36 + 0.55		
		Not present	Present	
Calculus index	Male (149)	92 (62)	57 (38)	0.007
	Female (204)	152 (75)	52 (25)	

Table 5: Correlations between gender with GI, PI, and CI among age groups (%)

	Gingival index	Plaque index	Calculus index
6 years			
Gender (310)	Rho = 0.049	Rho = –0.014	OR = 1.08
	p-value = 0.386	p-value = 0.803	p-value = 0.451
12 years			
Gender (353)	Rho = –0.066	Rho = –0.091	OR = 0.55
	p-value = 0.214	p-value = 0.087	p-value = 0.007

Table 6: Severity of gingival inflammation among all subjects and by age groups (%)

Severity	All (n = 663)	6 years (n = 310)	12 years (n = 353)
None	90 (13.6)	45 (14.5)	45 (12.7)
Mild	393 (59.3)	198 (63.9)	195 (55.2)
Moderate	171 (25.8)	64 (20.6)	107 (30.3)
Severe	9 (1.4)	3 (1.0)	6 (1.7)

Gingival condition and categorical gingival status are presented in Table 6. Only 13.6% out of 663 participants had no signs of gingival inflammation. This was 14.5% of 6-year-old group and 12.7% of 12-year-old group. Most of the participants, either of the whole sample or of each age group separately, had mild gingivitis. Children with moderate inflammation were more than those with healthy gingiva (25.8% compared to 13.6%). Severe inflammation was observed among few numbers of children (9 participants). Male subjects of 6 years and with healthy gingiva were more than female subjects with healthy gingiva in the same age group (17.65% compared to 12.07%). However, healthy gingiva was more frequent among 12-year-old females (14.7%) than 12-year-old male children (10.07%). In general, there was no big difference regarding the severity of gingival

males and females among each age group, there were no significant differences between both genders regarding all clinical parameters in the 6-year-old group. However, there was a significant difference between both genders regarding CI (p = 0.007) in 12-year-old group. With regard to PI and GI, there were no significant differences between males and females in this age group (Table 4). The correlations between gender within the same group and clinical parameters were very weak with all parameters in 6-year-old group. However, there was only significant correlation between gender and CI in 12-year-old group. The correlations between gender with PI and GI were also nonsignificant and very weak (Table 5).

Table 7: Severity of gingival inflammation among subjects by gender within the same age group (%)

		None	Mild	Moderate	Severe
6 years	Male	24 (17.65)	84 (61.76)	27 (19.85)	1 (0.74)
	Female	21 (12.07)	114 (65.52)	37 (21.26)	2 (1.15)
12 years	Male	15 (10.07)	82 (55.03)	47 (31.54)	5 (3.36)
	Female	30 (14.71)	113 (55.39)	60 (29.41)	1 (0.49)

inflammation between both genders within the age groups (Table 7).

DISCUSSION

The objective of the current study was to assess the gingival health status among 6- and 12-year-old school children in Dhamar city, Yemen. The results of the PI and GI among the participants of this study were higher than the results observed in previous studies conducted on 6-to 14-year- old and 5- to 12-year-old age groups in other Yemeni governments.[11,12] Different findings have been reported from other parts of the world.[17-20] These variations may be attributed to differences in methodology and/or age of study samples and may also be related to the socioeconomic condition which reflects genuine differences in oral hygiene practices. Another possible factors might be the culture, food habits, and geographical location that act as independent determinant.[12] There was no significant difference between the 6-year-old group and the older age group in relation to the mean of PI and GI. This result differs from previous reports.[21,22] Furthermore, there was no significant difference in the means of PI and GI between males and females within both age groups, which seems to be consistent with the results of Al-Jasser et al[17] and Mascarenhas.[23] This might be related to the poor oral hygiene practice among both genders. However, some previous reports showed opposite results.[12,18,24] The current study found that 12-year-old children had more calculus accumulation than 6-year-old children. It appears that children 12 years of age are 1.65 times more likely to have calculus deposits than 6-year-old children. This result suggests that the prevalence of dental calculus increased with the progression of age and this was in agreement with the findings of a previous study.[25] Furthermore, Sjodin and Mattson[26] have reported that the presence of dental calculus in children of 9 years of age was associated with development of periodontitis. Female subjects within the 12 years age group were 0.55 times less likely to have calculus deposits than males within the same age group. However, this was not significant between males and females within the 6 years age group. The high prevalence of dental calculus and gingivitis in Yemeni school children can affect the quality of life in both childhood and adulthood. Gingivitis is considered a very

significant precursor for periodontitis which is mostly induced by plaque and is a universal finding in children. This disease begins with primary dentition and reaches a pick around puberty.[3] The findings of this study showed a high prevalence of gingival inflammation (86.4%) among Yemeni school children in Dhamar city. This result is in agreement with other studies.[11,27,28] Al-Haddad et al[12] conducted a study on 5- and 12-year-old children in five Yemeni governorates and indicated that about 90% of the 12-year-old children in Sana'a city had gingivitis. The high occurrence of gingivitis among the current study subject can be attributed to the poor oral hygiene and the weak or absent of oral preventive programs that should be followed in public primary schools. Mild gingivitis had the highest percentage (59.3%) among the school children while moderate gingivitis was (30.3%) in the 12-year-old group, which was higher than that shown among 6-year-old group (20.6%). Although these findings are in agreement with some previous studies,[20,21] it seems different from the findings of Al-Sayyab's study.[28] This might be related to the fact that the mild gingivitis was considered the commonest type in early childhood, whereas the severity of gingival inflammation increases with age. In comparison between genders in both age groups, the results of present study found that males and females in older age group were more affected with moderate gingivitis than in smaller age group. This result is in agreement with the findings of a previous study.[29] Increase in severity of gingivitis as age progresses may be due to the change in the population of the oral microorganism. Other factor might also be involved, such as hormonal change that occurs during puberty which increases the permeability of the blood vessels.[30] Variations found between the results of this study and those found by Al-Haddad et al[12] may be related to socioeconomic status of the participants, study sample, and/or geographical location, which was considered as an independent determinant and which in turn may provide some sort of evidence for ethnic and possibly genetic variations.

CONCLUSION

Within the limitation of the current study, it was concluded that the prevalence of gingivitis was high among Yemeni school children from Dhamar city. Mild gingival inflammation was the highest among both age groups, while moderate gingivitis was more frequent in the 12-year-old group than in the 6-year-old group. It is highly recommended that oral health preventive programs using modern facilities and education about gingival inflammation should be conducted on Yemeni schoolchildren.

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