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Racial Differences Effects on Oral Health and Periodontal Diseases Extent, Staging and Grading among the Multi-Ethnic Expatriates in Aseer Region, Saudi Arabia

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Abstract

Background: Given the increase in the numbers of expatriates in Saudi Arabia and the shortage of information about expatriates' oral health and periodontal disease severity and progression. **Objectives:** This study aimed to evaluate the effects of the racial differences on oral health and periodontal disease extent, staging, and grading among the multi-ethnic expatriates in the Aseer region, Saudi Arabia. **Materials and Methods:** This cross-sectional study was carried out on 300 expatriates in Aseer region, Saudi Arabia. They were divided into three equal racial different groups (n = 100), Arabs (AR), Asians (AS), and Africans (AF). The interviews of all participants were completed then the clinical examinations of periodontal diseases extent, staging, and grading parameters were performed. Statistical analysis was done by ANOVA test, Tukey's test, and Chi-square test. The statistical significance level was determined at p < 0.05. **Results:** There were statistically significant differences in the comparison between the three ethnic/racial groups in clinical parameters except in GBI, PCR, FI, TFO, and BC, where there were no statistically significant differences in the comparison between the three ethnic/racial groups. There were differences associated with age, gender, smoking, and diabetes, without statistically significant differences among the three racial groups. **Conclusion:** We concluded that most participants in this study had a generalized severe grade 4 plaque-induced gingivitis and localized periodontitis stage III grade B.

Keywords

Multi-Ethnics, Oral Health, Periodontal Diseases Extent, Staging and Grading

1. Introduction

Oral health is necessary for public health and lifestyle. Consequently, Bad oral health maybe leads to difficulties eating or speaking and restrict daily life [1]. On the other hand, periodontal disease is a multifactorial inflammatory disease of the oral cavity that can be gingivitis confined only to the gingiva or periodontitis when exceeding the soft tissues and affects the hard tissues attachment of the teeth [2]. Periodontal disease affects 10% - 15% of people worldwide. Thus, it has a high effect on general health [3].

Periodontal diseases occur in all age groups due to common etiological and other predisposing factors that, causing the initiation and progression of periodontal diseases [4] [5]. Comparable to other chronic diseases, periodontal disease is considered a complex disease, and patient behaviors, environmental factors, medication use, genetic and epigenetic influences establish periodontal disease development [6]. Periodontitis affecting on 13% to 57% of adult populations in the Arab World, and mild-to-moderate periodontitis is the most common form [7] [8] [9].

The races of patients also promote the individuals' predisposition to periodontal diseases [10]. Racial differences in periodontal diseases in the U.S. have been recognized, with African Americans and Mexican-Americans as more susceptible to periodontal diseases than other racial groups [11] [12], where the periodontal health among white people is better than other ethnic groups [13]. This may be due to the effect of race on income and education [14]. Thus, recognition of racial variations is a significant side to recognizing the people's oral and public health and planning suitable [15].

The self-identification of the races is a complex process that includes several factors: geographical, inherited, ethnic, and somatic characteristics, moreover the language, customs, religion, and culture. The racial groups differ in lifestyle, such as smoking and diet, alcohol consumption also their dental services. As well as the impacts of assimilation, expatriation, and discrimination, furthermore, environmental effects such as variations in personal- and region-based socioeconomic level and the racial blend of people [16] [17]. Former studies display that the racial variations in oral health linked by behavioral, cultural, socioeconomic factors, as well as access to dental services and there were high level of dental diseases and low level of oral care among expatriates in contrast with local-born [18] [19] [20] [21]. There are multi distinct races among the minority groups, and oral health troubles highly spread between them [22].

In Saudi Arabia, 30% of the population is as expatriates from worldwide, and as far as we know, there is no study in the college of dentistry, King Khalid University, that displays the impact of racial differences on oral health and periodontal diseases extent, staging and grading among the multi-ethnic expatriates in Saudi Arabia. Therefore, the purpose of the present study is to evaluate oral health and periodontal status among expatriates from different racial origins in the Aseer region, Saudi Arabia.

2. Materials and Methods

2.1. Design of Study and Sample Size

This retrospective descriptive study was done on 300 expatriate patients with periodontal diseases at the clinics of the college of dentistry, King Khalid University, from 1st of October 2020 to the end of February 2021. The present study comprised three different race groups living in Saudi Arabia as group I (Arabs), group II (Asians), and group III (Africans). The three groups of the present study are all expatriates to Saudi Arabia recently (within the last 20 years). Consequently, they still in close connections with their origin countries, which can help them to resist alter behavior and beliefs. The sample size in the present study was determined to depend on a study conducted by Eke, *et al.* in 2012, a sample size of n = 300 (100 per group) [12].

2.2. Ethical Considerations and Ethics Approval

Written informed consent gained. The participants in the present study were volunteers and received explanations about the nature of the study, then their written informed consent was obtained. Moreover, ethical approval was obtained from the institutional review board, the college of dentistry, King Khalid University (IRB/REG/2020-2021/75).

2.3. Inclusion and Exclusion Criteria

The participants with or without systemic disease are involved in this study. The main inclusion criteria for all participants in the current research that they should be non-Saudi, and they all should be from three different races according to the study design. Study participants without periodontal diseases and who received mechanical and chemical periodontal therapy excluded. We excluded the participants who did not clarify their ethnic group and mixed ethnic group to avoid the difficulty in the interpretation of the results due to the heterogeneity within these groups.

2.4. Participants' Characteristics

In this study, we determine race and gender as non-changeable factors, whereas oral health periodontal parameters, smoking, diabetes are grouped as changeable factors. The participants' characteristics as age, gender, and race were included in our assessment to investigate the effects of these factors on oral health and periodontal diseases extent, staging and grading. We checked the other characteristics of the participants, such as the presence of diabetes and smoking status. The age range of the participants was between 14 - 89 years old.

2.5. Clinical Examination

The participants was interviewed and clinically examined by the researchers on the authority of to World Health Organization's (WHO) criteria [23]. Gingival

bleeding index (GBI), plaque control record (PCR) recorded [24] [25]. Moreover, clinical attachment loss (CAL), percentage (%) of bone loss (%BL), number of teeth missing due to periodontal diseases (NMT), Periodontal pocket depth (PPD), Pattern of bone loss (PBL), tooth mobility (TM), furcation involvement (FI), present of trauma from occlusion (TFO), bite collapse (drifting, flaring) (BC) and less than 20 remaining teeth (10 opposing pairs).

Periodontal disease in the present study was determined, like gingival diseases and periodontitis. Gingival diseases include localized or generalized (mild or moderate or severe), grade 1 or 2 or 3 or 4 or 5 dental plaque-induced gingivitis. Moreover, periodontitis was diagnosed as localized and generalized, stage I, II, III, or IV periodontitis. Diabetic status was determined by the glycated hemoglobin (HbA1c) test. When HbA1c less than 7.0, it will be grade periodontitis grade B, and when HbA1c of 7.0 or more, it will be periodontitis grade C. The participants' smoking status was determined, as smokers and non-smokers. When the participant's smoking less than ten cigarettes daily, it will be, periodontitis grade B, and when the participant's smoking ten cigarettes or more, it will be periodontitis grade C [26] [27].

2.6. Radiographic Evaluation

The alveolar radiographic bone loss in the current study evaluated as percentages of radiographic bone loss where we measured, in millimeters, the distance from the cement-enamel junction (CEJ) to the alveolar bone crest (ABC) as well as the distance from CEJ to the root apex with the calibrated measuring tool of Emago® (Oral Diagnostic Systems, Amsterdam, Netherlands) software—the radiographic imaging software at HSDM. Percentage bone loss is calculated by the difference between those distances multiplied by 100 [28]. The percentage of radiographic bone loss divided by the patient's age applied to the evaluation of periodontitis progression [29] [30].

2.7. Glycosylated Hemoglobin (HbA1c) Assessment

The medical reports of participants were used to identify glycosylated hemoglobin more or less than 7%, and according to these reports, the test kit (A1cNow+) was used with a laboratory method (Ion Exchange Resin method) using a semi-auto analyzer [31].

2.8. Statistical Analysis

The age and clinical parameters of the participants of the three groups were compared using the ANOVA test. Whereas the comparison between group I and II and between III and I. Moreover, a comparison between groups II and III based on their age and clinical parameters conducted using Tukey's test. Chi-square test carried out to the comparison between groups II, III, and I in the participants' characteristics and clinical parameters. The statistical significance level was determined at P < 0.05.

3. Results

The present study samples included 300 participants. There were 200 (66.7%) males and 100 (33.3%) females. They were divided into three equal groups Arabs (group I), Asians (group II), and Africans (group III). The ranges of ages for groups I, II&III were 14 - 89 ys, 21 - 76 ys, and 18 - 81 ys with means and standard deviations (±SD) 32.3 ± 14.5 ys, 42.96 ± 12.7 ys, and 39.32 ± 12.9 ys, respectively. Consequently, the ages of Asian participants more than the ages of Arabs and Africans, and the participants' ages of Africans more than the participants' ages of Arabs, and there were highly statistically significant differences in the comparison of the participants' ages between Arabs, Asians and Africans, Arabs and Asians and Arabs and Africans, without statistically significant differences in the comparison of the participants' ages between Asians and Africans (Table 1 & Figure 1).

On the other hand, 211 (70.3%) of the total participants were non-smokers, 89 (29.7%) were smokers, and 111 males (55.5%) were non-smokers, and 89 males (44.5%) were smokers, whereas all females were non-smokers. There no statistically significant differences in the present study between Arabs, Asians, and African participants in gender and smoking. Regarding number of cigarettes/day

Table 1. Age of participants.

	Age		ANOVA	
	Range	Mean ± SD	F	P-value
Group I (AR)	14-89	32.3203 ± 14.543		
Group II (AS)	21-76	42.9603 ± 12.703	16.253	<0.001*
Group III (AF)	18-81	39.3203 ± 12.9193		
		Tukey's test		
(I) AR & (II) AS		(I) AR & (III) AF		(II) AS & (III) AF
<0.001*		**<0.001***		**0.135**

AR: Arabs. AS: Asians. AF: Africans. I: Group I, II: Group II. III: Group III.
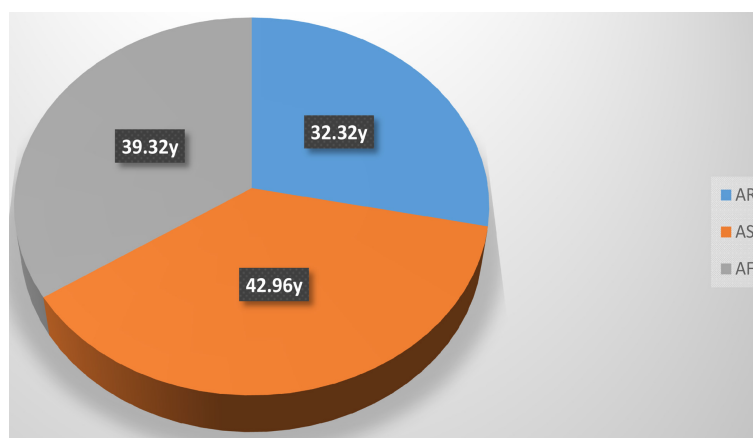
Figure 1. The mean of age of the study groups. AR: Arabs. AS: Asians. AF: Africans.

(NCs/D), there was an increase in the mean of NCs/D more than ten cigarettes per day (>10 Cs/D) without statistical significance differences in group I, II & III (14.13 ± 6.9), (12.13 ± 4.3) and (11.9 ± 5.5). Moreover, of the 300 participants, 271 (90.3%) had HbA1c <7% and 29 (9.7%) had HbA1c >7%. Consequently, the number of patients in the current study with HbA1c <7% is more than HbA1c >7% in group I, II & III without statistical significance differences ($p > 0.05$) (Table 2 & Figure 2).

Tables 3-5 and Figures 3-5 show the gingival and oral hygiene status, Periodontal parameters of periodontitis (severity) staging, and complexity of participants within racial/ethnic groups (group I, II, and III) in the current study.

Table 2. Characteristics of participants.

		Groups						Chi-square	
		AR		AS		AF		X^2	P-value
Age	Range	14 - 89		21 - 76		18 - 81		16.253	<0.001*
	Mean ± SD	32.32 ± 14.54		42.96 ± 12.70		39.32 ± 12.92			
Gender	Female	34	34.0%	33	33.0%	33	33.0%	0.030	0.985
	Male	66	66.0%	67	67.0%	67	67.0%		
Smoking	<10 Cs/D	70	70.0%	69	69.0%	72	72.0%	0.224	0.894
	>10 Cs/D	30	30.0%	31	31.0%	28	28.0%		
Diabetic	HbA1c >7%	5	5.0%	11	11.0%	13	13.0%	4.334	0.114
	HbA1c <7%	95	95.0%	89	89.0%	87	87.0%		

±SD: Standard deviation. Cs/D: Cigarettes/day. HbAc1: Glycosylated hemoglobin.

Table 3. Gingival and oral hygiene status of participants.

		Groups						Chi-square	
		Group I (AR)		Group II (AS)		Group III (AF)		X^2	P-value
		N	%	N	%	N	%		
GBI	<10	14	14.0%	11	11.0%	11	11.0%	0.788	0.940
	10 - 30.	29	29.0%	32	32.0%	29	29.0%		
	>30	57	57.0%	57	57.0%	60	60.0%		
ANOVA test									
PCR %	Mean ± SD		Mean ± SD		Mean ± SD		F	P-value	
	54.83 ± 27.01		59.88 ± 22.51		51.77 ± 27.12		2.554	0.079	
Tukey's test									
I&II			I&III			II&III			
0.346			0.675			0.067			

GBI: Gingival bleeding index. N: Number. PCR: Plaque control record.

Table 4. Periodontal parameters of periodontitis (severity) staging.

|			ANOVA		Tukey's test		
		Mean ± SD	F	P-value	I & II	I & III	II & III
CAL	AR	4.760 ± 1.980	6.798	<0.001*	0.002*	0.013*	0.817
	AS	5.785 ± 2.029					
	AF	5.605 ± 2.276					
RBL	AR	20.117 ± 10.880	6.911	<0.001*	0.001*	0.258	0.086
	AS	26.850 ± 14.350					
	AF	22.979 ± 13.091					
NMTP	AR	0.210 ± 0.701	4.461	0.012*	0.011*	0.094	0.701
	AS	0.750 ± 1.546					
	AF	0.600 ± 1.531					

CAL: Clinical attachment loss. RBL: Radiographic bone loss. NMTP: Number of teeth missing due periodontal diseases.

Table 5. Periodontal parameters of periodontitis staging (complexity).

		Group						Chi-square	
		AR		AS		AF		X²	P-value
		N	%	N	%	N	%		
TM	NO	77	77.0%	66	66.0%	78	78.0%	13.812	0.032*
	G I	12	12.0%	13	13.0%	3	3.0%		
	G II	9	9.0%	15	15.0%	12	12.0%		
	G III	2	2.0%	6	6.0%	7	7.0%		
FI	NO	69	69.0%	60	60.0%	60	60.0%	6.084	0.638
	G I	15	15.0%	17	17.0%	18	18.0%		
	G II	11	11.0%	13	13.0%	18	18.0%		
	G III	4	4.0%	8	8.0%	3	3.0%		
	G IV	1	1.0%	2	2.0%	1	1.0%		
TFO	NE	94	94.0%	90	90.0%	96	96.0%	2.959	0.228
	PO	6	6.0%	10	10.0%	4	4.0%		
BC	NO	78	78.0%	77	77.0%	78	78.0%	0.038	0.981
	PO	22	22.0%	23	23.0%	22	22.0%		
L20RT	NO	98	98.0%	83	83.0%	94	94.0%	15.923	<0.001*
	PO	2	2.0%	17	17.0%	6	6.0%		
		ANOVA test							
						F		P value	
PPD	AR	3.660 ± 0.913				5.713		0.004*	
	AS	4.175 ± 1.173							
	AF	3.910 ± 1.129							
		Chi-square							
		AR		AS		AF		X²	P-value
		N	%	N	%	N	%		
(PBL)	Absent	35	35%	17	17.0%	30	30.0%	18.265	0.006*
	H	49	49%	66	66.0%	52	52.0%		
	V	7	7%	2	2.0%	1	1.0%		
	H + V	9	9%	15	15.0%	17	17.0%		

TM: Tooth mobility. FI: Grade of function involvement. TFO: Secondary trauma from occlusion. BC: Bite collapse. L20RT: Less than 20 remaining teeth. PPD: Periodontal pocket depth. PBL: Pattern of bone loss. NO: No present, G: Grade. NE: Negative, PO: Positive. H: Horizontal. V: Vertical.
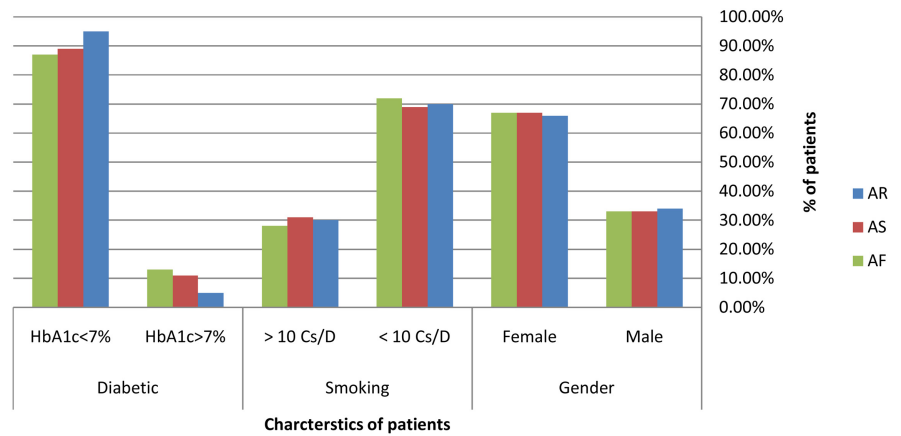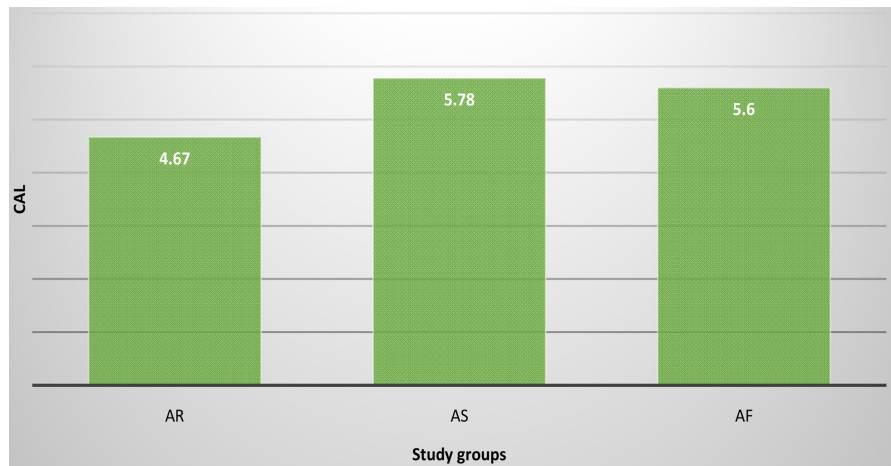
Figure 2. Characterstics of participants. Cs/D: Cigarettes/day. HbAc1: Glycosylated hemoglobin. AR: Arabs. AS: Asians. AF: Africans.
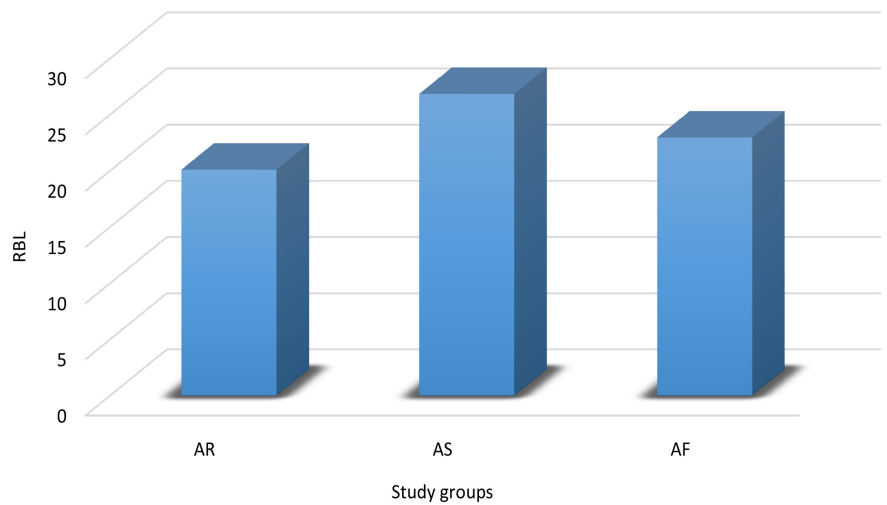

(a)

(b)
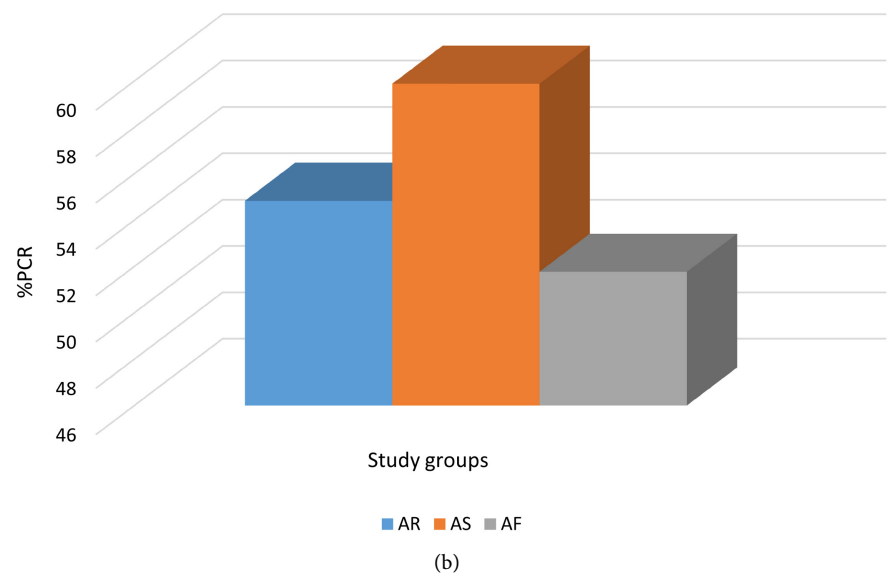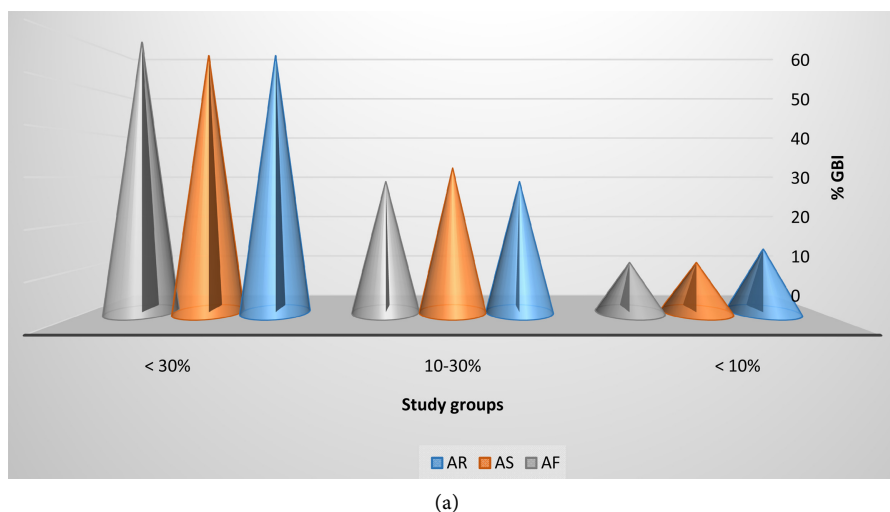
Figure 3. (a): Gingival bleeding index. % GBI: Percentage of gingival bleeding index. AR: Arabs. AS: Asians. AF: Africans. (b) The percentage of plaque control record. % PCR: Percentage of plaque control. AR: Arabs. AS: Asians. AF: Africans.
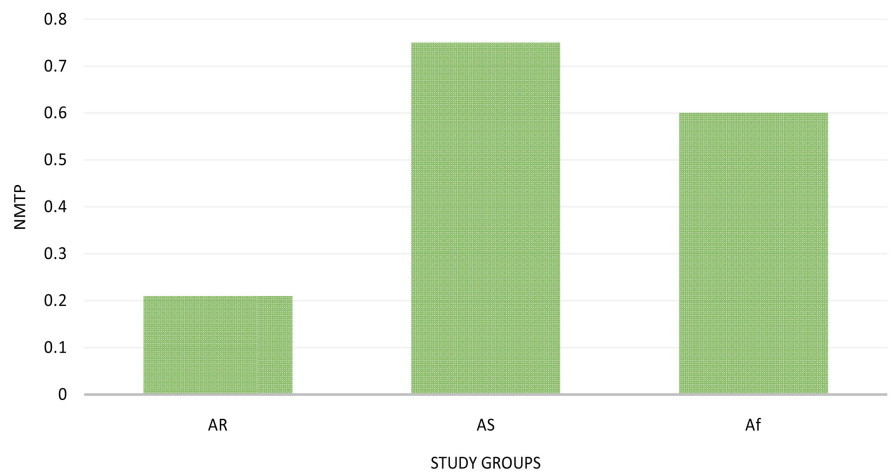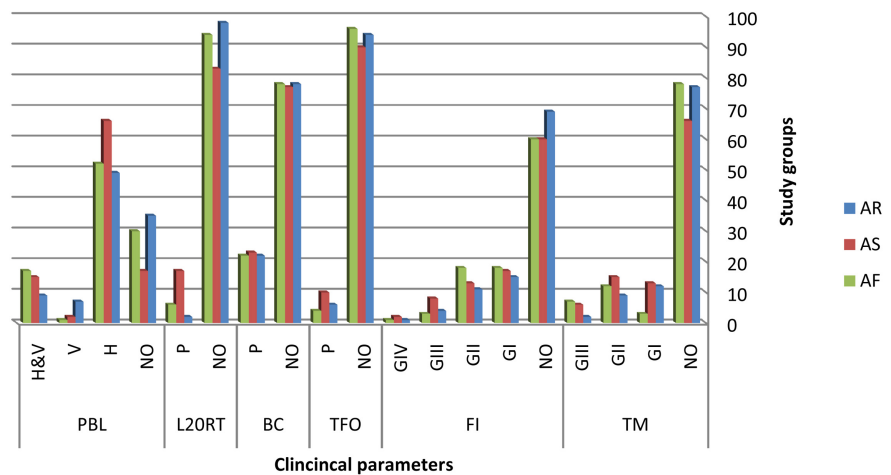
(a)

(b)

(c)

Figure 4. (a): Clinical parameters of periodontitis staging (CAL). CAL: Clinical attachment loss. AR: Arabs. AS: Asians, AF: Africans. (b) Clinical parameters of periodontitis staging (RBL). RBL: Radiographic bone loss, AR; Arabs, AS: Asians, AF: Africans. (c) Clinical parameters of periodontitis staging (NMTP). NMTP: Number of missing teeth due to periodontitis. AR: Arabs. AS: Asians, AF: Africans.

Figure 5. Clinical parameters of periodontitis staging complexity. TM: Tooth mobility. FI: Grade of function involvement. TFO: Secondary trauma from occlusion. BC: Bite collapse. L20RT: Less than 20 remaining teeth. PPD: Periodontal pocket depth. PBL: Pattern of bone loss. NO: No present, G: Grade. NE: Negative, PO: Positive. H: Horizontal. V: Vertical.

There was an increase in PCR, GBI, CAL, RBL, NMTP, and PPD among the patients of Asians more than group Arabs and Africans without statistical significance differences of PCR and GBI in the comparison between these three groups according to ANOVA test, Tukey's test, and Chi-square test. There were highly statistically significant differences between these groups according to the ANOVA test in CLA, RBL, NMTP, and PPD. On the other hand, there were differences in periodontal parameters of periodontitis severity without statistical significance differences according to Tukey's test except between Arabs and Africans in CAL, where there were statistical significance differences ($p = 0.013$).

There was no TM, FI, TFO, BC, and L 20 RT detected among most of the patients of groups, and there was a statistically significant difference in TM and highly statistically significant difference in L20 RT without statistically significant differences in FI, TFO, and BC in the comparison between Arabs, Asians, and Africans. Regarding the pattern of bone loss, horizontal bone loss was more than vertical, and both horizontal & vertical with highly statistically significant differences ($p = 0.006$). It was in Africans more than Arabs and Asians. Moreover, the Vertical bone loss of Arabs was more than Asians and Africans, while both horizontal and vertical bone loss of Africans was more than Arabs and Asians. There was a correlation between the plaque control record (O'Leary index) and the clinical parameters of periodontitis severity and progression except for furcation involvement (Table 6).

Table 7 and Figure 6 show gingivitis extent, severity, and grading where the localized gingivitis among the participants of groups I, II, and III was 43%, 43%, and 40%, and the generalized gingivitis was 57%, 57%, and 60% respectively. There were no significant differences in the extent of gingivitis between Arabs and Asians, but it was more among Africans compared to Arabs and Asians.

Table 6. Correlation between PCR, age, and periodontitis staging and grading.

Correlations		PCR	
		r	P-value
Age		0.134	0.02*
Periodontitis (severity) staging	CAL	0.330	<0.001*
	RBL	0.221	<0.001*
	NMTP	0.180	0.002*
Periodontitis Staging complexity	PPD	0.313	<0.001*
	TM	0.233	<0.001*
	FI	0.104	0.073
Periodontitis Progression (grading)	No. Cs/D	0.321	0.002*
	% HbA1c	0.451	0.0311*

CAL: Clinical Attachment loss. RBL: Radiographic bone loss, NMTP: Number of missing teeth due to periodontitits, PPD: Periodontal pocket depth. TM: Tooth mobility. FI: Furcation involvement. No. Cs/D: Number of cigarettes per day. % HbA1c: Percentage of Glycosylated hemoglobin.

Table 7. Gingivitis extent, severity and grading.

Clinical Findings		Group I	Group II	Group III
Extent	Localized	43%	43%	40%
	generalized	57%	57%	60%
Severity	Mild	14%	11%	11%
	Moderate	29%	32%	29%
	Severe	57%	57%	60%
Grade	1	14%	13%	12%
	2	14%	17%	18%
	3	14%	17%	19%
	4	30%	27%	26%
	5	28%	26%	25%
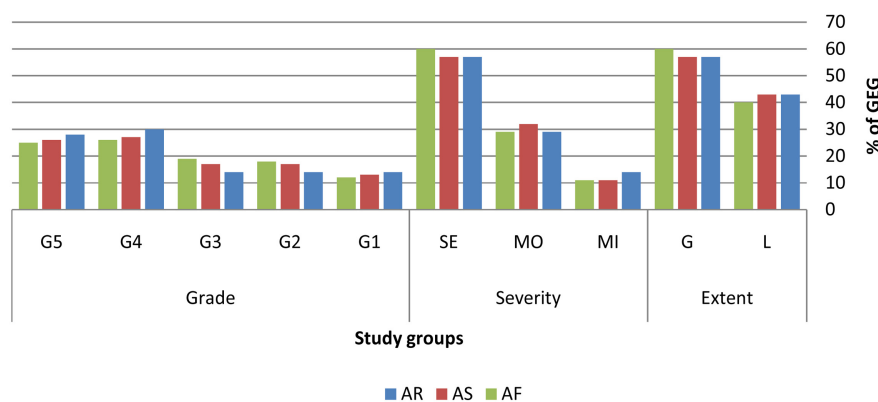
Figure 6. Gingivitis extent, severity and grading. L: Localized. G: Generalized. MI: Mild. MO: Moderate. SE: Severe. G1: Grade 1. G2: Grade 2. G3: Grade 3. G4: Grade 4. G5: Grade 5.

Mild gingivitis among Arabs was more, while moderate and severe gingivitis among Asians was more. More, detailed grading of gingivitis is also in Table 7 and Figure 7. Grade 1, 4, and 5 gingivitis of Arabs more than Asians and Africans, and Grade 2 and 3 gingivitis of Africans more than Arabs and Asians.

Table 8 and Figure 7 exhibit the clinical parameters of periodontitis extent and severity within each group. In all groups, generalized periodontitis was higher than localized periodontitis. Arabs displayed the highest periodontitis severity where 18% of them reached stage IV of periodontitis (very severe), followed by African and Asian 17% and 16% reached stage IV periodontitis. The progression of periodontitis rate of the participants in the current study increased for all groups. Table 9 and Figure 8 displayed that the majority (64%, 61% & 68%) of Arabs, Asians, and Africans had a moderate rate of periodontitis, while 17%, 21%, and 20% of them had a rapid rate of periodontitis compared to 19%, 18%, and 12% had a slow rate of periodontitis.

4. Discussion

Periodontitis comprises one of the global problems in the oral cavity [1]. The main objective of the evaluation studies for severity and progression of periodontitis is to supply the dental practitioners and periodontists with significant data to help them in the diagnosis and the assessment of prognostic factors with

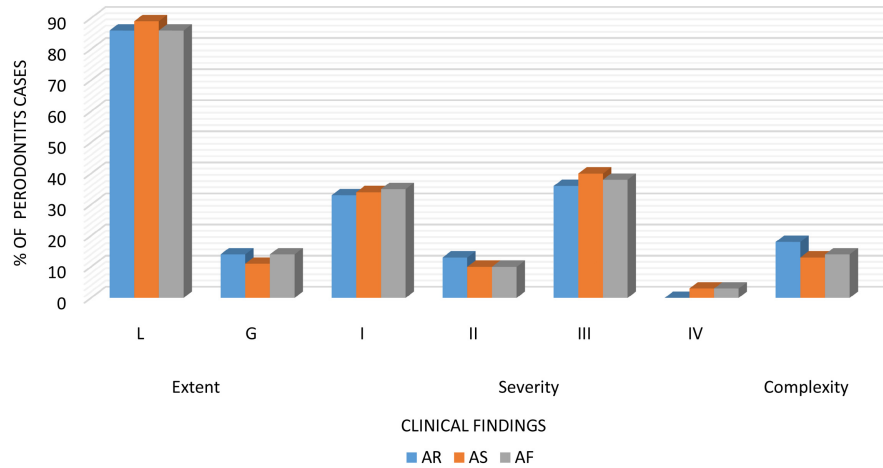**Table 8.** Periodontitis extent and severity (stages).

Groups	Extent		Severity (CAL, RBL, NMTP, PPD, FI)				Complexity (IV) (TM, TFO, BC, <20 RT)
	L	G	I	II	III	IV	
AR	86%	14%	33%	13%	36%	00%	18%
AS	89%	11%	34%	10%	40%	3%	13%
AF	86%	14%	35%	10%	38%	3%	14%

AR: Arabs. AS: Asians. AF: Africans. L: Localized. G: Generalized. I: Stage I. II: stage II, III: Stage III and IV: Stage IV. CAL: Clinical Attachment loss. RBL: Radiographic bone loss, NMTP: Number of missing teeth due to periodontitis, PPD: Periodontal pocket depth, TM: Tooth mobility. FI: Furcation involvement. TFO: Secondary trauma from occlusion, BC: Bite collapse, <20 RT: <20 remaining teeth.
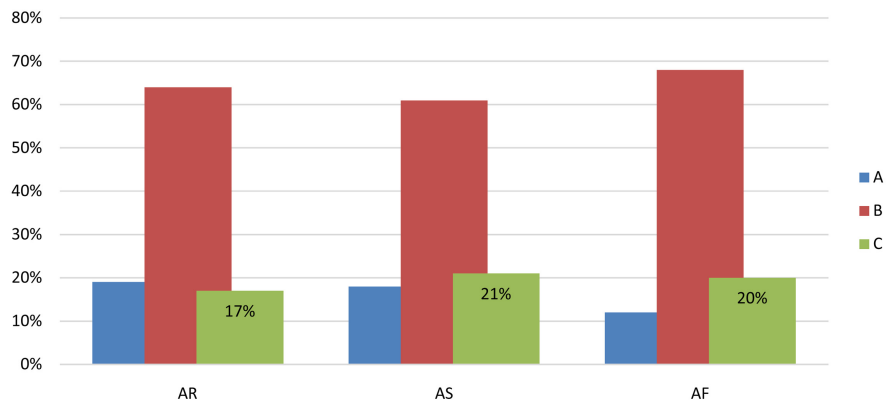
Table 9. Periodontitis progression (grading).

		A (% bone loss/age <0.25) and (Non-smokers and non-diabetic)	B (% bone loss/age 0.25 to 1.0) and (<10 Cs/D or HbA1c <7.0%)	C (% bone loss/age >1.0) and (>10 Cs/D or HbA1c ≥7.0%)
Grade modifiers	AR	19%	64%	17%
	AS	18%	61%	21%
	AF	12%	68%	20%

A: Grade A. B: Grade B. C: Grade C. AR: Arabs. AS Asians. AF: Africans. No. Cs/D: Number of cigarettes per day. % HbA1c: Percentage of Glycosylated hemoglobin.

Figure 7. Periodontitis extent and severity (staging). L: Localized, G: Generalized. I: Stage I. II: stage II, III: Stage III and IV: Stage IV. AR: Arabs. AS: Asians. AF: Africans.

Figure 8. Periodontitis progression (grading). A: Grade A. B: Grade B. C: Grade C. AR: Arabs. AS: Asians. AF: Africans.

planning periodontal therapy. These data comprise the presence of plaque, gingival bleeding, clinical attachment loss, radiographic bone loss, and periodontal pocket formation [32]. Moreover, age, smoking, and other factors associated with socioeconomic status like expatriation [33] [34] [35].

Based on our information, the present study is the first study conducted on selected expatriate population-based samples living in the same area and the same environmental conditions to assess the severity and progression of periodontitis among multi-ethnic patients in Aseer region, Saudi Arabia. This study detected differences in severity and progression of periodontitis among the three ethnic groups, and there were correlations between oral hygiene status and age. Moreover severity, and progression of periodontitis. These findings consistent with many previous studies that have exhibited periodontitis more severe in some ethnic groups [36] [37], and other studies displayed that progression of periodontitis was varying among ethnic groups [35] [38].

The results displayed that 57% of Arabs, 57% of Asians, and 60% of Africans had gingival bleeding more than 30% and that means generalized severe gingivi-

tis in 2017 classification compared to 43% of Arabs, 43% of Asians, and 60% of Africans had localized mild and moderate gingivitis that means gingival bleeding was less than 30%. Regarding grading of gingivitis grade 4, it is more than other grades, but the grading of gingivitis among Arabs is more than Asians and Africans. The present study revealed that most of the participants were suffering from gingivitis with periodontitis. This finding is similar to the study results of Idrees, *et al.* [39]. Moreover, Zhang, *et al.* detected that gingival inflammation affected 97.9% of Chinese adults and 95.7% of American adults [40]. It is well known that there is a closed association between dental plaque and gingivitis, and this demonstrates the association in this study between plaque formation and gingivitis among all participants [41].

In 2017, periodontitis was assessed based on the attachment loss in the interdental area (CAL) at ≥2 mm or as buccal CAL ≥3 mm with >3 mm pocket formation on ≥2 mm teeth [42].

The main objective of the clinical examination was to clarify whether the occurrence and measure of attachment loss varied among the three ethnic groups. The attachment loss was significantly different among the three ethnic groups, but there was an increase in attachment loss in Asians more than Arabs and Africans. The clinical periodontal parameters reflected the severity of periodontitis among the participants in the current study.

In periodontics, radiographic examination supplements the clinical examination, helping to diagnose periodontitis [43]. Several previous studies revealed that the prevalence of horizontal bone loss more than vertical bone loss among the patients of periodontitis. These findings are similar to those found by this study which appeared that the horizontal bone loss among Arabs, Asians, and Africans participants more than vertical bone loss [44] [45] [46].

There was an association between an increase in age and clinical attachment loss. These findings are comparable with Neely *et al.*, who clarified a positive correlation between age and clinical attachment loss [33].

When compared with the previous Libyan study, there were a high percentage of participants who had shallow pockets and deep pockets whereas this study exhibited that most Arabs participants had shallow pockets [47].

In the present study, there was an association between an increased HbA1c level of more than 7% and Clinical attachment loss, the gingival bleeding index where the African participants had HbA1c level of more than 7% moreover clinical attachment loss, gingival bleeding index more than Arabs and Asians participants. These results are consistent with previous studies that revealed that there was a positive correlation between an increase of HbA1c level and clinical attachment loss, gingival bleeding index [48] [49]. Surprisingly, Africans had a higher value of glycosylated hemoglobin than Arabs and Asians, with fewer smokers than the overall study participation. These results indicate that the destruction of periodontal tissues more among Africans than Arabs and Asians, Consequently Africans may have other risk factors linked to this racial/ethnic

group, which need more study.

The current study assessed the association of the presence grade of tooth mobility and other results such as radiographic bone loss, tooth loss due to periodontitis, furcation involvement, secondary occlusal trauma, bite collapse and less than 20 remaining teeth with a specific ethnic group where these periodontal parameters were more among Asians participants more than Arabs and Africans participants. These findings are consistent with an increased plaque control record percentage among Asian participants more than Arabs and African participants. In another previous study, there was a correlation between the degree of tooth mobility, the amount of radiographic alveolar bone loss, and periodontal pocket depth. Similarly, there was an increase in tooth mobility, the amount of radiographic alveolar bone loss, and periodontal pocket depth among Asian participants more than Arabs and African participants [50] [51].

Moreover, there was an increase in these clinical parameters among consumers of ≥10 cigarettes/day (Asian participants) more than other ethnic groups in this study. These results agree with the results of earlier studies that exhibited an increase in tooth mobility and severity of periodontal destruction among smokers more than non-smokers [52] [53].

On the other hand, there was no association between the type of radiographic alveolar bone loss (horizontal or angular). and other clinical parameters of periodontal destruction among the ethnic groups of the current study, where the horizontal bone loss was more among Asian participants whereas the angular was more among Arabs, few studies have examined the relationship between the type of radiographic alveolar bone loss and progression of periodontitis [54].

Borrell et al. detected that African-Americans had periodontitis more severity than other populations in the United States [55]. Consistent with the clinical findings of the current study detected that African participants had higher severity and progression periodontitis than Arabs and Asians. The results of this study exhibited that most Africans and Arabs participants had generalized periodontitis stage III and IV, grade B more than Asians, whereas most Arabs and Asians had localized periodontitis stage I and II, grade A among most Arabs and grade C among most of Asians more than Africans due to most of Asians were heavy cigarette smokers (more than 10cigarettes per day). Furthermore, there was an association between the increase of the progression of periodontitis and an increase of cigarettes smoked per day among the subjects in the current study where the mean age of Asian participants who were with grade (C) periodontitis more than the mean age of Arabs and Africans participants who were with grade (A) and (B) of periodontitis respectively. These clinical findings were in agreement with former studies, which indicated an increase in periodontitis with an increase in age [56] [57]. These clinical findings also corresponding with other clinical and epidemiological studies that exhibited that periodontal disease increases with the greater the number of cigarettes smoked a day [58].

In other previous studies on different ethnic groups, Africans had a higher

severity and progression of periodontitis than other groups [59]. Similarly, in this study, the severity of periodontitis among Africans and Asians is more than Arabs but the complexity of periodontitis severity among Arabs is more than Asians and Africans.

5. Strength and Limitations

The strength and limitation of the present study depend on the racial/ethnic variations of its participants. Moreover, there is very little knowledge about the severity of periodontal diseases of expatriates in Saudi Arabia, compares to each other in this country. This study did not collect any information from participants about the education level, socioeconomic status, oral hygiene measures, and the dental clinics' visit frequency. As there are different origins of expatriates in Saudi Arabia, it is essential that we fully understand the risk factors of periodontal disease among the racial/ethnic groups of the current study to help them and reduce the severity and progression of periodontitis. Additional studies with larger sample sizes are necessary to explain the impact of racial differences on oral health and periodontal disease extent, staging and grading.

6. Conclusion

In conclusion, the present study has reported changes in the severity and progression of periodontal diseases among the three ethnic groups, but the variables that may be associated with ethnicity did not examine such as, education level, economic level, and occupational status. Therefore, the results of this study suggest that these variables may affect the severity and progression of periodontal diseases.

Acknowledgements

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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