

Periodontal Disease Status and Associated Risk Factors in Patients Attending a Tertiary Hospital in Northwest Ethiopia

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Purpose: Information on periodontal disease and its predictors in sub-Saharan Africa is sparse. This study aimed to determine the prevalence of periodontal disease and assess the relationship with associated factors in patients who attended the University of Gondar comprehensive hospital.

Patients and Methods: A hospital-based cross-sectional study was conducted from October 1, 2019, to March 10, 2020, at the University of Gondar comprehensive Hospital. Participants were recruited with a systematic random sampling technique, and interviewed for sociodemographic and medical information through a structured questionnaire. Two examiners evaluated the periodontal status of the study participants using the community periodontal index (CPI).

Results: Four hundred twenty participants were involved in the study. The mean age of the study participants was 29.87 (± 7.76). The majority of the study participants had a habit of tooth brushing (72.1%) and almost half of them did not have a fixed time to brush their teeth. Periodontal change (CPI>0) was noted in 42.4% of the participants and among that 21.7% had shallow pocket (pocket depth of 4–5 mm) and 5.95% had a deep periodontal pocket (≥ 6 mm). The prevalence was higher in 20–34 years (57.3%), females (58.98%), monthly income of <2500 ETB (82.02%), and frequent carbohydrate intakes (65.17%). Age (AOR=9.61, 95% CI: 6.42, 13.04), gender (AOR=2.00, 95% CI: 1.36, 2.97), educational status (AOR=3.25), residency (AOR= 1.66), monthly income (AOR=2.13), oral hygiene habit (AOR=4.85) and systemic disease (AOR=1.96) were significantly associated with periodontitis.

Conclusion: In the present study, 42.4% of the study participants encountered periodontal disease. The study confirmed that various sociodemographic risk factors/indicators are associated with an increased risk of periodontitis.

Keywords: clinical attachment loss, periodontal disease, periodontal pocket, community periodontal index

Background

Periodontal disease is the second common oral health problem next to dental caries and highly prevalent in African populations.¹ The global burden of disease (1990–2010) revealed that periodontal disease as the 6th most prevalent disease in the world with a prevalence of 11.2%.² The prevalence was differed significantly in low (28.7%), lower-middle (10%), upper-middle (42.5%), and high-income countries (43.7%).³ The prevalence was different in East Africa with a prevalence of 89.8% in Egypt,⁴ 63.9% in Sudan,⁵ and 53.4% in Ethiopia.⁶

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Periodontal disease has been associated with poor life-style, low-socioeconomic status, poor access to health care, and health-related risk behaviors (smoking, obesity, alcohol intake, carbohydrate diets, and poor oral hygiene practice) in developing countries.^{7–12} A cross-sectional study in Ethiopia found males were affected by periodontal disease,⁶ and also the prevalence of periodontal disease increases as the age of the participants increases.¹³ The prevalence of severe periodontal diseases was low in sub-Saharan African countries.^{14–16} Gingival bleeding on probing (BOP), calculus deposition, probing depth, and loss of clinical attachment are the indicators of periodontal disease and provide data to diagnose the presence of periodontal disease.¹⁷

The presence of advanced periodontal disease increases the risk of multiple tooth loss, masticatory dysfunction, and edentulous, which affects nutritional habits, quality of life, and self-esteem of the patients.^{18–21} In addition to the orofacial outcomes, advanced periodontal disease has been linked to multiple systemic diseases such as; diabetes mellitus, cardiovascular diseases, adverse pregnancy outcomes, respiratory diseases, renal diseases, and increased risk of malignancies of the head and neck.^{22,23}

Because of the sparsity of data on periodontal disease among patients in Northwest Ethiopia, and the hypothesis that factors such as oral hygiene practice, sociodemographic behavior, and perception of oral health would be determinant factors for periodontal disease in adults. The present study is, aimed to determine the periodontal disease status and its potential determinant factors among a population in Northwest Ethiopia, Ethiopia.

Methods

Setting

A hospital-based cross-sectional study was conducted from October 1, 2019, to March 10, 2020, at the University of Gondar Comprehensive Hospital Dental clinic. The dental clinic is the only available governmental dental center in the area that provides oral health-care services for more than 5 million people in the catchment area. The clinic has both inpatient and outpatient services, and periodontal cases were evaluated and managed in the outpatient department.

Study Participants

The source populations were all residents living in Northwest Ethiopia and those who visited the dental clinic

of the University of Gondar Comprehensive Hospital during the study period would be included in the study.

Exclusion Criteria

A participant with the following condition was excluded from the study; A patient with a dental emergency or critically ill, a Participant refused to sign a consent, a patient on orthodontic treatment, and a patient on periodontal therapy or treated with periodontal disease in the last 6months.

Sampling Technique and Procedure

A sample size of 420 participants was selected using the single population proportion formula.

$$N = \frac{Z^2 p(1 - p) = 1.96^2}{d^2}$$

With the following assumptions, the prevalence of periodontal disease to be (P) 53.4% a study done in Addis Ababa, Ethiopia.⁶ Confidence level (CI) of 95%, marginal error (d=5).

The sample size would be 382 and with a 10% non-response rate, the final sample would be 420.

Sampling Procedure

Systematic random sampling would be used; the first participant was selected using random sampling and the remaining would be every third patient (k=3) until the sample size was reached.

Data Collection

Structured interviews were designed, adopted from the WHO oral health surveys,²⁴ and a face to face interview was conducted with the participants at the dental clinic. The interview questionnaire was developed in English, translated into the local language of Amharic, and back translated into English. Two dental professionals reviewed the questionnaire for its clearness, sensitivity to culture, and the presence of appropriate words. A pilot study was done in 42 patients attending the dental clinic, university of Gondar hospital, before the administration. Qualified two dental surgeons (KD and MT) did data collection. The collected data were sociodemographic, tooth brushing habits, dietary habits, and medical conditions. Moreover, the principal investigator (PI) trained the data collectors for 3 days on how to maintain confidentiality, approach, interview, and research ethics. A day-to-day supervision was made by the PI to check the completeness of the questionnaire.

Intra-Oral Examination

Two dental professionals (AT and BG) carried out all periodontal examinations in the dental clinic of the University of Gondar Hospital Dental Clinic based on the WHO oral health survey guideline²⁴ using CPI periodontal probe, mouth mirror, dental light source, and tissue forceps. Third molars were excluded from scoring due to its delayed eruption. A periodontal examination, for each participant, was performed with subjects seated in the dental chair. The sextant of each tooth was examined using a CPI probe around the whole circumference of the tooth, pocket depths were measured at two sites per tooth (buccal and lingual), and the highest sextant score was recorded. Finally, the participants were categorized based on their CPI results (CPI code: 0 = healthy periodontal tissue; 1 = bleeding on probing; 2=calculus; 3=periodontal pocket (PD) 4–5mm; 4=PD ($\geq$ 6mm)).

Data Analysis

Each questionnaire was checked for completeness and coded before fed into the computer, and entered into Epi-info 7.0 software, and transferred to SPSS version 20 for analysis. Categorical variables were presented using frequencies and percentages. The association between the independent variables and periodontal disease was initially investigated using bivariate analysis and those with a p-value of ≤ 0.2 were included in the multivariable analysis. Results were presented using OR with its 95% CI.

Ethical Consideration

Ethical approval was sought from the University of Gondar ethical review board (IRB) before the commencement of the study (V/P/RCS/05/149/2019). Besides, a study permit was acquired from the University of Gondar Department of Dentistry. Written consent was obtained from each participant.

Results

Sociodemographic data of the study participants are shown in Table 1. Fifty-one percent of the subjects were males, 35.2% were students and 78.1% were urban residents. The mean age of the participants was 29.87 (± 7.76). The majority (78.3%) attended formal education, and 73.1% were from the age group 20 to 34 years.

Table 2 presents the oral hygiene practice and carbohydrate intake habits of the study participants. The majority of the study participants had a habit of tooth brushing

Table 1 The Sociodemographic Characteristics of the Study Participants (n=420)

Characteristics		Number	Percentage
Age (year)	20–34	307	73.1
	35–49	61	14.5
	50–64	52	12.4
Sex	Male	214	51.0
	Female	206	49.0
Marital status	Single	197	46.9
	Married	207	49.3
	Divorced/widowed	16	3.8
Educational status	No formal education	91	21.7
	Has formal education	329	78.3
Occupation	Farmer	64	15.2
	Student	148	35.2
	Government employee	73	17.4
	NGO-employee	9	2.1
	Merchant/personal business	126	30.0
Religion	Orthodox	378	90.0
	Muslim	26	6.2
	Protestant	9	2.1
	Catholic	7	1.7
Residency	Urban	328	78.1
	Rural	92	21.9
Monthly income	<2500 ETB	311	74.0
	$\geq$ 2500 ETB	109	26.0

(72.2%). However, 62.7% had no regular tooth brushing habits. 43.6% of the participants brushed their teeth in the early morning and 81.9% used horizontal stroke to brush their teeth. Only 6.9% of the participants brushed their teeth twice and 43.2% had no fixed time to brush their teeth. In addition, 72.9% of the participants consumed fermentable carbohydrates (See Table 2).

Prevalence of Periodontal Changes and Associated Factors

Periodontal inflammation (CPI>0) was observed in 42.4% of the participants, bleeding on probing (BOP), calculus deposition and shallow and deep pockets were the commonly detected changes. The presence of a shallow pocket was found in 21.7% of the participants, and 5.9% had a deep periodontal pocket (Table 3). The prevalence was higher in 20–34 years (57.3%), females (58.98%), monthly

Table 2 Frequency Distribution of the Associated Factors for Periodontal Disease

Associated Factor		Number	Percentage (%)
Habit of tooth brushing	Yes	303	72.2
	No	117	27.8
Frequency of tooth brush	After every meal	4	1.3
	Twice/day	21	6.9
	Once/day	88	29.1
	Irregular	190	62.7
Time of tooth brush	Before bed	14	4.6
	Morning	132	43.6
	Both in the morning and before bed	26	8.6
	No-fixed time	131	43.2
Way of tooth brushing	Horizontal stroke	248	81.8
	Vertical stroke	33	10.9
	Semi-circular	22	7.3
Habit of carbohydrate intake	Yes	306	72.9
	No	114	27.1
Self-perceived halitosis	Yes	191	45.5
	No	229	54.5

income of <2500 ETB (82.02%), frequent carbohydrate intakes (65.17%), and self-perceived halitosis patients (56.17%) (See Table 4).

Logistic Regression Analysis

Table 4 shows the results of the adjusted analysis. Factors that had a significant association in the bivariate analysis were entered into the multivariate logistic regression model as an independent variable for the outcome of periodontal disease. The analysis found a significant association between periodontal disease and age (AOR=9.61 (6.42, 13.04); $P=0.0000$), gender (AOR=2.00 (1.36, 2.97); $P=0.000$), educational status (AOR=3.25 (2.00, 5.29)), residency (AOR=1.66 (1.04, 2.65)) and poor oral hygiene practice (AOR=4.85 (3.059, 7.69)).

A patient with self-perceived halitosis were 1.64 times at risk of developing periodontal disease (AOR=1.64 (1.11, 2.43); $P=0.012$), and the presence of the systemic disease, has a significant effect on the occurrence of mal-occlusion (AOR=1.96 (1.02, 3.79), $P=0.041$) (See Table 4).

Discussion

The habit of maintaining day to day oral hygiene was found to be significantly correlated with better periodontal health²⁵ and this perception was confirmed in the current study as the number of patients without tooth brushing habit showed more periodontal disease. The presence of periodontal disease is a reality in adult populations and affects the quality of their life.^{18–21} The present study has identified a significant amount (42.38%) of the participants had some form of periodontal inflammation, which corresponds with a study done in Addis Ababa (53.4%),⁶ and Arusi (52%).²⁶ However, this result is low compared with a study done in Egypt (89.8%)⁴ and Sudan (63.9%).⁵

A cross-sectional study done in Sudan among pregnant women revealed that 8.9% of the participants had moderate periodontal disease and 3.0% had a severe periodontal disease, which is supported by the present study where 5.95% had severe periodontal disease. However, the findings of the study were found to be higher in the study done in Brazil (2.9%).²⁷ This difference might be due to the oral health-care system and awareness difference between the two countries.

The present study revealed that 57.30% of periodontal disease was found within the 20–34 years age group and 24.15% in elderly patients. More than two-thirds of elder patients developed a periodontal disease which supports the findings of the previous studies.^{13,28,29} However, age itself does not affect the periodontal condition, rather it is the cumulative effect of untreated disease reflecting the effect of age on disease severity.³⁰ Moreover, females were 2 times at risk of developing periodontal disease than males which is similar to a study in India.³¹ However, a study done in Spain revealed a higher prevalence of periodontal disease among males than females.³² This might be males using more oral hygiene practice compared with females due to the cultural influence in the country and the hormonal changes during pregnancy and lactation increase the incidence of periodontal change.

On analysis of the socioeconomic variables, a statistically significant association was found between low educational level, low social class, and a higher prevalence of periodontal disease. This agrees with previous studies.^{20,27,32,33} Participants who had no formal education were 3.25 times at risk of developing periodontal disease (AOR=3.25, 95% CI: 2.00, 5.29). Moreover, participants with a monthly income of <2500Ethiopian birr were at high risk of developing periodontal disease (AOR=2.13, 95% CI:

Table 3 The Periodontal Status of the Study Participants Based on the Independent Variables

Predisposing Factors/Characteristics		Periodontal Condition				
		Code 0 (Healthy Gum)	Code 1 (BOP)	Code 2 (Calculus Deposition)	Code 3 (4– 5mm)	Code 4 (≥6mm)
Age (year)	20–34	205	27	16	50	9
	35–49	28	6	4	15	8
	50–64	9	9	0	26	8
Sex	Male	141	17	16	32	8
	Female	101	25	4	59	17
Marital status	Single	169	8	12	4	4
	Married	69	30	4	87	17
	Divorced/widowed	4	4	4	4	0
Educational status	No formal education	32	17	4	25	13
	Has formal education	210	25	16	66	12
Residency	Urban	198	25	16	65	24
	Rural	44	17	4	26	1
Monthly income	<2500 ETB	165	30	21	79	16
	≥2500 ETB	77	12	0	12	8
Religion	Orthodox	224	42	20	71	21
	Muslim	14	0	0	8	4
	Protestant	4	0	0	5	0
	Catholic	0	0	0	7	0
Tooth brushing	Yes	207	21	16	51	8
	No	36	21	4	40	16
Frequency of brushing	After every meal	4	0	0	0	0
	Twice/day	11	3	2	0	5
	Once/day	59	8	4	9	8
	Irregularly	110	13	16	43	8
Timing of tooth brushing	Before bed	7	2	1	0	4
	Morning	90	13	12	8	9
	Both in the morning and before bed	17	0	0	9	0
	No fixed time	82	8	8	23	10
Way of tooth brushing	Horizontal stroke	161	21	12	46	8
	Vertical stroke	7	0	6	9	11
	Semi-circular	18	0	2	0	3
Consumption of carbohydrates	Yes	190	25	12	55	24
	No	48	17	8	36	1
Halitosis	Yes	106	16	16	33	20
	No	136	26	4	43	5
Smoking habit	Yes	58	13	8	9	12
	No	184	30	16	78	12
Systemic disease	Yes	23	0	5	4	8
	No	154	21	12	63	12

Table 4 Multivariate Analysis of Variables Associated with Periodontal Disease Among Patients Visited the Dental Clinic of the University of Gondar Comprehensive Hospital, Gondar, Ethiopia

Factor		Periodontitis		AOR (95% CI)	P value
		Yes	No		
Age	20–34	102	205	1	0.0000
	35–49	33	28	4.05 (2.65, 7.01)	
	50–64	43	9	9.61 (6.42, 13.04)	
Sex	Male	73	141	1	0.0004
	Female	105	101	2.00 (1.36, 2.97)	
Educational level	No formal education	59	32	3.25 (2.00, 5.29)	<0.0001
	Has formal education	119	210	1	
Residency	Urban	130	198	1	0.031
	Rural	48	44	1.66 (1.04, 2.65)	
Monthly income	<2500 ETB	146	165	2.13 (1.33, 3.40)	0.001
	≥2500 ETB	32	77	1	
Tooth brushing	Yes	96	207	1	<0.0001
	No	81	36	4.85 (3.059, 7.69)	
Carbohydrate food intake	Yes	116	194	1	0.0005
	No	62	48	2.16 (1.39, 3.36)	
Self-perceived halitosis	Yes	100	106	1.64 (1.11, 2.43)	0.012
	No	78	136	1	
Smoking habit	Yes	43	58	1.01 (0.64, 1.59)	0.52
	No	135	184	1	
Systemic disease	Yes	23	17	1.96 (1.02, 3.79)	0.041
	No	155	225	1	

1.33, 3.40). The present study found a non-significant association between smoking and periodontal disease (OR=1.01, $p=0.52$) which is against a study done in Spain where smokers were twice more likely to develop periodontal disease (OR=2.0).³² The possible reason for the absence of a significant association in the present study included cultural influence on smoking and a small sample of the participants were smokers.

There are literatures that found a significant correlation between halitosis and increases prevalence and depth of periodontal pockets, increased radiographic bone loss, and the presence of periodontal pathogens.^{34,35} In the present study, there was a significant correlation between self-perceived halitosis and periodontal disease. A participant with self-perceived halitosis was 1.65 times more likely to develop periodontal change which corresponds with a study done in Spain, where the unfavorable periodontal condition was higher among those who evaluated their oral health negatively (e.g. Presence of halitosis).²⁷ Similarly, a significant association was found

between periodontal disease and the presence of systemic diseases. A participant who had other systemic disease was 1.96 times more likely to develop periodontal changes which are similar to previous studies.^{36,37}

Limitations of the Study

The present study had some inherent limitations. First, the study focused on patients who attended the dental clinic and we hope it increases the prevalence of the disease. Second, even if some factors worsened the periodontal condition, we only targeted individual-level factors. Hence, further research is recommended to focus on factors such as; service providers, barriers, community water fluoridation, and conduct on large-scale community surveys.

Strengths of the Study

The study used systematic random sampling during sample selection, subsequently, reduces the selection bias. Moreover, the questionnaire was adapted from the WHO

oral health survey 5th edition and the pretest was done in 10% of the total sample size before the actual study.

Conclusion

In the present study, 42.4% of the study participants encountered periodontal disease. The study confirmed that; age, gender, residency, monthly income, and presence of self-perceived halitosis were significant predictors associated with periodontal disease. To reduce the prevalence of periodontal disease and minimize its impact on the community oral health education should be given at the school level and community-based oral health education programs should be designed.

Abbreviations

CI, confidence interval; CPI, community periodontal index; AOR, adjusted odds ratio; PD, pocket depth.

Data Sharing Statement

All the supporting information were included in the main manuscript.

Ethics Approval and Consent to Participate

The study was approved by the institutional review board (IRB) of the University of Gondar and Complied with the Declaration of Helsinki Ethical Principles for Medical Research. Before the commencement of the study, a formal letter was given to the department of Dentistry and written consent was obtained from each study participant after explaining the purpose of the study. All the participants were informed about the confidentiality of their information (IRB number: V/P/RCS/05/149/2019).

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Author Contributions

Both authors made a significant contribution to the work reported, whether that is in the conception, study design, execution, acquisition of data, analysis, and interpretation, or in all these areas; took part in drafting, revising, or critically reviewing the article; gave final approval of the version to be published; have agreed on the journal to

which the article has been submitted; and agree to be accountable for all aspects of the work.

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Disclosure

The authors report no conflicts of interest in this work.

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