Original

Periodontal Disease in Premenopausal and Postmenopausal Nigerian Women: A Comparative Cross-Sectional Study

[1]Kehinde Olubukola Ojo,[2]Patricia Omowunmi Ayanbadejo,[2]Olutola Mary Eweka,[3]Damilola Akinlawon,[4]Tolutope Fasanmi Kolawole,[4]Oluwafunmilayo Adenike Oguntoye,[5]Foluso John Owotade

[1]*Department of Dentistry, College of Medicine and Health Sciences, Afe Babalola University, Ado-Ekiti and Federal Teaching Hospital, Ido-Ekiti, Ekiti-State, Nigeria.*
[2]*Department of Preventive Dentistry, Faculty of Dental Sciences, College of Medicine, University of Lagos, Lagos, Nigeria*
[3]*Department of Community Health and Primary Care, Lagos University Teaching Hospital, Lagos, Nigeria*
[4]*Department of Medicine, Afe Babalola University, Ado Ekiti, Nigeria*
[5]*Department of Oral Medicine and Oral Pathology, Obafemi Awolowo University, Ile Ife, Nigeria.*

Corresponding author: Kehinde Olubukola Ojo, Department of Dentistry, College of Medicine and Health Sciences, Afe Babalola University, Ado – Ekiti and Federal Teaching Hospital, Ido- Ekiti, Ekiti State, Nigeria ojoko@abuad.edu.ng: +2348039758002

Article history: Received 25 August 2025, Reviewed 20 November 2025, Accepted for publication 08 December 2025

Abstract

Background: Periodontitis is a chronic inflammatory disease which results in the destruction of connective tissue, alveolar bone, gingival bleeding, compromised aesthetics, recurrent periodontal infections, tooth mobility and eventual tooth loss. Various female hormonal alterations predispose postmenopausal women to several oral disorders. This study compared periodontal disease in premenopausal and postmenopausal Nigerian women.

Methodology: A cross-sectional analytical study at the Oral diagnosis and Oral medicine clinics in a large tertiary hospital, involving 35 premenopausal and 35 postmenopausal women within the ages of 40 to 60 years using a multistage sampling method. An interviewer-administered questionnaire, and oral examination was used to determine the prevalence of periodontitis in postmenopausal women. All participants were evaluated for periodontitis using Oral Hygiene Index (OHI), Community Periodontal Index for Treatment Needs (CPITN), and severity of periodontitis. Analysis was done using IBM SPSS version 26 software. Chi-square and Fischer's exact tests were used to test the relationship between outcome and independent variables. P-values ≤ 0.05 were statistically significant at a 95% confidence interval.

Results: the mean value of CPITN was statistically higher in postmenopausal women (1.49±1.2) compared with premenopausal women (0.91±0.8). The mean value of OHI was also statistically higher in postmenopausal women (1.49 ±0.9) than premenopausal women (1.07 ±0.8).

Conclusions: Postmenopausal women are more predisposed to periodontal disease compared with premenopausal women, which could be due to low oestrogen levels associated with menopause. Regular dental consultations and good oral hygiene practices are crucial in this population and will significantly influence periodontal health.

Keywords: Periodontal diseases, Postmenopausal, Premenopausal, Oestrogen, Oral hygiene.

How to cite this article

Ojo KO, Ayanbadejo PO, Eweka OM, Akinlawon D, Kolawole TF, Oguntoye OA, Owotade FJ. Periodontal Disease in Premenopausal and Postmenopausal Nigerian Women': A Comparative Cross-Sectional Study. The Nigerian Health Journal 2025; 25(4):1433 – 1443.
https://doi.org/10.71637/tnhj.v25i4.1196

INTRODUCTION

Menopause is the permanent cessation of menstruation due to loss of ovarian follicular function, and usually takes effect in the fifth decade of life in women[1]. Oestrogen and progesterone are responsible for the physiological changes in women at specific phases of their life such as puberty, menstrual, and menopause[2]. Postmenopause is considered as the date of the last menstruation which represents a brief and defined period (an interruption of 12 months)[3]. It is the physiological process in which there is a cessation of normal menstruation occurring usually in women[4].There is oestrogen production deficiency which affects the immune system, thus change making the individual susceptible to the progression of periodontal disease.[5]Oestrogen receptors are found in osteoblasts and fibroblasts of periodontal tissues[6]. These tissues respond to varying levels of hormones in different stages of reproductive life and thus affect the health of the periodontium[6]. Studies suggest that low oestrogen production after menopause is associated with increased production of interleukin 1 (IL-1), IL-6, IL-8, IL-10, tumour necrosis factor alpha, granulocyte colony-stimulating factor, and granulocyte-macrophage colony-stimulating factor, which stimulates mature osteoclasts, modulates bone cell proliferation, and induces resorption of both skeletal and alveolar bone. [5-8]

Women are now recognized as a hardworking, reliable and dependable group in the family setting as well as outside the family. They carry a parenting, sometimes the financial burden and hence the need for them to have optimum health.[9] In view of these, the oral status in Postmenopausal women with majority of them in the older age group than the premenopausal is being considered so that such preventable conditions will not hinder their socioeconomic and quality of life.

Several studies have been done in other parts of the world to compare periodontal disease in pre and postmenopausal women, but none has been carried out in Africa.[10,11,12] The objective of this study was to compare periodontal disease in pre and postmenopausal Nigerian women in a large tertiary hospital in Lagos, Nigeria.

METHODOLOGY

Study area and design: This study was carried out at the Oral Diagnosis and Oral Medicine clinics at the Lagos University Teaching Hospital. This cross-sectional analytical study consisted of 70 women in two study groups; Postmenopausal women: 1) aged 40 to 60 years, 2) cessation of menstruation for more than 12 months and 3) not on any medications were recruited. Meanwhile, premenopausal women: 1) aged 40 to 60 years with regular menstrual period, and 2) not on medications such as oral contraceptives and hormonal implants were included. Only healthy and non-pregnant patients without any confounding systemic diseases (diabetes mellitus, hypertension, hepatitis or HIV infection) and autoimmune conditions such as Crohn's diseases, coeliac diseases, systemic lupus erythematosus, rheumatoid arthritis, amyloidosis, sarcoidosis, women who did not undergo chemotherapy and radiation therapy, and no history of habitual smoking or alcohol consumption were recruited. For both groups, subjects with known salivary gland disorders such as focal infection, fibrosis of the major salivary glands, Mikulicz disease, and patients with dehydration, patients with less than three teeth in each quadrant and those who have received periodontal therapy or taken antibiotics in the preceding 6 months were also excluded.

Sample size determination was based Comparing 2 independent groups – [13]
The minimum sample size was estimated using the formula as follows: [13]

$$n = \frac{(Z_\alpha + Z_\beta)^2 (\sigma_1^2 + \sigma_2^2)}{\delta^2}$$ [13]

Where:
n = minimum sample size
$Z_{\alpha/2}$ = the critical value from the standard normal distribution corresponding to 3.29 at 99% confidence interval
Z_β = the critical value from the standard normal distribution corresponding to the desired power level (1 – β) which is 2.33 at 99% desired power
$\delta = |\mu_1 - \mu_2|$
μ_1 = the mean of the first group = mean clinical attachment level (CAL) of premenopausal women = 3.06[14]
μ_2 = the mean of the second group = mean clinical attachment level (CAL) of postmenopausal women = 4.46[14]
σ_1 = the standard deviation of the first group = 0.84[14]
σ_2 = the standard deviation of the second group = 1.03[14]

Print ISSN: 0189-9287 Online ISSN: 2992-345X

$$n = \frac{(2.58 + 2.33)^2 \quad (0.84^2 + 1.03^2)}{(3.06 - 4.46)^2} \approx 22 \text{ (each group)}$$

Considering the non-response rate of 10%, minimum sample size was:
n= 24 (each group)
The sample size used in this study was 35 women in each group.
Hence 35 premenopausal and 35 postmenopausal women were recruited, making a total of 70 women.

Sampling technique:
Multistage sampling method was used to recruit all registered post and premenopausal women who met inclusion criteria. The sampling consisted of two stages. Stage one involved the use of stratified random sampling to divide the women into strata based on their menopausal state. The size of each stratum was non-proportionally allocated into 35 women for each group. Stage two involved the use of simple random sampling (by balloting) to select eligible participants.

Research Instrument
Data was collected in an interviewer-administered questionnaire by the principal investigator (oral physician) and a periodontologist which was however divided into sections A to E. Section A assessed socio-demographic and socio-economic characteristics, section B oral complaints, C assessed sialometry, oral hygiene habit and dental clinic attendance, while section D assessed periodontal status, oral hygiene status of all the patients, DMFT and this was done within six months from July 2019 to January 2020.

Ethical consideration: this was obtained from the Health Research and Ethics Committee of the Lagos University Teaching Hospital with reference number ADM/DCST/HREC/APP/2000. Written informed consent was obtained from each participant; confidentiality was maintained by using codes for the participants. Participation in the study was voluntary.

Sialometry
All women were subjected to measurement of saliva flow rate using saliva-check buffer by Shenzhen Kang Shengbao biotechnology co ltd China to determine both unstimulated and stimulated saliva production. Saliva collection was done between 8 am and 11 a.m.
Women presented in fasting state or 2 hrs after breakfast and did not brush their teeth for a duration of 45 min prior to saliva collection and denture wearers removed their denture prior to saliva collection.[15]
Whole unstimulated saliva production by draining method; Women were asked to sit upright with head slightly bent down. Saliva secreted through the first minute was swallowed, while that secreted through the next 5 minutes was allowed to drip passively from the lower lip into a calibrated cup and flow rate measured in ml/min.[15]

Stimulated whole saliva production by spitting method; Women were asked to sit upright with head slightly bent down. Saliva secreted through the first minute was swallowed, and then women were asked to chew on a piece of paraffin wax. Saliva secreted through the next 5 minutes of chewing was spat into a calibrated cup every minute and flow rate measured in ml/min. [15]
A diagnosis of hyposalivation was made when the stimulated salivary flow rate was <0.5 ml/min and the unstimulated salivary flow rate was <0.1 ml/min [15].

Clinical examination
Extra and intra-oral examination were carried out in the participants by the principal investigators (Oral physician and Periodontologist) using visual inspection and palpation, with adequate light source from the dental chair and strict adherence to universal precautions with basic sterile examination set consisting of mouth mirror and probes, and instruments for assessing periodontal disease including (CPITN) probes using the Community Periodontal Index of Treatment Needs (CPITN)[16]. It is primarily a screening procedure which requires clinical assessment for the presence or absence of periodontal pockets (destruction of tooth supporting tissues and bone forming a deeper space around the teeth allowing for bacterial accumulation), calculus and gingival bleeding. Use of a special CPITN periodontal probe is recommended (a specially designed light weight probe with 0.5mm ball tip bearing a black band between 3.5- 5.5mm, from the ball tip) for clinical purposes in adult populations, 10 specified index teeth (17, 16, 11, 26, 27, 36, 37, 31, 46, 47) was examined. The patient's mouth was divided into sextants: 14-17, 13-23, 24-27, 34-37, 33-43, 44-47.[16]

The Community Periodontal Index of Treatment Needs score ranged from 0 to 4 was described as follows:[16]

Print ISSN: 0189-9287 Online ISSN: 2992-345X

Community Periodontal Index of Treatment Needs 0 = Absence of condition (no bleeding, no calculus, no pathological pocket), CPITN 1 = Bleeding upon gentle probing (no calculus, no pathological pocket), CPITN 2= presence of supra and/or subgingival calculus or other plaque retentive factors (with or without bleeding, no pathological pocket), CPITN 3 = 4 or 5 mm deep periodontal pockets (with or without bleeding and calculus), CPITN 4 = 6mm or deeper periodontal pocket (with or without bleeding and calculus).[16]

Periodontal management according to the 'Treatment Need' (TN) code is as follows: CPITN-0: TN-0 home care; CPITN-1: TN-1 instructions on proper oral hygiene; CPITN-2, CPITN-3: TN-2 instructions on proper oral hygiene and professional scaling; CPITN-4: TN-3 Complex periodontal treatment.

The prevalence of periodontitis was categorized according to their periodontal status, those with CPITN 0 have healthy gums, those with CPITN 1 or 2 were in the mild periodontal disease group (gingivitis), those with CPITN 3 had moderate periodontitis, whereby those with highest scores of CPITN 4 were in the severe periodontitis group.[16]The process for each patient took about 10 minutes.

The assessment of oral hygiene was done using the Simplified Oral Hygiene Index by Green and Vermillion,[17] and this was performed on all patients.
The scoring method of OHI is based on the combined debris index and calculus index. Each index evaluates the amounts of debris or calculus on the buccal and lingual surfaces of the teeth separately in three segments of each dental arch. The scoring method for evaluating oral hygiene status involves assessing 6 surfaces of six index teeth – four posterior and two anterior teeth. ((buccal surface of 16, labial surface of 11, buccal surface of 26, lingual surface of 36, labial surface of 31, lingual surface of 46). [17]

The amount of debris or calculus is quantified using a 4-point scale (0, 1, 2, 3) with an appropriate score assigned to each surface based on the accumulation level
The scores and criteria for calculus (CI-S) on facial (buccal/labial) or oral (palatal/lingual) surfaces are as follows:[17]
Score 0: No calculus present
Score 1: Supragingival calculus covering no more than one-third of the exposed tooth surface
Score 2: Supragingival calculus covering more than one-third but not more than two-thirds of the exposed tooth surface, or individual flecks of subgingival calculus around the cervical portion of the tooth, or both
Score 3: Supragingival calculus covering more than two-thirds of the exposed tooth surface, or a continuous heavy band of subgingival calculus around the cervical portion of the tooth, or both.
The scores and criteria for oral debris (DI-Score) on facial (buccal/labial) or oral (palatal/lingual) surfaces are as follows: [17]
Score 0: No debris or stains present
Score 1: Soft debris covering no more than one-third of the tooth surface or the presence of extrinsic stains without other debris, regardless of the surface area covered
Score 2: Soft debris covering more than one-third but not more than two-thirds of the exposed tooth surface
Score 3: Soft debris covering more than two-thirds of the exposed tooth surface.

Calculation:
DI-S score = total score/no of surfaces examined
CI-S score = total score/no of surfaces examined
Once the DI-S and CI-S are calculated separately, then they are added together to get the OHI-S score. [17]
Interpretation: For OHI-S score
Good = 0.0 to 1.2, Fair = 1.3 to 3.0, Poor = 3.1 to 6.0[17]

Data entry and analysis
This was done using the IBM SPSS (Statistical Package for Social Sciences) version 26 Software. Chi-square and Fisher's exact tests were used to find the association between categorical variables. Independent student *t*-test was used for mean comparison between two groups. Bivariate analysis was done by cross-tabulation between the independent variables and the outcome variables; the Chi-square and Fischer's exact tests were used to test the relationship between the outcome and independent variables. P-values ≤ 0.05 were statistically significant at a 95% confidence interval.

RESULTS
A total of 70 respondents were involved consisting of 35 premenopausal and 35 post-menopausal women attending the dental clinic of the teaching hospital. Majority of the premenopausal women 30(85.7%) were

Print ISSN: 0189-9287 Online ISSN: 2992-345X

in the age group of 41 to 50 years while majority of the postmenopausal women 24(68.6) were in the age group of 51 to 60 years, and the age difference between both groups was statistically significant ($p < 0.001$). Majority of the premenopausal and postmenopausal women were married 29(82.9%) and 26(74.3%) respectively), attained menarche before 16 years of age 29(82.9%) and 26(74.3%) respectively, had no history of alcohol intake 31(88.6%) and 33(94.3%) respectively, and had no history of tobacco smoking 35(100.0%) and 34(97.1%) respectively. The highest frequency of both premenopausal 16(45.7%) and postmenopausal women 13(37.1%) were businesswomen (Table 1).

The mean CPITN value of premenopausal women was significantly lower (0.91±0.8) than that of the postmenopausal women (1.49±1.2), $p \leq 0.019$. Good oral hygiene index was commonly observed in premenopausal women 23 (65.7%) compared with postmenopausal women 15(42.9%), the mean value of oral hygiene index score (OHI-S) of the premenopausal women was significantly lower (1.07 ±0.8) than that of the postmenopausal women (1.49 ±0.9), $p \leq 0.046$ (Table 2).

Unstimulated sialometry was higher among the premenopausal women (2.75 ± 1.4) than the postmenopausal women (2.07 ± 1.4). Stimulated sialometry was also higher among the premenopausal women 9.46 ± 3.6 than the postmenopausal women (8.03 ± 4.1) (Table 2).

Most of the premenopausal and postmenopausal women had oral complaints 33(94.3%) each. The commonest oral complaints among the pre-menopausal respondents were toothache (60.6%), dysphagia (24.2%), dryness (18.2%), bleeding gums (15.2%) and the commonest oral complaints among the post-menopausal respondents were toothache (69.7%), swelling (27.3%), dysphagia (24.2%), dryness (18.2%), mobile teeth (15.2%), bleeding gums (12.1%) (Figure 1). Majority of the premenopausal women and postmenopausal women utilized toothbrush and toothpaste to clean their teeth (34(97.1%) and 31(88.6%) respectively, however most also cleaned only once daily 22(62.9%) and 19(54.3%) respectively. Majority of both groups also had carious teeth 18(51.4%) and 20(57.1%) respectively and absence of filled teeth 26(74.3%) each. The highest percentage of premenopausal and postmenopausal women used toothpick for cleaning interdental spaces 16(45.7%) and 14(40.0%) respectively and had their last visit to the dentist greater than 24 months ago 11(31.4%) and 12(34.3%) respectively.

A greater percentage of postmenopausal women 13(37.1%) also had mobile teeth, compared to the premenopausal women 4(11.4%) (Table 3). Multivariable analysis on all associated variables with menopause revealed 15-fold odds of women in the age group of 51 to 60 years being postmenopausal compared to those in the age group of 41-50 years (AOR = 15.047, 95% CI = 3.444 – 65.731, $P < 0.001$), and also revealed a significantly increased odds of menopausal women having mobile dentition (AOR = 3.390, 95% CI = 1.199 – 22.159, $p = 0.028$) (Table 4).

Print ISSN: 0189-9287 Online ISSN: 2992-345X

Table 1: Socio-demographic characteristics of respondents.

Variable	Frequency (%) Premenopausal (n = 35)	Postmenopausal (n = 35)	Chi squared(x^2)	p value
Age group (years)				
41 – 50	30(85.7)	11(31.4)	21.253	0.000*
51 – 60	5(14.3)	24(68.6)		
Marital status				
Married	29(82.9)	26(74.3)	0.764	0.382
Not married	9(25.7)	6(17.1)		
Occupation				
Administrative officer	2(5.7)	4(11.4)	2.525	0.909**
Businesswoman	16(45.7)	13(37.1)		
Fashion designer	2(5.7)	2(5.7)		
Health care worker	2(5.7)	4(11.4)		
Teacher	2(5.7)	2(5.7)		
Unemployed/retired	1(2.9)	2(5.7)		
Others	10(28.6)	8(22.9)		
Menarche(years)				
< 16	29(82.9)	26(74.3)	0.764	0.382
≥ 16	6(17.1)	9(25.7)		
Lifetime history of alcohol				
Yes	4(11.4)	2(5.7)	3.026	0.581
No	31(88.6)	33(94.3)		
Lifetime history of smoking				
Yes	0(0)	1(2.9)	1.014	1.000**
No	35(100.0)	34(97.1)		

* Statistically significant, ** fisher's exact

Table 2: Oral health indicators of respondents.

Variable	Frequency (%) Premenopausal (n = 35)	Postmenopausal (n = 35)	Chi squared (x^2)/ Independent t test (t)	p value
Oral complaints				
Yes	33(94.3)	33(94.3)	0.000	1.000**
No	2(5.7)	2(5.7)		
Periodontal status (CPITN)				
0	11(31.4)	6(17.1)		
1	17(48.6)	16(45.7)		
2	6(17.1)	6(17.1)		
3	1(2.9)	4(11.4)		
4	0(0)	3(8.6)		
Mean ± SD	0.91 ± 0.8	1.49 ± 1.2	-2.400	0.019*
Oral Hygiene Index (OHI-S)				
Good	23(65.7)	15(42.9)		
Fair	11(31.4)	18(51.4)		
Poor	1(2.9)	2(5.7)		
Mean ± SD	1.07 ± 0.8	1.49 ± 0.9	-2.034	0.046*
Sialometry (ml/min) Mean ± SD				
Unstimulated	2.75 ± 1.4	2.07 ± 1.4	1.994	0.050

Print ISSN: 0189-9287 Online ISSN: 2992-345X

Variable	Frequency (%) Premenopausal (n = 35)	Postmenopausal (n = 35)	Chi squared (x^2)/ Independent t test (t)	p value
Stimulated	9.46 ± 3.6	8.03 ± 4.1	1.531	0.130

CPITN - Community Periodontal Index of Treatment Needs, OHI-S - Oral Hygiene Index Score, *statistically significant, ** fisher's exact

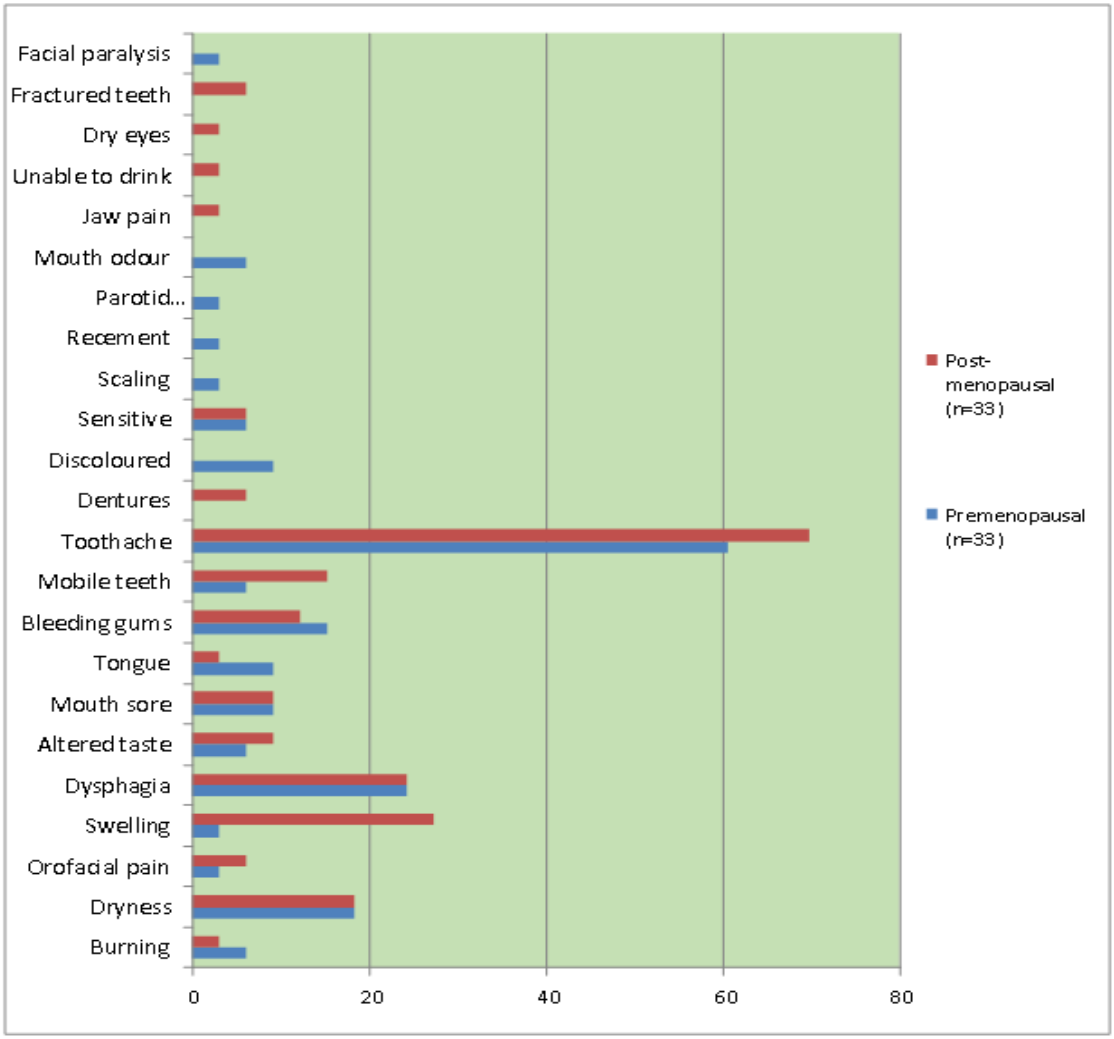

Figure 1: List of Oral complaints of respondents.

Table 3: Oral hygiene habit and examination of respondents

Variable	Frequency (%) Premenopausal (n = 35)	Postmenopausal (n = 35)	Chi squared (x^2)	p value
Tool for cleaning teeth				
Brush and paste	34(97.1)	31(88.6)	2.176	0.421**
Chewing stick	0(0)	2(5.7)		
Both	1(2.9)	2(5.7)		
Frequency of cleaning				
Once daily	22(62.9)	19(54.3)	0.530	0.467

Print ISSN: 0189-9287 Online ISSN: 2992-345X

Twice daily	13(37.1)	16(45.7)		
Tool for cleaning spaces in-between teeth				
Dental floss	11(31.4)	9(25.7)	2.062	0.833**
Toothpick	16(45.7)	14(40.0)		
Broomstick	1(2.9)	1(2.9)		
Nothing	7(20.0)	10(28.6)		
Others	0(0)	1(100.0)		
Last dentist visit				
<6months	8(22.9)	3(8.6)	4.414	0.361**
6 – 12months	5(14.3)	8(22.9)		
12 – 24 months	2(5.7)	5(14.3)		
>24months	11(31.4)	12(34.3)		
Never	9(25.7)	7(20.0)		
Carious teeth				
Present	18(51.4)	20(57.1)	0.230	0.631
Absent	17(48.6)	15(42.9)		
Mobile teeth				
Present	4(11.4)	13(37.1)	6.293	0.024* **
Absent	31(88.6)	22(62.9)		
Filled teeth				
Present	9(25.7)	9(25.7)	0.000	1.000
Absent	26(74.3)	26(74.3)		

*Statistically significant, ** fisher's exact

Table 4: Logistic regression analysis of associated parameters and menopause

Variable	Adjusted Odds Ratio	95% CI	p value
Age group (years)			
41 – 50	Reference (1.0)		
51 – 60	15.047	(3.444 – 65.731)	0.000*
Periodontal status			
0	Reference (1.0)		
1	0.997	(0.163 – 6.097)	0.993
2	1.134	(0.138 – 9.299)	0.834
≥ 3	1.631	(0.087 – 30.648)	0.834
Oral Hygiene Index			
Good	Reference (1.0)		
Fair	2.009	(0.474 – 8.509)	0.343
Poor	1.783	(0.084 – 37.961)	0.711
Mobile teeth			
Present	3.390	(0.686 – 16.757)	0.134
Absent	Reference (1.0)		

CI- Confidence Interval, *Statistically significant

Print ISSN: 0189-9287 Online ISSN: 2992-345X

DISCUSSION

The aim of this study was to compare periodontal diseases in the premenopausal and postmenopausal Nigerian women. Postmenopause is considered as the date of the last menstruation which represents a brief and defined period (an interruption of 12 months)[3]. This leads to reduced ovarian activities causing deficiency of oestrogen production with certain hormonal variations, which will bring about many menopausal symptoms which include; reduced salivary flow, altered taste, burning mouth, oral mucosal disorder, periodontal diseases and tooth loss[2].

Fluctuations in oestrogen levels affect the immune system and thus makes the individual susceptible to the progression of periodontal disease. Due to oestrogen deficiency at menopause, the anti-inflammatory action of this hormone on the periodontium is ceased and the periodontium may get compromised, however these hormonal changes may not affect every woman as factors like genetics and prior dental care mitigate oral health problems.[18]

Our study compared periodontal disease status in premenopausal and postmenopausal Nigerian women and showed the mean value of CPITN (which are measures of gingival health and probing depth of the attachment area in the periodontium) for postmenopausal women was significantly higher 1.49±1.2 compared to the premenopausal women 0.91±0.8. The mean value of OHI-S was also significantly higher (1.49 ±0.9) in postmenopausal women when compared to premenopausal women (1.08 ±0.8).

These findings suggest that the postmenopausal women have poorer oral hygiene, higher pocket depth and susceptible to periodontal disease, which will require higher treatment needs compared to the premenopausal women. This can be attributed to the poor oral hygiene habit, reduced frequency of cleaning, reduced tools for cleaning spaces in-between teeth and irregular dental visit which was significantly lower in postmenopausal women compared to the premenopausal women as recorded in our study. These are reasons why the result revealed a significantly increased odds of menopausal women having mobile dentition.

Oestrogen receptors are expressed in the periodontium and mucosa of the oral cavity, thereby affecting cellular proliferation, differentiation, and keratinization of the gingival epithelium thereby facilitating longer retention of plaque.[19] During menopause, the gingival epithelium becomes thinner, atrophic and more prone to inflammatory changes, also interfering with satisfactory oral hygiene with other periodontal tissues (gingival and periodontal ligament). Although bacteria are initiators in the process, it is the host's immune response to the bacterial infection that is majorly responsible for most of the periodontal destruction[19]hence environmental circumstances can alter a patient's health in developing periodontal diseases. Periodontal disease that is plaque-induced appears to be enhanced or aggravated following menopause[19-22]. The presence of bacteria in plaque touching the gingival tissues produce various compounds like hydrogen sulphide (H_2S), ammonia (NH_3), amines, endotoxins, enzymes (such as collagenases) and antigens; these compounds penetrate the gingiva and elicit an inflammatory response. The inflammatory response though protective is responsible for the loss of periodontal supporting tissue which leads to the formation of periodontal pockets, tooth mobility and eventual tooth loss[23]. During the early stages of periodontal disease, there is an increase in the vascular permeability and migration of immune cells (mainly neutrophils) to the site of infection. With disease progression, lymphocytes and macrophages migrate to the affected site. If the condition remains untreated, destruction of the connective tissues and bone occurs and the junctional epithelium migrates apically along the root surface of the tooth to form the periodontal pocket; at this point, plasma cells and lymphocytes become predominant[24].

Studies have also confirmed that oestrogen deficiency results in upregulating immune cells and osteoclasts which are liable to produce more bone-resorbing cytokines such as interleukin (IL)-1, (IL)-6, and tumor necrosis factor (TNF) 1 and 2, IL-1 and TNF are well known for bone resorption and inhibition of bone formation. Deficiency of oestrogen is one of the major reasons for osteoporosis or low systemic bone mineral density in females during menopause and this reduced bone mineral density could possibly contribute to the progression of periodontal disease with resultant alveolar bone loss, which is the most significant sign in the pathogenesis of periodontal diseases.[24]

The result of our study is in line with Agrawal et al[11], Varghese et al[10], and Prasanna et al[12], which reported a

Print ISSN: 0189-9287 Online ISSN: 2992-345X

highly statistically significant difference in all the parameters between their two groups with postmenopausal women presenting poorer periodontal status than premenopausal women.

Our study revealed that significant difference in salivation was seen for unstimulated saliva in premenopausal women with mean ± SD of 2.75 ± 1.4 compared to 2.07 ± 1.4 in postmenopausal women and 5(14.3%) of postmenopausal women had more hyposalivation compared to 2(5.7%) premenopausal women. This implies that premenopausal women produce more saliva than the postmenopausal women who often present with dry mouth and discomfort, hyposalivation is one of the most common complications in menopause which affects quality of life.[24]

Oestrogen receptors have been identified in the oral mucosa and salivary glands which have effect on the flow rate directly through neural mechanisms depending on the level of oestrogen.[25] Menopause could affect oral mucosa and other body systems, but the exact mechanism of these changes caused by oestrogen is unknown. However, relief of discomfort with hormone replacement therapy can be an indication of possible mechanism of action against xerostomia.[25]

The result of our study is in line with similar studies done by Hosseinimehvar[26], Shirzaiy[27], Foglio Bonda[28], and Poudel[29] which indicated the average unstimulated salivary flow rates in premenopausal women higher than those in postmenopausal women ($P<0.001$). This suggests that the reduction in salivary flow causes abnormalities in salivary quantities and/or qualities resulting in loss of the antibacterial properties of saliva with an increased risk of oral conditions such as xerostomia, caries**,** and may accelerate infections and aggravate periodontal diseases[30]. Dryness of the mouth can interfere with basic daily functions such as chewing, swallowing, and speaking, therefore prevention of this condition is very important.[30] Considering these results, we can conclude that the influence of hyposalivation caused by menopause, coupled indirectly with poor innate cleansing seen in these postmenopausal women predisposed them to periodontal infection.

Study Limitation

The limitation of this study was the small sample size which may just provide limited information. A longitudinal study using larger sample size might provide a precise representation. Furthermore, identification of inflammatory makers would be more specific.

CONCLUSION

Within the limitations of this study, postmenopausal women are more prone to periodontal disease when compared to premenopausal women. This study will thereby help to create awareness among postmenopausal women to go for a routine dental visit before progression to an active periodontal disease, we therefore infer that the influence of sex hormones can be minimized with good plaque control and hormone replacement therapy. Prevention and early management of oral disorders is priority in women's health.

REFERENCES

1. Monteleone p, Ascagni G, Giannini A, Genazzani AR, Simoncini T. Symptom of Menopause- Global prevalence, Physiology and Implications. *Nat RevEndocrinol.* 2018; 14:199-215
2. Singh B, Kaur K, Narang RS, Singh S, Kaur P. Oral Dryness in postmenopausal women: Hormone Inpact. *J Gerontol Geriatr Res*. 2016;5:4. doi:10.4172/2167-7182.1000325
3. ZangL. Research progress on the relationship between Postmenopausal Osteoporosis and Periodontal diseases in women. *Clin Med.* 2020;40(7).122-124 doi: 10.19528/j.issn.1003-3548.2020.07.049
4. Divya P, Bharat K, Rushabh D, Jitender S, Prerna T, Deepika V. Evaluation of the effect of menopause on saliva and dental health. *International Journal of Oral Health Dentistry*. 2016;2(2):71-6. doi:10.5958/2395-499X.2016.00012.5
5. Qi J, Guo Y-F. Association between Periodontal disease and Osteoporosis in Postmenopausal women: a protocol for systemic review and meta-analysis. *BMJ Open* 2021;11: e049277. doi: 10.1136/bmjopen-2021-049277
6. Labunet A, Objelean A, Kui L, Vigu A, Sava S. Oral manifestations in menopause-A scoping Review.*Medicinas*.2025;61(65):837 doi:10.3390/medicina61050837
7. Goyal L, Goyal N.D, Gupta. Osteoporosis and periodontitis in postmenopausal women: a systematic review. *J Mid-life Health*.2017: 8(4)151 doi: 10.4203/jmh.jmh_55_17
8. Dhayanithi J, Rajadekar A. A Comparison of Alveolar bone level around Osseointegrated Dental Implant among premenopausal and Postmenopausal Women: A 2 Year Study. *J. Long*

Print ISSN: 0189-9287 Online ISSN: 2992-345X

Term. Eff. Med. Implant 2024;34,89-92. doi:10.1615/JLongTermEffMedIplants.2023047432
9. Goodwin PY, Garrett DA, Galal O. Women and Family Health: The Role of Mothers in Promoting Family and Child Health. *International Journal of Global Health and Health*. 2005;4(1):30-42. Available at : https://scholarworks.uni.edu/ijghhd/vol4/iss1/4
10. Varghese T, Madhumala R, Saranyan R, Varghese A. Evaluation of periodontal status among premenopausal and postmenopausal women- A comparative study. *Annals of International Medical and Dental Research*. 2016;2(6):46. doi:10.21276/aimdr.2016.2.6.DE10
11 Agrawal R, Ahmed H, Soorgani N, Naik L, Reddy S, Medabalmi M. Assessment of Periodontal Status in Pre- and Postmenopausal Women with Chronic Periodontitis: A Cross-Sectional Study. *J Pharm Bioallied Sci* 2021:S997–S9. doi:10.4103/jpbs.jpbs_145_21 11
12. Prasanna JS, Sumadhura C, Karunakar P. A comparative analysis of pre and postmenopausal females with periodontitis and its response to a non invasive clinical approach. *J Menopausal Med*. 2017;23(3):202-9. doi:10.6118/jmm.2017;23.3.202
13. Taylor DW. The calculation of sample size and power in the planning of experiments. *McMaster University*. 2003.
14. Muneshwar S S, Ashwinirani S R, Gole A A, Suragimath G. Oral Manifestation in Postmenopausal Women of Maharashtra, Western Region. *J,Mid-life Health*. 2023,14:28-33 doi: 10.4103/jmh.jmh_194_22
15. Lee JM, Garon E, Wong DT. Salivary diagnostics. *Orthodontics & Craniofacial Research*.2009 12(3):206-11. doi:10.1111/j.1601-6343.2009.01454.x
16. Cutress TW, Ainamo J, Sardo-Infirri J. The community periodontal index of treatment needs (CPITN) procedure for population groups and individuals. *Int Dent J*. Dec1987 37(4):222–33. PMID: 3481626
17 Greene, Vermillion. Simplified Oral Hygiene Index. *J Am Dent Assoc*. 1964;68:7-13. doi:10.14219/jada.archive.1964.0034
18. Mascarenhas P, Gapski R, Al-Shammari K, Wang H. Influence of sex hormones on the periodontium. *J Clin Periodontol*. 2003;30:671–81. doi:10.1034/j.1600-051X.2003.00055.x
19. Mishra R, Haider K, Rizwan R, Monga S, PritamA, Singh P. Assessment of effect of Menopause on Saliva and Oral Halth Status.J Pharm Bioallied SCI. 2021; 13(Suppl 2),S1535-S1537 doi: 10.4103/jpbs.jpbs_276_21
20. Crandall C J,Mehta J M, Manson J E. Management of Menopausal Symptoms: A Review. *JAMA* 2023; 329, 405-420.doi:10.1001/jama.2022.24140
21. Pavithra J, Ramesh A,Thomas B, Kumari N S,Sharmila K P. Salvary Calprotection Levels and Bone Mineral Density in Postmenopausal Women with and without Chronic Periodontitis- An Evaluation Study. *Indian J.Dent.Res*.2024;35,140-144 doi:10.4103/ijdr.ijdr_522-21
22. Mutneja P, Dhawan P, Raina A, Sharma G. Menopause and the oral cavity. *Indian J Endocrinol Metab*. 2012;16:548 51. doi:10.4103/2230-8210.98007
23. Menopause. World Health Organisation. 2025. Available online: https://www.who.int/news room/fact-sheets/detail/menopause
24. World Health Organisation. Periodontal Country Profiles.*WHO* 2005.
25. Pavithra J, Ramesh A, Thomas B, Kumari N S, Sharmila K P. Salvary Calprotection Levels and Bone Mineral Density in Postmenopausal Women with and without Chronic Periodontitis- An Evaluation Study. *Indian J.Dent.Res*.2024;35,140-144 doi: 10.4103/ijdr.ijdr_522-21
26. Hosseinimehvar B, Alaee A, Azizi A, Shafizadeh N. Risk of hyposalivation in menopausal patients. *Journal of Research in Dental and Maxillofacial Sciences*. 2017;2(3):16-21. http://jrdms.dentaliau.ac.ir/article-1-162-en.html
27. Shirzaiy M. Comparison of unstimulated salivary flow rate and oral symptoms between premenopausal and postmenopausal women. *J of Inflammatory Diseases. Qazvin Univ Med Sci*. 2015;19(2):39-45. Dis.19(2):e155898
28. Foglio-Bonda P L, Rocchetti V, Nardella A, Fantinato M, Sandhu K, Foglio-Bonda A. Salivary pH and flow rate in menopausal women. *Eur Rev Med Pharmacol Sci.* 2019; 23:918-22
29. Poudel K, Poudel R, Nair GR, Gaur, A. Evaluation of Unstimulated Salivary Flow Rate and Oral Symptoms in Menopausal Women- A Clinical Study in Healthy Subjects. *J of India Academy of Oral Medicine and Radiology* 2023;35 9(2):202. doi:10.4103/jiaomr_75_23
30. Crandall C J,Mehta J M, Manson J E. Management of Menopausal Symptoms: A Review. *JAMA* 2023; 329, 405-420.doi:10.1001/jama.2022.24140

Print ISSN: 0189-9287 Online ISSN: 2992-345X