

The Prevalence and Severity of Periodontal Diseases and Its Impact on Preterm Birth Among Pregnant Women Attending the Antenatal Clinics in Ile-Ife

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ABSTRACT

Objective: To determine the prevalence and severity of periodontal diseases among pregnant women and its impact on the prevalence of preterm births in Ile-Ife, Nigeria.

Methods: This was a cross sectional study of two hundred and fifty-eight (258) pregnant women recruited from the antenatal clinic of Obafemi Awolowo University Teaching Hospitals Complex (OAUTHC) between 15th to 28th weeks gestational age. The women were followed up until after delivery. Interviewer-administered questionnaires and secondary data sources (Case notes) were used for data collection. Previous pregnancy history, medical conditions, and present pregnancy history and status of the baby at birth were collected from the case notes. Oral examination was done on the dental chair with good lighting and the periodontal health of the pregnant women was rated using the Gingival index and Community Periodontal Index. Oral hygiene motivation was done for all. Non-surgical intervention was carried out on those with poor oral hygiene. Statistical significance was set at $p < 0.05$

Results: The prevalence of gingivitis was 97.6% while it was 2.4% for periodontitis. The prevalence of periodontitis among pregnant women was lower (2.4%) in comparison with previous data from same environment, and so was the prevalence of preterm birth (6.7%). The majority of the women had mild gingivitis while only 3 had severe gingivitis based on gingival index. Furthermore only (2.4%) had moderate periodontitis (pocket depth 4-5mm) while none had severe periodontitis (pocket depth ≥ 6 mm). The severity of the periodontal diseases was not influenced by frequency of brushing, educational attainment, parity and gravida ($P > 0.05$). Binary logistic regression showed that the severity of gingivitis is not a predictor of preterm birth in this population.

Conclusion: The prevalence of gingivitis was high although the majority of the pregnant women exhibited mild gingival inflammation with no deep periodontal pocket. The prevalence of preterm birth in Ile-Ife was low compared to other South Western Nigerian populations and its previous reports from Ile-Ife.

Keywords: Prevalence, Severity, Periodontal diseases, pregnant women

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CLINICAL IMPLICATIONS

Preterm birth is a poorly understood global scourge, which disproportionately affects blacks-especially Nigerians. Theories abound in number, complexity and disagreements as to the etiological factors responsible for preterm birth. Plausible explanations also abound regarding periodontitis-preterm links. It was therefore necessary to investigate this phenomenon in our environment with a view to proffering simple preventive measures.

INTRODUCTION

Periodontal diseases are a group of conditions that cause inflammation and destruction to the supporting structures of the teeth.¹ They can be broadly classified into gingivitis – which could be plaque-induced or non-plaque-induced – and periodontitis. American Association of Periodontology (AAP) and European Federation of Periodontology (EFP) recently re-classified periodontitis based on a multidimensional staging and grading system that could be adapted over time as new evidence emerges.²

Gingivitis, the commonest form of periodontal diseases, can be defined as the inflammation of the gingiva without the destruction of the tooth-supporting tissues.³ It is characterized by hyperemia, swelling, loss of stippling and bleeding. The hallmark of gingivitis is bleeding on probing or spontaneous bleeding³ and it affects 50% to 90% of adults⁴ and 50% to 100% of dentate patients worldwide.⁵ Studies from Europe (specifically, Italy) showed a prevalence of 99% for gingivitis.⁶ In the United States of America, a prevalence of 95.7% was reported in adults aged 18 to 90 years⁷ while a randomized clinical study in the same country reported a prevalence of 56% to 94% among twins aged 13 to 22 years.⁸ In Saudi Arabia, the prevalence of gingivitis was 100% among adults aged 18 to 40 years old⁹ whereas it was 97.9% in China.¹⁰ The prevalence of gingivitis is also high in Africa and surprisingly among children.¹¹ A prevalence of 26.7% was documented in northwest Cameroon among school children aged 12 to 13 years.¹² There is the paucity of information on the prevalence of gingivitis among Nigerian adult population. One of the few published studies reported a prevalence of 75.4% among Nigerian male population.¹³ Another study documented that the prevalence of gingivitis is higher among pregnant women and it ranged from 35% to 100%.^{14,15}

Periodontitis is defined as an inflammatory disease of the supporting tissues of the teeth, caused by

groups of specific microorganisms leading to progressive attachment loss and eventual bone loss.¹⁶ Periodontitis, formerly known as chronic periodontitis, is the most common type.² Mild to moderate periodontitis affects the majority of adults¹⁷ while the severe form of periodontitis affects 5-20% of adults in Africa.¹¹ The prevalence of chronic periodontitis is known to be quite high in Nigeria, with more than 70% of the adult population in Nigeria having chronic periodontal diseases.^{18, 19} Chronic periodontitis was documented in 73.9% of elderly patients in Ile-Ife, and it was reported to be associated with age but not gender.²⁰ Additionally, adult periodontal infection (chronic periodontitis) may affect 40% of women of reproductive age.²¹ The prevalence of periodontitis was low among pregnant women in Lagos, Nigeria.²² Also, it was said to be uncommon among pregnant women in Nepal because of their young age group.²³ However, a report from Mali found the prevalence of periodontitis to be 47% among pregnant women.²⁴ Bacterial plaque remains the primary etiological factor in addition to other predisposing factors such as calculus, faulty restorations, complications of orthodontic therapy, self-inflicted injuries, tobacco and others^{4,5} which can include systemic or environmental factors that may modify the host's response to plaque accumulation. An example of such a systemic factor is pregnancy.¹⁵ Hormonal changes in women increase the likelihood of developing or making an existing periodontal disease worse.²⁵ Females may experience gingival inflammation before menstruation and during ovulation due to a high level of progesterone which blocks the repair of collagen fibers and causes the dilation of blood vessels.²⁶ Also, pregnant women often exhibit gingivitis and sometimes localized growth of gingival tissues.^{27,28} Usually, these inflammatory changes disappear within few months after delivery without causing permanent damage to the periodontal tissues.²⁸

The implications of these periodontal diseases among pregnant women have been widely studied. Recently there is evidence of the effect of periodontal diseases on pregnancy outcome. Several studies, Soroye et al and others^{22,29} have shown increase in the incidence of preterm birth among pregnant women with periodontal diseases compared to those with mild to moderate periodontal disease. It was suggested that the inflammation caused by the periodontal diseases leads to the activation of active matrix

metalloproteinase 8 (aMMP8) which is a known collagenase and responsible for the rupture of the amniotic membrane.³⁰ Active MMP8 rises steadily during pregnancy and reaches its peak around 9 months gestational age at which stage it stimulates uterine contraction and labor.^{30, 31} However, when the level of aMMP8 rises to the peak earlier during pregnancy as a result of contributions from periodontal infection, premature labor is instituted and preterm birth ensues.³²

In the light of high rate of preterm birth in Nigeria, it is important to determine if the prevalence and severity of periodontal diseases is associated with preterm birth among pregnant women in Nigeria with a view to educate the policy makers on the potential dangers of such diseases on pregnancy outcomes and to device ways of minimizing the impact of such diseases.

MATERIALS AND METHODS

This was a cross sectional study of pregnant women. Two hundred and fifty-eight (258) women were recruited from the antenatal clinics of Obafemi Awolowo University Teaching Hospitals Complex (OAUTHC). Interviewer-administered questionnaire and secondary data sources (Case notes) were used for data collection. Previous pregnancy history, medical conditions, and present pregnancy history and status of the baby at birth were collected from the case notes. The oral examination was done on the dental chair with good lightning. The oral hygiene of the pregnant women was rated using the Gingival index and Community Periodontal Index. Gingival index, developed by H. Loe and J. Silness in 1963 was used to assess the severity of gingivitis by examining the qualitative changes of the gingival The index teeth and the sextants were as follows:

7 6	1	6 7
7 6	1	6 7

The CPI scores, as measured by the probing depths, are

CPI 0 - no bleeding on probing (BOP), no periodontal pocket depth; healthy

CPI 1 - gingival BOP;

CPI 2 - the presence of supra/sub-gingival calculus;

CPI 3 - moderate periodontitis (probing pocket depth of 3.5-5.5mm); and

CPI 4 - the presence of severe periodontitis (probing pocket depth of 6mm or greater).

The CPI score per individual is the worst score per sextant.

soft tissues.³³ Four surfaces: buccal, lingual, mesial and distal surfaces of six teeth were examined.

4 2 | 6

6 | 2 4

The scores given are:

0 - means no inflammation;

1 - mild inflammation – slight color change and texture;

2 - moderate inflammation – moderate redness, edema, bleeding on probing; and

3 - severe inflammation – marked redness, edema and bleeds spontaneously.

The four scores on a tooth were added and divided by four to give a score for a tooth. Afterward, all the scores for the teeth were added and divided by the score of teeth examined to get the gingival score.

The score ratings are:

0.0 = Excellent

0.1-1.0 = Good

1.1-2.0 = Fair

2.1-3.0 = Poor.

The Community Periodontal Index was used to assess the oral health status and the periodontal condition of the pregnant women.³⁴

The examination was done with the use of the CPI Probe Clinical (C). Ten index teeth were examined in adults and six teeth in persons who were 20 years and below. The probe was “walked” around the selected tooth on six points – mesiobuccally, midbuccal, distobuccal, mesiolingual, midlingual and distobuccal. ³⁴The whole mouth was divided into sextants with a sextant containing two or more teeth. If only one tooth or no tooth was present in the sextant, that sextant was included in the adjacent sextant.

After oral examination, the pregnant women with poor oral hygiene had non-surgical intervention comprising of scaling and polishing and/or root planing done. Ultrasonic instruments or hand scalers and curettes depending on their preference were used for scaling. Sterile curettes were used for subjects whose probing pocket depth was ≥4mm. Polishing of the teeth was done using brush/rubber cup with prophylactic polishing paste. All the women were followed up until birth and the status of their baby at birth was documented as full term or preterm

The data analysis was done using IBM SPSS Version 23.0. Descriptive statistics were used to characterize the socio-demographic variables such as age, sex, marital status, and occupation. For categorical variables, simple frequency and percentages were determined and associations were tested using Chi-square. For continuous variables such as age and pocket depth, the mean, standard deviation and range were determined. A previously reported prevalence of preterm birth in Ile-Ife was documented. Also, the prevalence of preterm births and prevalence of periodontal diseases in Lagos, Ilorin was collected from published data and compared with Ife data. Level of significance was set

at $p < 0.05$.

RESULTS

A total of 258 pregnant women with a mean age of 29.63 (SD = 3.73) years that met the inclusion criteria were recruited for the study. The periodontal status of the pregnant women was assessed using GI and CPI.

The total prevalence of plaque-induced periodontal diseases among the subjects was 100% with a prevalence of 97.6 % for gingivitis and 2.4% for periodontitis (Stage 1, Grade A) (Table 1). Seventy one percent of the pregnant women had mild gingivitis while only 3 had severe gingivitis (Table 2).

Table 1: Prevalence of Periodontal diseases as measured by CPI

Severity	Frequency	%
CPI 0	12	4.7
CPI 1	22	8.5
CPI 2	218	84.5
CPI 3	6	2.4
Total	258	100.0

Table 2: Prevalence of periodontal diseases according to GI

Gingival index	Frequency	%
Mild	184	71.2
Moderate	71	27.5
Severe	3	1.3
Total	258	100

There was no significant influence of the levels of education, gravida, parity and frequency of brushing on the prevalence and severity of periodontal

diseases among the pregnant women in the study (Tables 3, 4, 5 and 6).

Table 3: Influence of Level of educational attainment on periodontal disease as measured by GI and CPI

Educational Level	GI				CPI			
	Mild	Moderate	Severe	Total	0	1 & 2	3	Total
Primary	6	0	0	6	0	6	0	6
Secondary	69	37	1	107	2	105	0	107
Tertiary	109	34	2	145	10	129	6	145
Total	184	71	3	258	12	240	6	258

* Likelihood Ratio = 4.477, $P = 0.345$

* Likelihood Ratio = 9.348, $p = 0.155$

The severity of the periodontal diseases was not influenced by frequency of brushing, educational attainment, parity and gravida ($P > 0.05$). Binary

Logistic regression showed that the severity of gingivitis is not a predictor of preterm birth.

Table 4: Influence of gravida on periodontal status as measured by GI and CPI

Gravida	GI recode				CPI			Total
	Mild	Moderate	Severe	Total	0	1 / 2	3	
1.00	58	14	1	73	5	67	1	73
2.00	54	20	1	75	4	71	0	75
3.00	52	20	0	72	3	64	5	72
4.00	19	11	1	31	0	31	0	31
5.00	1	2	0	3	0	3	0	3
6.00	0	4	0	4	0	4	0	4
Total	184	71	3	258	12	240	6	258

Likelihood Ratio = 14.392, p=0.156

Likelihood Ratio = 7.916, p=0.442

Table 5: Influence of parity on periodontal status as measured by GI and CPI

Parity	GI				CPI			Total
	Mild	Moderate	Severe	Total	0	1 / 2	3	
.00	82	19	2	103	7	94	2	103
1.00	49	26	0	75	4	70	1	75
2.00	43	17	1	61	1	59	1	61
3.00	8	1	0	9	0	9	0	9
>3.00	2	8	0	10	0	8	2	10
Total	184	71	3	258	12	240	6	258

Likelihood Ratio = 7.916, p=0.442

Likelihood Ratio = 8.937, p=0.708

Table 6: Influence of frequency of brushing on periodontal status as measured by GI and CPI

Frequency of tooth brushing	GI				CPI			
	Mild	Moderate	Severe	Total	0	1 / 2	3	Total
Once	136	52	2	190	8	178	4	190
Twice	47	19	1	67	4	61	2	67
Thrice	1	0	0	1	0	1	0	1
Total	184	71	3	258	12	240	6	258

Likelihood Ratio = 0.820, p=0.936

Likelihood Ratio = 6.768, p=0.661

Binary logistic regression showed that severity of periodontal diseases (gingivitis and Periodontitis) are not predictors of preterm birth in this study.

Table 8 shows a general trend of high prevalence of preterm birth in previous studies conducted in Nigeria. Only two studies attempted to link prevalence of periodontal diseases with prevalence

of preterm birth. The prevalence of preterm birth in this study is low (6.7%). It is also noted that the prevalence of periodontitis is low among this study sample. Whereas the prevalence of periodontal disease in Soroye's study is high with a prevalence of preterm birth as well.

Table 7: Binary logistic regression of severity of Periodontal disease and Preterm birth

GI	B	S.E.	Sig.
Mild Gingivitis	19.175	28420.268	1.00
Moderate	19.817	28420.268	1.00
Constant	-21.203	28420.268	1.00
CPI			
0	-20.10	16408.71	1.00
1 / 2	-0.29	1.40	0.84
3	-0.67	1.18	0.57
Constant	-1.10	1.16	0.34

Table 8: Prevalence, severity of Periodontal diseases Vis-a-Vis prevalence of preterm birth

Study	Periodontitis: Prevalence %	Periodontitis: Severity	Gingivitis: Prevalence %	Gingivitis: Severity	Prevalence of preterm birth %
Present study	2.4	Few moderate No severe	100	Mostly mild	6.7
Soroye et al ²²	19.4	Moderate Severe	No information	No information	12.5
(Mukuolu et al) ³⁵	No information	No information	No information	No information	11.8
Butali et al) ³⁶	No information	No information	No information	No information	16.8
Onwuanaku et al ³⁷	No information	No information	No information	No information	31.3
Ifesanya et al ³⁸	No information	Only gingival condition reported	100	Mostly moderate	No information
Oluwafemi et al ³⁹	No information	No information	No information	No information	15.4
Opeodu ⁴⁰	48.2	Deep pocket	100	Moderate	No information

DISCUSSION

Nigeria ranks as one of the poorest countries in sustainable development goals (SDGs) in terms of those with preterm births and deaths.⁴¹ The latest release from the World Health Organization (WHO) reveals that 773,600 pregnancies among Nigerian women end in preterm births.⁴² The burden of preterm birth is heavy, and the outcome is highly unpredictable in a resource-limited setting like Nigeria; apart from the loss of a child, there is a psychological burden on the family with the loss of resources as a result of time taken off work due to the pregnancy.^{43, 44}

Alongside the high rate of preterm birth is the high rate of periodontal diseases among Nigerians.⁴⁵ Furthermore, pregnancy further worsens the periodontal status as a result of hormonal changes.⁴⁶ The question that readily comes to mind is whether the high prevalence of preterm births among Nigerians is due to the high prevalence of plaque-induced periodontal diseases. Therefore, the grave impact of preterm birth and the high prevalence of periodontal diseases in the country necessitated this study. Although there is evidence of a link between periodontal diseases and pregnancy, there are very few well-designed studies from Nigeria to support this claim.^{22,46}

The overall prevalence of periodontal diseases was high with gingivitis been 97.6% while it was 2.4% for periodontitis using the Community Periodontal Index. The overall prevalence of gingivitis among the pregnant women was very high (100%) using the Gingival Index. This value is similar to those obtained in previous studies among pregnant women, which reported that the prevalence of gingivitis ranges from 35 to 100%.¹⁴⁻¹⁵ However, these values are higher than the values reported for non-pregnant Nigerian women and men (41.6% and 75.4% respectively).^{47,48} The reason for the higher prevalence of gingivitis among pregnant women can be attributed to hormonal influences on the gingiva.⁴⁹

Studies show that periodontal diseases are linked to preterm birth.^{22, 50} However, the influence of the prevalence and severity of the diseases on pregnancy outcome is sparse. The high prevalence of periodontal diseases in the present study compared to the normal population is expected due to the influence of hormones on gingival tissues. However, the present study found that the majority of pregnant women had mild gingivitis with only a few having a severe form of gingivitis. Most studies showed a more severe form of gingivitis among pregnant women.^{22,40} Reasons for the difference between our findings and others could be due to good oral hygiene practice, a higher level of educational attainment and the young age of our

Prevalence of Periodontal Diseases

study population.^{14,23,49} A study from Nigeria showed that those with a higher level of education are better informed of oral hygiene practices and showed better utilization of oral health care, although not significantly.⁵¹ Furthermore, the prevalence of periodontitis in this study is lower than that reported in other studies.^{22,40} Also, the severity of periodontitis is less compared to other reported data from Nigeria.⁴⁰

Periodontal disease and preterm birth

The link between periodontal diseases (gingivitis and periodontitis) and preterm birth has been established. The bacterial by-products of periodontal diseases such as lipopolysaccharides (LPS) stimulate the cellular components of inflammation leading to the production of cytokines and enzymes.^{52, 53} These will result in an inflammatory and catabolic process that destroys bone and collagen via the matrix metalloproteinases (MMPs).^{54,55} MMP8, which is a known collagenase, is responsible for the rupture of the amniotic membrane.⁵⁶ Active MMP8 rises steadily during pregnancy and reaches its peak around 9 months' gestational age at which it stimulates uterine contraction and labour.⁵⁷ However, when the level of aMMP8 rises to the peak earlier during pregnancy as a result of contributions from periodontal infection, premature labor is instituted and preterm birth ensues.⁵⁸

A previous study reported the prevalence of preterm birth in Ile-Ife to be 12.6%.⁵⁹ However, this study did not report the periodontal condition of the pregnant women recruited for the study. This prevalence is at par with the high prevalence documented by World Health Organization for Nigeria. The prevalence of preterm birth reported in the present study in Ile-Ife is 6.7%, which is far lower than the previously reported figure. The reason for this difference could be the periodontal intervention carried out among these women at the second trimester of pregnancy. Several studies have shown that non-surgical intervention such as scaling and polishing with root planning significantly influence birth outcomes in pregnant mothers.^{22, 58}

It is important also to determine which type of periodontal diseases (gingivitis or periodontitis) impact on the pregnancy outcome. The pregnant women in this study had low severity of periodontitis (2.4%) and compared to a high prevalence of 19.4% reported by Soroye et al.²² Despite a prevalence of 100% gingivitis among the pregnant women in our study the prevalence of preterm birth (6.7%) was still

lower than that reported by Soroye et al.²² (12.5%) whose study population had a prevalence of 19.4% moderate periodontitis. Thus, we could infer that the low prevalence of preterm birth may be due to the low prevalence of periodontitis rather than gingivitis. Our inference on impact of periodontal disease on birth outcome should be taken with caution until a well-designed study is able to show such association. Furthermore, a major limitation of the present study is the absence of severe forms of periodontal infection among the women studied. This may be why the severity of periodontal disease was not a predictor of preterm birth. There are no previous studies that show the influence of the types of periodontal disease on pregnancy outcomes to compare our results with. Further well-designed studies and more especially biochemical assay studies are needed to confirm our findings.

CONCLUSION

The prevalence of periodontal diseases appears to be related to the prevalence of preterm births. However, no relationship was found between the severity of periodontal diseases and preterm births in Ile-Ife, Nigeria.

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Conflict of Interest

None declared

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