

Oral hygiene status, gingival status, periodontal status, and treatment needs among pregnant and nonpregnant women: A comparative study

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Abstract:

Objectives: The gingival and periodontal changes during pregnancy are well known. Gingivitis is the most prevalent oral manifestations associated with pregnancy. The hormonal and vascular changes that accompany pregnancy are known to exaggerate the inflammatory response to the local irritants. Hence, a study was designed to assess oral hygiene status, gingival status, periodontal status, and treatment needs (TNs) among pregnant and nonpregnant women. **Materials and Methods:** A cross-sectional study was conducted among 120 pregnant and 120 nonpregnant women of 18–44 years age attending the Outpatient Department of Gynaecology and Obstetrics in Government Hospital of Belgaum city, Karnataka, India. The study consisted of an interview and oral examination. Type 3 examination was followed. Simplified Oral Hygiene Index (OHI-S), Gingival Index, and Community Periodontal Index and TNs Index were used to assess “oral hygiene status,” “gingival status,” and “periodontal status and TNs,” respectively. **Results:** The pregnant women showed poor oral hygiene with the mean OHI-S score as 2.68. Gingivitis was prevalent in almost all the pregnant and nonpregnant women. However, it was found more severe in pregnant women with mean gingival score as 1.25. A definite increase in gingivitis was found from Trimester II to Trimester III. The mean number of sextants showing healthy gingiva was significantly ($P < 0.01$) lower among pregnant women. **Conclusions:** Pregnant women showed poor oral hygiene, more gingival inflammation, and more periodontal disease as compared to nonpregnant women. The severity of gingivitis increased in Trimester III. Proper oral hygiene practice can prevent these diseases and further complications.

Key words:

Gingivitis, oral hygiene, periodontal pockets, pregnant women, trimester

INTRODUCTION

The oral health is an integral part of general health. The oral problems indigenous to the female population have been addressed since long. Physiological conditions such as pregnancy, puberty, menses and menopause, and nonphysiological conditions such as hormonal contraception and hormonal therapy all influence women's oral health.

Periodontal health in pregnant women has become a field of research since 1960.^[1] The inflammatory changes in gingiva during pregnancy have been termed as pregnancy gingivitis (gingivitis gravidarum), which is most prevalent oral manifestation associated with pregnancy and has been reported to occur anywhere from 30% to 100%,^[2] although it most frequently ranges from 60% to 75%.^[3]

Hormonal changes during pregnancy are believed to influence susceptibility to gingivitis.

It is generally accepted that increased circulating levels of female sex hormones play a central role in the etiology of pregnancy gingivitis.^[4-8]

Gingivitis in pregnancy might be considered as a tissue reaction in which estrogen and progesterone have acted on the local tissue and its microvascular system to lower the threshold level for tissue injury causing endothelial damage,

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increased vascular permeability, and reduction in corpuscular flow rate. The effect of progesterone is more pronounced than that of estrogen.^[9,10]

It is possible that the inflammatory response to the local irritants is heightened leading to gingival changes during pregnancy.^[11] The gingival mast cells may be disrupted under the influence of sex hormones, releasing their contents of histamine and proteolytic enzymes, and aggravate the inflammation produced by local irritants.^[12]

Pregnancy does not cause gingivitis but may aggravate preexisting disease. The gingival changes usually resolve within a few months of delivery if local irritants are eliminated.^[3,8]

On the other hand, few longitudinal studies conducted during pregnancy and postpartum suggested that the local irritants such as plaque and calculus seemed to play no definite role in the cause of gingivitis.^[13,14] However, there are few works of research denying the association between pregnancy and gingival inflammation.^[15,16]

In addition to gingival changes, there may also be periodontal changes such as increased pocket depth, minimal loss of attachment, and increased tooth mobility.^[17] Studies also suggested that the pregnancy only has a reversible effect on the gingiva without inducing periodontal attachment loss. The effect of female sex hormones on the periodontal ligament and tooth-supporting alveolar bone has rarely been investigated.^[18]

The maternal periodontal disease may be a possible risk for adverse pregnancy outcomes such as preterm deliveries, low birth weight, and spontaneous abortions.^[3,19,20]

The gingival and periodontal diseases are very well preventable during pregnancy. In view of the conflicting reports, this study was designed to assess the oral hygiene status, gingival status and periodontal status, and treatment needs (TNs) among pregnant and nonpregnant women and to find if any difference exists between these two groups.

MATERIALS AND METHODS

A study was conducted among pregnant and nonpregnant women of age 18–44 years attending Government Hospital of Belgaum, Karnataka, India.

Study population

It consisted of 120 pregnant and 120 nonpregnant women of age 18–44 years attending the Outpatient Department (OPD) of Gynaecology and Obstetrics Department of Government Hospital, in Belgaum city, Karnataka, India. The 120 pregnant women were equally divided into three groups of 40 each belonging to Trimesters I, II, and III.

Written informed consent was obtained from all the participants and the study was approved by the ethical committee of the institution.

The pregnancies were confirmed after taking thorough medical history and examination done by the obstetrician. Similarly, 120 nonpregnant women of comparable age

attending government hospital as attendants of the patients were examined.

Study participants were selected according to following criteria:

Inclusion criteria

1. Participants without a history of oral contraception
2. Pregnant group with primigravidae and multigravidae
3. Nonpregnant group participants with a minimum of 15-month postpartum period was chosen to avoid the effect of prolactin hormone on the levels of estrogen and progesterone in the body. Breastfeeding in India usually extends to a period of 1 year and more, the prolactin levels in lactating mothers are found to be high. Keeping this in mind, the control group was selected with participants more than 15-month postpartum and avoided interference of all gonadotropins.

Exclusion criteria

1. Participants with a contributory medical history
2. Participants who had a history of antibiotic or drug therapy
3. Participants who had received dental prophylaxis during the past 6 months before the study.

Collection of data

Permission to examine population groups was obtained from concerned hospital authority.

A deliberate sampling method was followed to select the sample. The examination was carried out and recorded by a single examiner for 2 months.

Method of examination

The present study consisted of an interview and oral examination. Brief history included their age, duration of gestation, and socioeconomic status (SES). The patients were made to sit on a wooden chair resting their heads comfortably during the examination. The WHO Type III examination was followed (using mouth mirror, sharp explorer, and adequate illumination).^[21]

Simplified Oral Hygiene Index (OHI-S by Greene and Vermillion),^[22] Gingival Index (Loe and Sillness),^[1] and Community Periodontal Index and TNs (CPITN)^[23] were used to assess oral hygiene status, gingival status, periodontal status, and TNs, respectively.

Statistical analyses

The data were entered into computer and further tabulated and analysed using SPSS software version 20 (IBM, New York, USA). Chi-square test was used to compare the proportion of patients between the two groups. Unpaired *t*-test was used to compare the means of OHI-S, gingival index (GI), and CPITN between the two groups.

RESULTS

A study was conducted in Belgaum city among 120 pregnant and 120 nonpregnant women to assess the oral hygiene status, gingival status, periodontal status, and TNs.

Oral hygiene assessment

The mean OHI-S status in the pregnant group was significantly

higher (2.68) when compared to nonpregnant group (2.07). Majority of women (55%–56%) exhibited fair oral hygiene status in both the groups. In pregnant group, 35% of women had poor oral hygiene as compared to 18.33% of women in nonpregnant group [Table 1].

Gingival assessment

The higher proportion of pregnant women (66.6%) suffered with severe form of gingivitis and higher proportion of nonpregnant women (70%) suffered with mild form of gingivitis. The mean GI score of pregnant group (1.25) was found significantly higher ($P = 0.005$) when compared to nonpregnant group (0.82). The mean GI score increased to 1.14 in Trimester I and remained same in Trimester II and slightly increased in Trimester III (1.36) [Table 2].

Periodontal status

The difference in proportion between the CPITN scores of periodontal disease of pregnant and nonpregnant group was highly significant ($P < 0.001$). In pregnant group, the percentage of women who had presence of bleeding on probing, presence of shallow pockets, and presence of deep pockets was comparatively higher than the nonpregnant group, this difference was highly significant, while the percentage of women with healthy sextants and calculus deposition was higher in nonpregnant group as compared to pregnant group with highly significant difference [Table 3]. In pregnant group, 40% of women in the Trimester I had shallow pockets which increased to 55% in the Trimester II and remained constant in the Trimester III.

The mean number of sextants affected per person was significantly higher ($P < 0.001$) among nonpregnant group (3.48) as compared to pregnant group (2.92). While the difference in mean number of sextants affected per person with periodontal pocket of 4–5 mm and 6 mm was significantly higher ($P < 0.001$) in pregnant group [Table 4].

Table 1: Mean Simplified Oral Hygiene Index score of pregnant and nonpregnant groups and percentage distribution in each group

OHI-S	Pregnant group, n (%)	Nonpregnant group, n (%)	χ^2	P
Good	10 (8.34)	32 (26.67)	40.471	<0.001*
Fair	68 (56.67)	66 (55)		
Poor	42 (35)	22 (18.33)		
Total	120 (100)	120 (100)		
Mean scores	2.68	2.07		

* $P < 0.001$ – highly significant; $P < 0.01$ – very significant; $P < 0.05$ – significant; $P > 0.05$ – not significant. OHI-S – Simplified Oral Hygiene Index; P – probability value; χ^2 – chi-square value

Table 2: Mean gingival index scores of pregnant and nonpregnant groups and percentage distribution in each group

GI scores	Trimester I, n (%)	Trimester II, n (%)	Trimester III, n (%)	Pregnant group, n (%)	Nonpregnant group, n (%)	χ^2	P
0.0	0	0	2 (5)	2 (1.67)	0	12.857	0.005*
0.1-1.0	4 (10)	0	4 (10)	8 (6.67)	84 (70)		
1.1-2.0	6 (15)	14 (35)	10 (25)	30 (25)	36 (30)		
2.1-3.0	30 (75)	26 (65)	24 (60)	80 (66.66)	0		
Total	40 (100)	40 (100)	40 (100)	120 (100)	120 (100)		
Mean scores	1.14	1.14	1.36	1.25	0.82		

$P < 0.001$ – highly significant; * $P < 0.01$ – very significant; $P < 0.05$ – significant; $P > 0.05$ – not significant. GI – Gingival index; P – probability value; χ^2 – chi-square value

Treatment needs

TN 1, that is, oral hygiene instructions was required by all the women in pregnant group (100%) and 96.67% of nonpregnant group. TN 2, that is, oral prophylaxis was required by 96.67% of pregnant and 95% of nonpregnant women. TN 3, that is, complex treatment was required by only 6.67% of pregnant women and 1.67% of nonpregnant group. However, this difference in proportion between two groups was nonsignificant [Table 5].

DISCUSSION

The recording of gingival health and periodontal health during pregnancy needs sufficient attention. Hence, the present study was undertaken among 120 pregnant (40 women in each trimester) and 120 nonpregnant women of age 14–88 years attending OPD's of Obstetrics and Gynaecology of Civil Hospital, Belgaum.

Oral hygiene status

The present study showed high mean OHI-S score in pregnant (2.68) as compared to the nonpregnant group (2.07). This difference was found to be highly significant ($P < 0.001$). This observation is in agreement with some previous studies.^[11,24-26]

An appreciable increase in mean OHIS (1.46) in the pregnant as compared to the mean OHIS (0.88) in nonpregnant women was observed in the study of Samant *et al.*^[11]

The mean OHI-S of 1.56 in pregnant and 1.31 in nonpregnant was documented in an another study.^[24] Arafat observed a slight increase in the OHI-S score in pregnant than in the nonpregnant women in Baltimore.^[25]

Amin and Shetty in Mangalore, Karnataka, observed significantly higher ($P < 0.001$) mean OHI-S (1.031) in pregnant women than in nonpregnant women (0.592).^[26]

Higher proportion of pregnant women (35%) exhibited poor oral hygiene status. This reflects a high degree of oral uncleanliness as compared to nonpregnant women (18.33%) in the present study. It is also possible that pregnancy gingivitis may make brushing and routine dental care uncomfortable and may hasten deposition of local irritants such as debris and calculus.^[17] In contrary to our statement, few studies showed no difference in oral hygiene status between two groups.^[7,13,14,27,28]

Gingival status

The present study found the gingivitis of varying grades in almost all the pregnant (99%) and nonpregnant women (100%). The reported prevalence of gingivitis from various studies

Table 3: Percentage distribution of pregnant and nonpregnant groups showing signs of periodontal disease and the highest community periodontal index and treatment needs code number recorded

CPITN codes	Pregnant group, n (%)	Nonpregnant group, n (%)	χ^2	P
0	0	4 (3.33)	102.469	<0.001*
1	4 (3.33)	2 (1.67)		
2	48 (40)	68 (56.66)		
3	60 (50)	44 (36.67)		
4	8 (06.67)	02 (1.67)		
X	0	0		
Total	120 (100)	120 (100)		

* $P < 0.001$ – highly significant; $P < 0.01$ – very significant; $P < 0.05$ – Significant; $P > 0.05$ – not significant. CPITN: Community periodontal index and treatment needs; P – probability value; χ^2 – chi-square value

Table 4: Mean number of sextants affected per person scoring with codes 0 to X among pregnant and nonpregnant groups

CPITN codes	Pregnant group (n)	Nonpregnant group (n)	t	P
0	0.80	1.52	-19.769	<0.001*
1	0.53	0.32	28.257	<0.001*
2	2.92	3.48	-68.586	<0.001*
3	1.57	0.67	110.227	<0.001*
4	0.29	0.02	33.068	<0.001*
X	0.00	0.00	0.000	1.000**

* $P < 0.001$ – highly significant; $P < 0.01$ – very significant; $P < 0.05$ – significant; ** $P > 0.05$ – not significant; CPITN: Community periodontal index and treatment needs; P – probability value; t – t test value

Table 5: Percentage distribution of pregnant and nonpregnant groups according to treatment needs as assessed by community periodontal index and treatment needs

Treatment needs	Pregnant group (%)	Nonpregnant group (%)	χ^2	P
0	0.00	3.33	12.000	0.213**
1	100	96.67		
2	96.67	95.00		
3	6.67	1.67		

$P < 0.001$ – highly significant; $P < 0.01$ – very significant; $P < 0.05$ – significant; ** $P > 0.05$ – not significant; P – probability value; χ^2 – chi-square value

ranges from 35% to 100%.^[2,29] Loe reported a 100% prevalence of gingivitis in a group of pregnant women.^[27] The higher percentage of severe type of gingivitis was observed only in pregnant women (66.6%), whereas majority of nonpregnant women showed mild type of gingivitis (70%) in the present study. Similarly, el-Ashiry *et al.*^[12] and Samant *et al.*^[11] observed majority of nonpregnant women with mild type of gingivitis as 86% and 75%, respectively, in their surveys, and they also found severe type of gingivitis only in pregnant group with 42% and 6.6%, respectively. The increased severity of gingivitis during pregnancy has been reported in many previous studies.^[7-14,17,25-27,30,31]

The present study reported a significantly higher ($P < 0.001$) mean gingival index score of 1.25 in pregnant women than 0.82 of nonpregnant women. Similar findings were observed in many studies.^[5,9,11,12,27,31,32]

The mean GI score in our study was 1.14 in Trimester I, which remained same in Trimester II and gradually increased to 1.36 in Trimester III, but this difference was statistically nonsignificant. Similarly, el-Ashiry *et al.*^[12] reported an increase in GI score of 1.6 in Trimester I which remained same in Trimester II and got aggravated in Trimester III to 1.9. Loe and Silness observed an increase in severity of gingivitis from the 2nd month of pregnancy and reached maximum during the 8 month.^[27,28] The gradual increase in severity of gingivitis toward the end of pregnancy has also been reported by many authors.^[3,7,8,11,12,14,27,28,30,33,34]

The aggravation of gingival inflammation during pregnancy occurred in two peaks, the first during Trimester I coincident with the overproduction of gonadotropins, and the second during the Trimester III in chronological association with maximum estrogen and progesterone secretions. In contrary, few studies reported the greater gingival disease during Trimester II of pregnancy.^[3,5,11,13,17,27] Miyazaki *et al.* and Jonsson *et al.* reported no association between pregnancy and gingival inflammation.^[15,16]

In accordance with the previous studies,^[1,2,5,8] recent cross-sectional and longitudinal studies have further confirmed and extended the association between pregnancy and gingival condition in many cultural and ethnic groups.^[35-37]

Gingival changes usually occur in association with poor oral hygiene and local irritants such as calculus, plaque, and food debris. However, the hormonal and vascular changes that accompany pregnancy often exaggerate the inflammatory response to the local irritants.^[3,27]

Pregnancy does not cause gingivitis but may exaggerate preexisting disease. During pregnancy, even the soft deposits might evoke an appreciable gingival inflammation.^[11,25,34]

It is observed that the severity of gingivitis is reduced after childbirth^[8,35] but the gingiva does not necessarily return to a state of health.^[14]

Periodontal status

The current study found a high prevalence of periodontal disease during pregnancy of 100% with poor periodontal condition in low-income women. Nonpregnant women of 96.67% were found affected with periodontal disease.

Based on clinical observations, the prevalence of periodontal disease during pregnancy varies from 10%^[38] in some studies to 95% in others.^[15]

Speculations have been made on the effects of hormonal changes, systemic health, and sociocultural characteristics as well as other possible factors on periodontal condition during pregnancy.^[35,36,39]

A study of Vogt *et al.* found 47% of prevalence of periodontal disease during pregnancy in low-income Brazilian women. Other South American study reported a lower prevalence of periodontal disease of 29.85% in pregnant Chilean population.^[40]

In the present study, more number of women in both the groups were scored with code 2 (calculus) and code 3 (shallow pockets) as their highest scores. The presence of shallow pockets was higher in pregnant (50%) than nonpregnant women (36.67%) and the presence of calculus was higher among nonpregnant (56.66%) women than pregnant women (40%). These differences were highly significant statistically ($P < 0.001$). Sequeira and Varma reported 90.61% of the pregnant and 88.2% of the nonpregnant women with calculus as their highest score in a study.^[24]

Cohen *et al.*^[13,17] observed an elevated level of periodontal disease during pregnancy by a partial remission at 3-month and 15-month postpartum in their two longitudinal studies.

The periodontal index tends to be significantly higher (<0.001) in pregnant women (07.37 ± 0.476) than in nonpregnant women (0.370 ± 0.401) in a study of Amin and Shetty^[26] in Mangalore.

Increased level of clinical periodontitis with increased pocket depth in pregnant women as compared to nonpregnant women was also reported by many authors.^[13,15,17,24,25,35-37,39,40]

The observations of few authors suggested that pregnancy only has a reversible effect on the gingiva without inducing significant clinical periodontal attachment loss.^[13,35-37]

Cohen *et al.*, reported minimal periodontal attachment loss and increased tooth mobility in a study.^[17]

Vogt *et al.* and Machuca *et al.* observed more cases of periodontal damage with greater clinical attachment loss in pregnant women in Trimester III in their studies.^[39,40]

In contrary, several studies found no significant difference in pocket depth between pregnant and nonpregnant groups.^[5,7,11,35,41]

The prevalence of deep pockets was lower as 6.67% among the pregnant group, but significantly higher as compared to nonpregnant group (1.67%). Similarly, the proportion of deep pockets was found lower in studies of Miyazaki *et al.* and Sequeira and Varma (1.8%).^[15,24]

It appears that hormonal changes are predisposing factors and the local deposits are the precipitating factors for more periodontal disease in pregnancy.

Mean number of sextants (MNS)

The mean number of healthy sextants was significantly higher ($P < 0.01$) in nonpregnant (1.52) than pregnant women (0.80) in the current study.

Similarly, Nuamah and Annan reported more healthy sextants in nonpregnant group with mean number of sextant as 3.78 as compared to pregnant group (2.73).^[19]

In contrary, Miyazaki *et al.*^[15] observed higher mean of sextants with healthy periodontal condition in pregnant (2.4) than that of nonpregnant women (1.9).

In the present study, Mean number of sextants (MNS) assessed with CPITN code 2 was predominant than any other code in both the groups. It was found significantly higher in nonpregnant (3.48) than pregnant group (2.92). Similarly, the sextants most affected were with calculus in a study of Sequeira and Varma.^[24] Miyazaki *et al.* similarly observed MNS with code 2 as 2.4 in pregnant and 3.2 in nonpregnant group.^[15]

The prevalence of shallow pockets was found significantly higher among pregnant (Mean number of sextants = 1.57) as compared to nonpregnant (MNS = 0.67) group. In contrary, the mean number of sextants with shallow pockets was very low as 0.4 in pregnant and 0.3 in nonpregnant women in a study of Miyazaki *et al.*^[15]

These changes were interpreted to suggest that the increase of pocket depth during pregnancy was caused by gingival enlargement rather than by periodontal destruction

Treatment needs as assessed by Community Periodontal Index and Treatment Needs

In the present study, all 100% women in pregnant group and 96.67% of women in nonpregnant group required TN I (oral hygiene instructions).

Similarly, 95% of pregnant women required TN I in a study by Miyazaki *et al.*^[15] among Japanese participants. Sequeira and Varma^[24] observed more than 90.6% of pregnant women requiring TN I in their study.

TN II (oral prophylaxis) was required in 96.67% of pregnant women and 95% of nonpregnant women in our study.

Similar results were observed by Miyazaki *et al.* and Sequeira and Varma in their studies who reported of 94% and 90.6%, respectively, among pregnant women and more than 88.2% and 94% among nonpregnant women requiring TN II.^[15,24]

Very less proportion of women required TN III (complex treatment) among pregnant (6.67%) and nonpregnant (1.67%) women in our study.

Similarly, Miyazaki *et al.* reported 1%–2%^[15] and Sequeira and Varma^[24] reported 1.8% among pregnant group requiring complex treatment in their studies.

CONCLUSIONS

In conclusion, pregnant women had poor oral hygiene conditions when compared to nonpregnant women. Almost all the pregnant and nonpregnant women had gingivitis. Severe type of gingivitis was predominant in pregnant group. The periodontal disease was found to be higher among pregnant women as compared to nonpregnant women. Shallow periodontal pockets were predominant among pregnant women. A definite increase in gingivitis was found in Trimester I, which remained same in Trimester II and gradually increased in Trimester III. Oral hygiene instructions and oral prophylaxis were required by almost all the pregnant and nonpregnant women in the study. Very few required complex treatment. It appears that the hormonal changes are predisposing factors and the local deposits are

the precipitating factors for periodontal changes during pregnancy.

Women in the reproductive age constitute large number of population in our country as demand for health-care services by the majority of our population is predominantly influenced by 'felt needs', an increase of up to 100% prevalence of gingivitis in pregnant women could be used as motivation for seeking dental care. Excellent oral hygiene practice unquestionably is an important factor in the prevention of pathological conditions in the mouths of pregnant women.

A program of oral health promotion should be planned for pregnant women of low SES on their early stage of pregnancy to provide education on oral hygiene maintenance and periodontal disease treatment, especially those at greater risk. However, these diseases are very well preventable if due attention is given on prevention of disease before it becomes worse. It can make the pregnancy even safe. Oral health during pregnancy is important to minimize possible adverse undesirable perinatal outcomes and to improve the quality of life.

Limitations

This study has got certain limitations in terms of sample size and lack of longitudinal evaluation, which would have more clearly depicted the temporal association between pregnancy and gingival changes. Furthermore, biochemical tests could have been performed to assess the possible hormonal variations. A longitudinal study of large number of participants is always desirable.

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Conflicts of interest

There are no conflicts of interest.

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