



## Prevalence of Caries and Periodontal Disease Among Indonesian Pregnant Women


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### Abstract

**Objective:** To determine the extent of bleeding on probing, probing pocket depth and the level of oral hygiene and caries prevalence among pregnant women. **Material and Methods:** Random samples of pregnant women attending eight public health centers were examined. Their periodontal and caries statuses were examined using the Community Periodontal Index, Simplified Oral Hygiene Index and DMF-T. The good criteria of OHI-S ranged from 0 to 1.2, the fair from 1.3 to 3.0 and the poor from 3.1 to 6.0. Descriptive statistics were used to calculate the absolute and relative frequencies. **Results:** 84.7% had caries and the DMF-T index score was 4.34 (fair). 73% suffered gingival bleeding, 34% with 4-5 mm pocket depth, 2% with 6 mm or deeper pocket depth, while the majority had good oral hygiene. The prevalence of 4-5 mm probing pocket depth increased between the first and second trimesters (12.1% to 48.5%), before undergoing a slight decrease in the third trimester (39.4%). Gingival bleeding was found to be most prevalent in the third trimester. Pocket depth of 4-5 mm was found to be highest in the second trimester. Pocket depth of 6 mm or more was restricted to the third trimester. Oral hygiene scores increased in tandem with gestational age. **Conclusion:** The majority had caries, which strongly suggests that the awareness of the pregnant women regarding their oral hygiene remains limited.

**Keywords:** Pregnant Women; Periodontal Index; Periodontal Diseases; Dental Caries.

## Introduction

Hormonal change during pregnancy involving progesterone and estrogen can affect periodontal tissue and increase the risk of caries [1,2]. An increase in progesterone during pregnancy can also cause edema, accumulation of inflammatory cells and bleeding [3]. Ultimately, hormonal changes can cause local inflammation and decrease immune response with the result that the periodontium is more susceptible to gingival sulcus dilation and the development of periodontal pockets [4,5].

The composition and virulence of subgingival film changes during pregnancy supports gram-negative anaerobic bacteria growth in the oral cavity. Dental plaque and other factors, including systemic and local ones, initiate periodontal inflammation potentially affecting the occurrence and severity of periodontal disease. Pregnant women are prone to gingival redness, swelling and bleeding, increased pocket depth on probing and tooth mobility from the second to eighth month of gestation [6].

Pregnancy-related gingivitis constitutes an abnormality of periodontal tissue in pregnant women characterized by bleeding, edematous, erythema, ulceration, halitosis and gingival enlargement [5-7]. Periodontitis can be induced by bacterial build-up and is exacerbated by hormonal changes [8]. Bleeding on probing (BOP) and probing pocket depth (PPD) are specific methods involved in periodontal risk assessment. Oral hygiene has major influence in preventing debris and plaque build-up, which can aggravate the periodontal network condition [9].

An increase in progesterone levels can also cause a decrease in the salivary flow rate [10] which, together with changes in the salivary elements, can weaken the immune system contained in saliva which, in turn, will lead to tooth decay and mucosal inflammation [11]. The increase in progesterone may also produce a decrease in the level of plasma bicarbonate, which reduces salivary pH. Increased acid production in the oral cavity accompanied by a lack of attention paid by pregnant women to oral cavity hygiene will accelerate the onset of caries [12]. Estrogen regulates the proliferation, differentiation and keratinization of cells leading to desquamation of the oral mucosa. Desquamated cells may expand the microbial environment by providing nutrients and ideal conditions for bacterial growth.

Pregnant women run a higher risk of caries because of the raised pH resulting from vomiting compounded by their reluctance to maintain oral hygiene. Pregnant women also experience cravings for sweet and sour foods, which exacerbate the condition of the oral cavity. Other risk factors leading to caries in pregnant women are (1) lack of attention to oral hygiene, (2) less frequent brushing of their teeth due to fatigue or nausea when doing so, or (3) anxiety about the potential for bleeding gums to be caused by brushing [13-15].

According to a previous study, 84% of pregnant women failed to have their teeth regularly checked by a dentist. During pregnancy, the teeth are more easily damaged rendering further studies on the prevalence of caries and periodontal disease in pregnant women necessary [16]. The data can be useful for planning intervention and prevention programs while inducing the adoption of such

healthy behavior through persuasion, attractive invitations, information provision and awareness raising among other means.

The purpose of this study was to determine the extent of bleeding on probing, probing pocket depth and the level of oral hygiene and caries prevalence among pregnant women.

## **Material and Methods**

### **Study Design and Sample**

This study was descriptive observational in character, incorporating a cross-sectional design, conducted at several randomly selected public health centers (Dr. Soetomo, Dupak, Gundih, Krembangan, Kenjeran, Tanjungsari, Simomulyo, and Mulyorejo) in Surabaya, Indonesia, from October to November 2017.

The sample were calculated using non probability sampling with random sampling technique. The sample included up to 98 respondents with the minimum number being 73. The selection criteria comprised female non-smokers in any trimester of their pregnancy who were free from systemic disease in all ages, did not take drugs which could potentially affect the condition of the oral cavity and were willing research subjects. In this study, the state of the periodontal tissue and the value of DMF-T before pregnancy were not examined.

### **Data Collection**

Subjects were interviewed to confirm their identities, asked to fill in a questionnaire and then instructed to rinse their mouths with mineral water before examination. The periodontal disease of subjects was assessed by a modified Community Periodontal Index (CPI), their oral hygiene by means of a Simplified Oral Hygiene Index (OHI-S) and the extent of their caries using a DMF-T index. A WHO Probe (Osung MND, Seoul, Korea) was used for the purposes of examination [17]. The good criteria of OHI-S ranged from 0 to 1.2, the fair from 1.3 to 3.0 and the poor from 3.1 to 6.0.

The assessors were the dentists who has been trained in epidemiological survey after being calibrated by “gold standard” dentist. The “gold standard” dentist is an examiner who has been trained, calibrated, and experienced in doing CPI, OHI-S, and DMF-T index. There are three dentists participated in this study.

### **Data Analysis**

Data were analyzed using Microsoft Excel Software. Descriptive statistics were used to calculate the absolute and relative frequencies and mean.

### **Ethical Aspects**

This study was approved by the Commission for the Ethical Health Research of the Faculty of Dental Medicine, Universitas Airlangga (179/HRECC.FODM/IX/2017). The subjects had the examination procedure explained to them and gave their informed consent prior to commencement of the study.

## Results

A total of 27% of subjects experienced bleeding on probing. It was found that 64% had no periodontal pocket, 34% had a 4–5 mm pocket and only 2% had a pocket with a depth of 6 mm or more. There was high prevalence among those pregnant women in both their first and second trimesters (11.1% to 36.1%). It was found that the prevalence of BOP increased in tandem with their gestational age. The highest proportion of pregnant women, 52.8%, experienced BOP in their third trimester (Table 1).

**Table 1. Distribution of bleeding on probing (BOP) in modified CPI based on gestational age.**

Gestational Age	Without BOP		With BOP	
	N	%	N	%
1 <sup>st</sup> Trimester	5	19.2	8	11.1
2 <sup>nd</sup> Trimester	10	38.5	26	36.1
3 <sup>rd</sup> Trimester	11	42.3	38	52.8
Total	26	100.0	72	100.0

The prevalence of 4–5 mm probing pocket depth (PPD) increased between the first and second trimesters (12.1% to 48.5%), before undergoing a slight decrease in the third trimester (39.4%). PPD of 6 mm or more was only found in pregnant women in their third trimester. The total number of subjects without PPD increased with gestational age (Table 2).

**Table 2. Distribution of probing pocket depth (PPD) in modified CPI based on gestational age.**

Gestational Age	No PPD		4 – 5 mm PPD		> 6 mm PPD		Total	
	N	%	N	%	N	%	N	%
1 <sup>st</sup> Trimester	9	14.3	4	12.1	0	0.0	13	13.3
2 <sup>nd</sup> Trimester	20	31.7	16	48.5	0	0.0	36	36.7
3 <sup>rd</sup> Trimester	34	54.0	13	39.4	2	100.0	49	50.0
Total	63	100.0	33	100.0	2	100.0	98	100.0

A total of 27 subjects had a good OHI-S (27.5%) and 13 had a poor OHI-S (13.3%). The average value of OHI-S in this study was 1.96 (fair). The average value of OHI-S of first trimester pregnant women was 1.62, the second trimester 1.69 and the third trimester 2.25. The prevalence of good OHI-S was found to be highest in second trimester (48.1%), while fair OHI-S was mostly widely experienced by their third trimester counterparts (53.4%) and poor OHI-S was found in pregnant women in their third trimester (69.2%) (Table 3).

**Table 3. OHI-S criteria based on gestational age.**

Gestational Age	Good		Fair		Poor		Total	
	N	%	N	%	N	%	N	%
1 <sup>st</sup> Trimester	5	18.5	7	12.1	1	7.7	13	13.3
2 <sup>nd</sup> Trimester	13	48.1	20	34.5	3	23.1	36	36.7
3 <sup>rd</sup> Trimester	9	33.4	31	53.4	9	69.2	49	50.0
Total	27	27.5	58	59.2	13	13.3	98	100.0

The pregnant women suffering from caries totalled (84.7%), while only 15 (15.3%) were caries-free. The mean values of DMF-T pregnant women were expressed as follows: D = 3.03, M = 1.08 and F = 0.05. The average DMF-T index in pregnant women was 4.34. According to DMF-T index assessment criteria, this condition confirms that the susceptibility to dental caries of pregnant women in eight public health centers was fair. Pregnant women in their first trimester had DMF-T values of 2.33, while those in their second trimester had DMF-T values of 4.69. Third trimester pregnant women had DMF-T values of 4.57. The distribution of subjects based on the frequency of their visits to the dentist was as follows: 87 subjects visited the dentist infrequently (88.8%), while 11 subjects made routine visits (11.2%).

## Discussion

This study shows that the prevalence of BOP increases with gestational age and that pregnant women in their third trimester had the greatest number of BOP sites. Clinical manifestations of pregnancy-related gingivitis include: redness, bleeding and gingival swelling. These symptoms were observed from the second month of pregnancy, progressively increasing along with advancing gestational age and reaching their peak in the eighth month of pregnancy [6].

The results showing increasing BOP in the second trimester are also in accordance with a theory that such a rise can occur from that point in time to the birth of the baby [18]. Increased production of reproductive hormones during pregnancy can induce changes in the oral cavity in the form of increased permeability of gingival blood vessels, rendering it susceptible to localised irritations such as plaque, calculus and caries [19].

The greatest prevalence of periodontitis within 4–5 mm PPD was observed in second trimester pregnant women and decreased in the third trimester. The proportion of anaerobic and aerobic bacteria increases in the second trimester, especially that of *Prevotella intermedia* (*P. intermedia*), until the third trimester when the *P. intermedia* level decreases. Microbial changes are related to the levels of estrogen and progesterone in plasma [6]. The ratio of subgingival anaerobic-aerobic bacteria in the second trimester leads to significant estrogen and progesterone accumulations in subgingival plaque compared to other trimesters [20]. Only 2% of pregnant women had 6 mm or more PPD. Increasing hormone production during the nine months of pregnancy was insufficient to cause significant destruction of periodontal tissue attachments [9].

Increased PPD is indicated by inflammation-induced swollen gingiva, increasing levels of microorganisms such as *Bacteroides*, *Prevotella*, and *Porphyromonas*, which are etiologies of periodontal disease, and the ability of the probe to penetrate deeper into the pocket [21]. Increased PPD during pregnancy with clinical manifestations such as gingival redness and swelling was due to the formation of pseudo pocket [6].

This study indicated that the value of OHI-S increased progressively with gestational age, but was still considered fair. This was due to physiological changes during pregnancy causing

pregnant women to neglect their oral hygiene [9,19]. The third trimester produced the worst OHI-S results because oral hygiene was not well-maintained during pregnancy [9].

Based on DMF-T index, the prevalence of caries in pregnant woman in Surabaya was fair. The percentage of pregnant women who experienced caries in this study was high. This result was in line with previous findings, which posited that the percentage of pregnant women affected by caries and gingivitis was higher than that of their non-pregnant counterparts [14]. This could be caused by a number of psychological conditions experienced by pregnant women.

During pregnancy, the widest physiological and hormonal fluctuations occur. The whole-body functions of a pregnant woman must adapt to new conditions. Estrogen and progesterone are the most significant hormones during pregnancy. Estrogen regulates proliferation, differentiation and keratinization of cells that cause desquamation of the oral mucosa. The presence of desquamated cells will raise the possibility of microbial environment expansion by providing nutrients and becoming a location suitable for bacterial growth. Progesterone influences the microvascularization of the gingiva and alters collagen production. Its increase can lead to a decline in plasma bicarbonate, which, in turn, also reduces salivary pH. Excess acid production in the oral cavity accompanied by poor oral hygiene will accelerate the emergence of caries [12]. In addition, progesterone increase also impedes the salivary flow rate [10]. A decrease in the salivary flow rate and changes to salivary elements can weaken the immune system in saliva and cause caries and mucosal inflammation [11].

The reason for pregnant women to run a higher risk of caries was due to a reduction in the pH of the oral cavity caused by vomiting which produces an acidic atmosphere. Nausea and vomiting often render pregnant women unwilling to maintain their oral hygiene, with the result that acid produced by dental plaque and vomiting will accelerate the decay process. Pregnant women also tend to have a greatly increased appetite for sweet and sour foods that exacerbate the already acidic condition of the oral cavity due to vomiting. Failure to maintain oral hygiene because of fatigue and fear of nausea when brushing their teeth increases the risk of caries and periodontal disease [13-15]. There are also some psychological changes that occur during pregnancy, including mood swings and anxiety regarding their unborn baby in the third trimester, that will affect the behavior of pregnant women in respect to oral hygiene [22].

In this study, the number of DMF-T fillings was very low at 0.05 since only two pregnant women had fillings. This indicated that the majority of such individuals did not undergo regular dental check-ups, while there were numerous instances of tooth decay that needed to be filled.

The distribution of research subjects across the successive trimesters of pregnancy showed that the highest prevalence of caries among pregnant women occurred in the second trimester with a DMF-T value of 4.69 (fair), somewhat similar to the third trimester with a DMF-T value of 4.57. The first trimester showed a DMF-T value equal to 2.33, which indicated a low prevalence of caries. The literature shows that the prevalence of caries increases as gestational age increases [13]. The high prevalence of dental caries in pregnant women in their second and third trimesters can occur because the production of estrogen and progesterone increases gradually until the eighth month of



pregnancy. In the final month of pregnancy, the concentration of progesterone is constant, while the production of estrogen continues to increase. In the third trimester, the pH of saliva and buffer capacity reach their lowest levels, thus augmenting the risk of caries due to the increasing numbers of *Streptococcus mutans* [10].

The high prevalence of research subjects who did not have their teeth checked regularly by a dentist was related to a lack of information or knowledge about oral health and poor oral hygiene conditions [23]. The lack of consultations related to periodontal health maintenance could cause plaque accumulation resulting in gingival bleeding and further periodontal inflammation [24]. Calculus is a local factor in gingivitis because its rough surface provides a suitable location for plaque retention, especially on the gingival margin area [25]. Poor maintenance of oral hygiene will exacerbate periodontal tissue conditions [26].

Pregnancy-related complications that have been associated with periodontal disease include pre-term birth, low birth weight, miscarriage and preeclampsia [2]. Infectious agents present in pregnant women with severe periodontitis can activate the inflammatory process both locally and extraorally with results including: placenta-fetus issues, premature labor, preeclampsia and intrauterine growth retardation [27].

The limitations of this study are low awareness of pregnant women to do dental check up, so that the samples were not much as expected. Pregnant women consider dental health is not related to fetal health. In order to increase the visitation of pregnant women to the public health center, the caregiver should persuade them to come door to door. It is not possible for us to go door to door in order to gain all samples. The health focus of developing country, especially Indonesia, prefers to systemic health, dental health is not the first.

## Conclusion

Pregnant women suffer gingival bleeding, with more than 4 mm pocket depth, although the majority maintains high levels of oral hygiene. Most have caries, which suggests that the awareness of pregnant women regarding their oral hygiene remains limited.

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**Conflict of Interest:** The authors declare no conflicts of interest.

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