The Correlation between Oral Hygiene Status and Gingival Status among Pregnant Women

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Abstract

During pregnancy, a series of hormonal changes occur which cause a woman's body to experience various physical and physiological changes, including periodontium.

Aim was to investigate the relationship between the level of oral hygiene and the severity of periodontal disease in order to reduce the incidence of periodontal disease in pregnant women in the Dringu district area.

This type of research is cross-sectional with random sampling technique. Clinical assessment was carried out by measuring the patient's gingival status using the gingival index (GI) and Oral Hygiene Index Simplified (OHI-S).

The result was found that 100% of pregnant women had gingivitis, and 19% of participants had severe gingivitis. Thirty-five percent of pregnant women experienced poor hygiene conditions. The analysis of the relationship between GI, OHIS, and sociodemographics based on the Mann-Whitney and Kruskall Wallis tests found significant differences between all variables and characteristics of sociodemographics. The result of the Spearman correlation test shows that there is a significant relationship between the GI and OHIS scores of pregnant women had a significant result, meaning that every increase in the OHIS score will be followed by an increase in the GI scores.

This study indicated that the correlation between the GI and OHIS scores of pregnant women had a significant result. The better of the OHIS, the lower the gingivitis status.

Clinical article (J Int Dent Med Res 2023; 16(1): 801-808) Keywords: Oral Hygiene Index-Simplified (OHI-S), Gingival Index (GI), pregnant women, medicine, dentistry.

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Introduction

Periodontal diseases are one of the health problems that are often experienced by people, including pregnant women.¹ During pregnancy, a series of hormonal changes occur which cause a woman's body to experience various physical and physiological changes, including oral problems related to the periodontium. Globally, as many as 538 million people have severe periodontal disease, and as many as 276 million people lose their teeth due

*Corresponding author: Shafira Kurnia Supandi, DDS., MSc., PhD Department of Periodontology, Faculty of Dental Medicine, Universitas Airlangga, Surabaya, Indonesia. JI. Prof Dr. Moestopo No.47, Surabaya. E-mail: shafira-k-s@fkg.unair.ac.id to periodontal disease.² Meanwhile in Indonesia itself, the results of The Consolidated Report on Indonesia Health Sector Review (*Riset Kesehatan Dasar*) in 2018 stated that women in Indonesia had a prevalence of gingivitis of 74%.³ Research from the Nigerian Teaching Hospital stated that as 82.3% of the 374 pregnant women participants who were examined had gum inflamation or called gingivitis.⁴ In addition, the prevalence of pregnancy's gingivitis ranges from 30% -100% of all pregnant women in the world.⁵

Alteration to the periodontium tissue during pregnancy have been studied in previous studies, there were investigations have verified the link between pregnancy and periodontal disorder in a variety of people in some countries. For instance, in Sri Lanka, pregnant women influence the periodontal health compromise. According to this study, progesterone and

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estrogen can improve the irritating effects of plaque, which causes severe gingivitis.^{6,7}

Durina pregnancy, the hormones progesterone and estrogen are continuously secreted by the corpus luteum, causing an increase in hormone levels in the blood circulation and affecting the response of the periodontal tissue to local factors so that the risk of developing periodontal disease is greater.^{8,9} Pregnancy-related gingivitis appears to be independent of dental plaque build-up.¹⁰ Good oral hygiene during pregnancy seems capable of partially neutralizing hormonal effects, because its relation to periodontopathogenic bacteria¹¹. Although it is well knowledge that periodontal illnesses are caused by microbes, it has been suggested that pregnancy's effect on gingival tissue may be independent that pregnancy may produce gingivitis.12

The researcher revealed the emergence of gingival inflammation in pregnant women with periodontal health and good dental hygiene. The result is periodontal health was unrelated to the presence of dental plaque based on bleeding on probing (BOP) and the periodontal pockets (PPD) 4 mm.¹³ According to some studies aforementioned, pregnancy is the primary cause of gingival inflammation. The results revealed the potential harmful impact of pregnancy on periodontal health. It can cause more periodontal defects when the inflammation is untreated. Therefore, the necessity of maintaining oral hygiene is mandatory especially in pregnant women.

Periodontal disease is an inflammatory condition that cause defect on the gingiva, alveolar bone, periodontal ligament, and cementum which can cause tooth loss.¹⁴ Periodontal disease can be caused by a complex relationship between the host immune system and the subgingival biofilm that occurs in the periodontal tissues.¹⁵ In pregnant women, periodontal disease allows adverse effects such as prematurity, preeclampsia, low birth weight, and miscarriage.¹⁶

Regardless of whether plaque levels stayed unchanged or were low, these findings from the majority of research support the theory that during pregnancy, gingival inflammation increases without periodontal attachment loss and decreases after childbirth. However, there are still a small number of studies that refute the

link between pregnancy and gingival inflammation. Community Periodontal Index of Treatment Needs (CPITN) is often used to asses' periodontal health. There was a considerable increase in the CPITN index II and III, and pregnant women required additional oral health education.¹³

One form of periodontal disease is gingivitis. Untreated gingivitis will develop into a more severe disease, namely periodontitis.¹⁴ In gingivitis, inflammation occurs only in the gingiva with the characteristics of inflammation in general, namely swelling, redness, and tissue bleeding. Whereas in periodontitis, inflammation does not only occur in the gingiva, but can widen and destruct bone. In early stage, not all gingivitis can develop into periodontitis. If gingivitis is well maintained, the disease development will stop, however, if gingivitis is not well maintained, then the gingivitis will develop into periodontitis.^{15,16} According to the current study, 4.4% of pregnant women in Indonesia had periodontal disease.¹⁷

Owing to the fact that periodontal disease in pregnant women are riskier than in nonpregnant, the earlier periodontal disease management the better pregnant health can obtain. It is pivotal to know the gingival status in pregnant women so that a preventive method can be optimized. According to an analysis of patient visit data in 2020 at the Dringu's Primmary Health Center, Probolinggo Regency, East Java, Indonesia more than 50% of dental and oral polyclinic patient visits were patients with cases of periodontal disease. Meanwhile, 65% of pregnant women in the Dringu district experienced periodontal disease.

Data from Dringu's health primary center frequently show that the oral condition in pregnant women is already found in severe stages requiring more invasive treatment. This shows that there are still high cases of periodontal disease in the Dringu district. Based on the matters above, the authors assess the relationship between the level of oral hygiene practice and the severity of periodontal disease in pregnant women.

It is important to carry out a study on the relationship between oral hygiene level and the severity of periodontal disease so that it can be used as a health provider's guide in carrying out preventive and curative actions, in order to reduce the incidence of periodontal disease in pregnant women in the Dringu district area.

Materials and methods

This type of research is cross-sectional with random sampling technique. A sample of 26 pregnant women in the Dringu District, Probolinggo Regency. The sample inclusion criteria were (1) pregnant women who agreed to participate as respondents, (2) filled out and signed informed consent, (3) were present at the study site, (4) did not use fixed orthodontic appliances, (5) had no history of systemic disease, (6) age range 17-45 years.¹⁸

The research was conducted September 16th 2022 at the Dringu Primary Health Centre, Probolinggo Regency. The data were obtained from the participants. The subjects have to fill out informed consent and then checking the vital sign of the subjects such as blood pressure, pulse rate, and respiration rate. The participant was interviewed with a structured questionnaire to obtain sociodemographic data such as age, address, education, occupation, oral hygiene habits, and tooth brushing frequency. For data on pregnancy history, the data was taken from the medical records of the Primary Health Centre. Furthermore, a clinical examination was carried out regarding oral hygiene level and gingivitis stage.

Examination of oral hygiene status and gingivitis status

The materials needed include an form, mouth examination mirror, explorer. tweezers, excavator, UNC probe (Osung®, South Korea), instrument tray, disclosing agent solution (GC Corporation®, Japan), cheek retractor, cotton, gauze, alcohol, mask, gloves, medical gowns, and face shields. Clinical examination was carried out by measuring the patient's gingival status using the gingival index (GI) and the level of oral hygiene using the Simplified Oral Hygiene Index (OHI-S). OHI-S is known by measuring the level of oral hygiene by scoring (scoring) by adding up the Calculus Index (CI) and Debris Index (DI).

Gingival index (GI)

The degree of gingivitis status was determined using the GI index introduced by Loe and Silness. Measurements were made on tooth

elements 16, 11, 26, 36, 31 and 46. Each of the four gingival areas of tooth receives a score from 0 to 3 depending on gingival inflammation condition. The probe was inserted into the gingival sulcus in the area of the disto-labial papillae, labial gingival margins, mesiolabial papillae and lingual gingival margins. The score for each tooth is obtained by adding up the scores of the four sides examined, then the total number obtained is divided by four (the number of sides examined). The sum of the scores of all the teeth examined divided by the number of teeth examined, the gingival index score was obtained.¹⁹

GI was assessed based on the following gingival examination assessment criteria: 0 = normal gingiva; 1 = Mild inflammation, slight discoloration and slight edema. no bleeding on probing; 2 = Moderate inflammation. gingiva redness, edema, and shiny, bleeding on probing; 3 = Severe inflammation, gingival redness, edema, and ulceration with tendency to spontaneous bleeding. GI staging score criteria are 0.1 - 1.0 Mild Gingivitis 1.1 - 2.0 Moderate Gingivitis 2.1 - 3.0 Severe Gingivitis²⁰.

Oral Hygiene Index Simplified (OHI-S)

OHIS was meassured in the tooth region using is 6 index tooth surfaces which represent the state of the oral cavity. The teeth selected as the index teeth along with the index tooth surfaces that are considered to represent each tooth segment are: a. Tooth 16 on the buccal surface, b. Tooth 11 on the labial surface, c. Tooth 26 on the buccal surface, d. Tooth 36 on the lingual surface, e. Tooth 31 on the labial surface, f. Tooth 46 on the lingual surface. The OHI-S measurement is a combination of Debris Index Simplified (DI-S) and Calculus Index Simplified (CI-S). The OHIS score per individual is obtained from the sum of the DI-S and CI-S scores²¹. DI-S is a value (score) obtained from the results of examination of soft deposits on the tooth surface which can be in the form of plaque. alba material, and food debris, while CI is the value (score) of hard deposits or calculus. DI-S is performed by applying a disclosing agent to the tooth surface then placing a probe on the tooth surface in the 1/3 incisal/occlusal area and moving it towards the 1/3 gingival/cervical area. Scoring for DI-S according to the criteria. Debris was found on the buccal and lingual surfaces to represent the 3 segments of the teeth²¹.

The DI-S assessment criteria follow the following conditions (Greene and Vermillion (1964)):

 $Debris Index = \frac{\text{The total number of debris}}{\text{Total number of examined teeth}}$ The DI-S criteria following, 0 : No stainsor debris; 1 : Plaque covering not more than 1/3
of the cervical surface or extrinsic stains on the
tooth surface; 2: Plaque covering more than 1/3
but less than 2/3 of the surface examined; 3 :
Plaque covering more than 2/3 of the surface
examined.

CI-S was performed to measure the calculus found on the buccal and lingual surfaces to represent the 3 segments of the teeth. The probe is placed on the cervical gingiva and moved towards the subgingival area. How to move it from the distal to the mesial contact area.

The CI-S assessment criteria follow the following conditions (Greene and Vermillion (1964)):

 $Calculus Index = \frac{The total number of calculus}{Total number of examined teeth}$

Assessment Criteria for CI-S. 0 : No calculus present; 1 : Supragingival calculus covering not more than 1/3 of the cervical surface examined; 2 : Supragingival calculus covering more than 1/3 but less than 2/3 of the surface being examined, or patches; 3 : Subgingival calculus around the cervical of the tooth Supragingival calculus covering more than 2/3 of the surface or there is subgingival calculus around the cervical of the tooth.

The criteria for assessing debris and calculus are the same, which follows the following provisions: a. Good: if the value is between 0-0.6 b. Moderate: if the value is between 0.7-1.8 c. Bad: if the value is between 1.9-3.0.

The OHI-S score results are obtained based on the following formula:

OHIS = DI + CI

OHI-S has its own criteria, which follow the following provisions: a. Good: if the value is between 0-1.2 b. Moderate: if the value is between 1.3-3.0 c. Bad: if the value is between 3.1-6.0.

Then the Mann Whitney and Kruskall Wallis tests were carried out to see the periodontal health index of pregnant women based on sociodemographic and Spearman correlation and linear regression to look for the presence or absence of a relationship between oral hygiene and the severity of periodontal disease. Data analysis using Statistical package for social science (SPSS) 27.0 version (IBM corporation, Illinois, Chicago, US) from Windows.

Results

Based on the sociodemographic characteristics of participants, the mean age of the participans was 26-45 years (69.2%), with the highest level of education is senior high school (50%). The average pregnant woman is unemployed/housewife (92.3%) and most of them are in the third trimester of pregnancy (57.7%) (Table.1). Application of disclosing agent for detecting teeth debris was done to every patient before the dental checkup (Figure 1).



Figure 1. Aplication of disclosing agent for detecting teeth debris.

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Characteristics	Ν	%
Age (years)		
17-25	8	30,8
26-45	18	69,2
Education level		
Elementary school	4	15,4
Junior high school	7	26,9
Senior high school	13	50,0
University	2	7,7
diploma/degree		
Occupation		
Employed	2	7,7
Unemployed	24	92,3
Gravid		
1	9	34,6
>1	17	65,4
Trimester of pregnancy		
(1) (<12 weeks)	5	19,2
(2) (12-26 weeks)	6	23,1
(3) (>26 weeks)	15	57,7
Total	26	100,0

Table 1. Sociodemographic characteristics of the participants.

The OHIS examination was carried out to assess how well pregnant women can maintain oral hygiene. The result was found that 35% percent of pregnant women experienced poor hygiene conditions (Table 3). The aim of GI examination was to know the level of periodontal disease. All pregnant women (100%) in this case had gingivitis and 19% of them had severe gingivitis (Table 4).

Variabel	Mean	SD	Min.	Max
OHIS	1,32	0,76	0,17	2,83
GI	2,65	1,53	0,00	6,00

Table 2. Inferential frequency distribution.

	Frequency	Percentage (%)
Good	3	11
Fair	14	54
Poor	9	35

Table 3. The distribution of frequency of OHIS inpregnant women.

	Frequency	Percentage (%)
Good	9	35
Fair	12	46
Poor	5	19

Tabel 4. The Distribution of severity of gingivitis(GI-S) in pregnant women.

Characteristics	GI Median (Min- max)	P Value	OHIS Median (Min-max)	P Value
Age (years) 17-25	1,10(0,16-2,17)	P= 0.339	2.67(0.33-4.67)	P= 0.998
26-45	1,40(0,00-2,31)	,	2,50(0,00-6,00)	,
Education level				
Elementary	1,06(0,79-1,67)	P= 0,700	2,38(1,50-2,67)	P= 0,808
school	1,29(0,83-2,67)		2,00(1,40-6,00)	
Junior high	1,50(0,17-2,83)		3,33(0,00-6,00)	
school	1,60(1,29-1,92)		2,00(0,50-3,50)	
Senior high				
school				
University				
diploma/degree				
Occupation	4 50/4 00 4 00	B 0 7 40	0.00/0.07.0.50	B
Employed	1,50(1,08-1,92)	P= 0,742	3,08(2,67-3,50)	P= 0,683
Unemployed/hou	1,29(0,16-2,83)		2,38(0,00-6,00)	
sewife				
Trimester of pregnancy	4 00/0 05 4 74)	D _ 0.070	0 50(0 00 0 00)	D -0.004
(1) (<12 weeks)	1,08(0,25-1,71)	P= 0,376	2,50(0,33-2,83)	P= 0,284
(2) (12-26	0,77(0,25-2,08)		1,92(0,00-4,67)	
weeks)	1,50(0,17-2,83)		2,83(0,50-6,00)	
(3) (>26 weeks)				

Table5.The relationship betweensociodemography, OHIS and GI in pregnantwomen.

The analysis of the relationship between severity of gingivitis, oral hygiene status, and sociodemographic of pregnant women in Dringu District, Probolinggo Regency, East Java, Indonesia, based on the normality test with Saphiro-Wilk obtained p = 0.05, which means that the data is not normally distributed. The Mann-Whitney and Kruskall Wallis tests found no significant differences (all variables >0.05) between all variables and characteristic of sociodemographics. (Table 5).

The result of the Spearman correlation test shows that there is a significant relationship between the GI and OHIS scores of pregnant women had a positive direction and strong because the correlation coefficient is r = 0.766, meaning that every increase in the OHIS score will be followed by an increase in the GI scores. The results of the linear regression test showed that the effect of GI on OHIS was 58.6% (Table 6).

OHIS	Nilai r	P-Value
GI	0,766	0,0001*

Tabel 6. The Spearman Correlation Test and linear regression of the gingival index and OHIS. *P<0,05

Discussion

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The results of the oral hygiene status examination indicate that most pregnant women had moderate (54%) and poor (35%) OHIS indexes. During pregnancy, and estrogen progesterone increase which is characterized by physiological changes such as lethargy²² as well as morning sickness (nausea and vomiting in the morning), especially in early stages of pregnancy.²³ As a result, pregnant women often overlooked oral hygiene and don't consider it a priority, leading to oral health problems which can affect the health of the periodontal tissues.²⁴

Based on the results of an article review on pregnant women awareness of oral and dental hygiene, it was concluded that there is a relation between knowledge and oral hygiene where if the knowledge of pregnant women is good, the OHI-S value is like wise to be good.²⁵ The frequency of toothbrushing can be used as a main measurement for clinical oral hygiene indices.²⁶ In addition, there is also a significant relation between the behavior of pregnant women and oral hygiene, OHIS during pregnancy. Lower levels of education can lead to less awareness of periodontal health, less use of oral health services, and negligence oral hygiene practices. If the level of oral hygiene is low in the pregnancy period, it will accelerate and increase gingivitis than non-pregnant.²⁷

The result shows that all the participants (100%) had gingivitis; 46% of the participants had moderate gingivitis and 19% had severe gingivitis. All respondents also (100%) had a habit of brushing their teeth 2-3 times a day. During the pregnancy period, the psychological change and increase in estrogen and progesterone affect the periodontal tissue such as inflammation, resulting in an increase in gingivitis. ^{14,28} The response to gingivitis in this phase of pregnancy increases even with a relatively small local irritation factor.¹⁴ Hormonal changes that affect the oral hygiene of pregnant women amount to 60% with 10-27% of pregnant women having gingivitis²⁹. Research states that pregnant women are uncomfortable brushing teeth because their of nausea, hence accelerating the deposition of local irritants such as debris and calculus. Within the pregnancy period, if the level of oral hygiene is low, gingivitis will increase and accelerate.³⁰

Based on the results of the Spearman correlation test, there is a significant relationship between the gingivitis index (GI) and oral hygiene of pregnant women (OHIS). The results of the linear regression test show that the effect of GI on OHIS was very high, equal to 58,6%. This is consistent with the research which states that there is a relation between dental and oral hygiene behavior and index debris in pregnant women and there is a relation between gingivitis and number of pregnancy risk factors, including gestational age, toothbrush frequency, brushing time and plaque index.^{27,31} This research is also in line with Newman's theory which states that the main cause of gingivitis is due to the accumulation of plaque-containing bacteria¹⁴.

The pregnancy itself doesn't cause gingivitis but is able to worsen the gingivitis that has already existed. During pregnancy, soft deposits can even produce considerable gingivitis³¹ Research states that the GI of pregnant women is significantly increased and reaches its peak in the third trimester but decreases at 3 months postpartum³². However, there are also evidences showcasing the severity of gingivitis decreases after giving birth, but the gingiva does not always return to a healthy state³¹. Based on the results of this survey, dental and oral health data collection must be carried out more comprehensively. Besides that, mothers perspectives on dental behavior can enhance children's dental habits³³.

In primary healthcare provider, it is pivotal to establish anteronatal care (ANC) for dental and oral health promotion programs for pregnant women. It is should be planned from the early stages of pregnancy to provide education about maintaining oral hygiene and treating periodontal disease, especially for pregnant women who are at high risk. The relation between periodontal health and pregnancy must be made clear to dental health professionals and gynecologists in order to be able to treat women for the overall benefit of health and the success of the pregnancies, which will have a positive impact on the community's health and the economy as a whole.

Gingivitis can be prevented before it becomes periodontitis so that it can reduce the risk factors for periodontal disease in pregnant women such as premature babies and low birth weight babies (LBW)³⁴. The pregnant mother's

health and child can be improved by maintaining good oral health. The overall findings indicate that pregnant women's understanding and behavior need to be considerably improved. Improving oral health during pregnancy is important to minimize the possibility of redundant perinatal outcomes and to improve the quality of life for mother and baby.

This study has several restrictions in sample size. For further study, it is imperative to conduct data acquisition from a wider sample. In addition, longitudinal study, CPITN, and outcome of the treatment of periodontal disease need to be assessed among pregnant women.

Conclusions

This study indicated that the correlation between the GI and OHIS scores of pregnant women had a positive direction. The better of the OHIS, the lower the gingivitis status. In the future, it is important to develop antenatal care (ANC) program as an integral part of oral health promotion programs for pregnant women.

Declaration of Interest

The authors have no proprietary, financial or other personal interest of any nature or kind in any product, service and/or company presented in this article.

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