

The Relationship of Gravida, Gestational Age, and Education with Gingivitis and Periodontitis in Pregnant Women with Malocclusion

Hubungan Gravida, Usia Kehamilan, dan Pendidikan Terhadap Gingivitis dan Periodontitis pada Ibu Hamil dengan Maloklusi

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ABSTRACT

Hormonal changes, number of pregnancies (gravida), gestational age, education level, and the presence of malocclusion—especially if accompanied by the use of braces—can increase the risk of gingivitis and periodontitis in pregnant women. This study aims to analyze the relationship between gravida, gestational age, and education level on the incidence of gingivitis in pregnant women with malocclusion. The study involved 51 pregnant women who met the inclusion criteria and provided consent by signing an informed consent form. Interviews and oral screenings were conducted, and the data were analyzed using the Chi-squared test. The results of this study found that the number of pregnancies (gravida) had a significant relationship with the incidence of gingivitis ($p = 0.024$) and dental caries ($p = 0.029$). Gestational age showed a significant relationship with the incidence of periodontitis ($p = 0.003$) and dental caries ($p = 0.020$). Meanwhile, educational level did not show a significant relationship with gingivitis or periodontitis, but was significantly associated with dental caries ($p = 0.050$). It is concluded that there is a significant relationship between gravida, gestational age and education level with dental caries in pregnant women with malocclusion. Gestational age is significantly associated with periodontitis, and gravida is significantly associated with gingivitis.

Keywords: Gingivitis, gravida, malocclusion, periodontitis, pregnancy

ABSTRAK

Perubahan hormonal, jumlah kehamilan (gravida), usia kehamilan, tingkat pendidikan, dan adanya maloklusi, terutama jika disertai penggunaan kawat gigi, dapat memperburuk risiko gingivitis dan periodontitis pada ibu hamil. Penelitian ini bertujuan menganalisis hubungan antara gravida, usia kehamilan, dan pendidikan terhadap kejadian gingivitis pada ibu hamil dengan maloklusi. Subyek penelitian ini berjumlah 51 ibu hamil yang memenuhi kriteria inklusi dan memberikan kesediaan dengan menandatangani *inform concent*. Dilakukan wawancara serta skrining gigi dan mulut, lalu datanya dianalisis menggunakan uji Chi-Square. Hasil menunjukkan bahwa jumlah kehamilan (gravida) berhubungan signifikan dengan kejadian gingivitis ($p = 0,024$) dan karies gigi ($p = 0,029$). Usia kehamilan menunjukkan hubungan signifikan dengan kejadian periodontitis ($p = 0,003$) dan karies gigi ($p = 0,020$). Sedangkan tingkat pendidikan tidak berhubungan signifikan dengan gingivitis dan periodontitis, tapi signifikan berhubungan dengan karies gigi ($p=0,050$). Disimpulkan terdapat hubungan yang signifikan antara gravida, usia kehamilan dan tingkat pendidikan dengan karies gigi pada ibu hamil dengan maloklusi, usia kehamilan berhubungan signifikan dengan kejadian periodontitis, begitu juga gravida signifikan dengan gingivitis.

Kata kunci: Gingivitis, gravida, maloklusi, periodontitis, kehamilan

INTRODUCTION

During pregnancy, the body undergoes significant physiological changes, including shifts in hormone levels and immune responses, which can affect oral health.¹ The increased levels of estrogen and progesterone can lead to an exaggerated inflammatory response to plaque, particularly in the gums.² As a result, pregnant women are more prone to developing periodontal diseases like gingivitis, marked by symptoms such as redness, swelling, and bleeding gums.³

Pregnancy gingivitis is a condition that affects pregnant women, causing gums to become inflamed, red, swollen, and prone to bleeding. This is mainly due to hormonal changes, specifically the surge in estrogen and progesterone levels, which amplify the gums' reaction to plaque.^{4,5} The condition typically starts during the first trimester, reaches its peak around the eighth month, and then subsides as delivery approaches.⁶

The elevated hormone levels during pregnancy can trigger an inflammatory response by increasing the production of chemicals like TNF- α , IL-1, IL-6, and PGE2. Additionally, these hormonal changes can disrupt the balance of bacteria in the mouth, leading to an overgrowth of harmful bacteria such as *Porphyromonas gingivalis*, *Prevotella intermedia*, and *Tannerella forsythia*.⁷ If left unchecked, this inflammation can escalate into more severe condition known as periodontitis.⁸

Periodontitis is characterized by several clinical indicators, including the formation of periodontal pockets greater than 3mm, bleeding on probing, tooth mobility, gingival recession, periodontal pus, as well as the presence of clinical attachment loss (CAL) and bone resorption, which can be observed on radiographs.⁹ This condition poses a threat not only to oral health but also to the health of pregnant women, as it has been linked to increased risks of pregnancy complications, including premature birth, low birth weight (LBW), and preeclampsia.³

Malocclusion, a positional abnormality, can make optimal tooth cleaning difficult, leading to increased plaque accumulation and triggering gingival inflammation, which is a contributing factor to the severity of gingivitis and periodontitis in pregnant women.¹⁰ Pregnant women with malocclusion have a higher susceptibility to

gingivitis and periodontitis, especially if they lack proper oral hygiene education and behavior.¹¹

This condition becomes more complex if pregnant women use orthodontic appliances such as braces, as these appliances increase plaque retention around the teeth and braces, making oral hygiene more difficult to maintain and significantly increasing the risk of gingivitis.¹² Pregnancy gingivitis is one of the most common oral disorders in pregnant women, with a prevalence of up to 60–75%. In addition to hormonal changes, various other factors can influence the severity of gingivitis during pregnancy, including the number of pregnancies (gravida), gestational age, and educational level.¹³

Gravida, or the number of pregnancies a woman has experienced, is an essential factor that can influence oral health status during pregnancy, including the severity of gingivitis. Generally, pregnant women with more than one pregnancy (multigravida) have different experiences during pregnancy, including in terms of oral hygiene management and maintenance, compared to pregnant women experiencing their first pregnancy (primigravida).¹⁴

The severity of gingivitis may also increase with the number of pregnancies, due to the repeated hormonal changes that occur during each pregnancy.¹⁵ Repeated hormonal exposure in multigravida women may lead to a more severe cumulative inflammatory response if oral hygiene care is suboptimal.¹⁶

Gestational age and trimester are physiological factors that influence gingival health in pregnant women.¹⁷ Hormonal changes during pregnancy are not static; they can increase with advancing gestational age, particularly in the second and third trimesters, triggering an inflammatory response to bacterial plaque in the gingival tissue.²

Pregnancy can lead to changes in vascularization, accumulation of tissue fluid, and increased sensitivity of gingival tissue to local irritants, such as plaque and calculus. Therefore, pregnant women are more prone to gingivitis and pregnancy periodontitis, characterized by swelling, redness, spontaneous bleeding of the gums, and the presence of exudate and loose teeth.⁵

Educational level is one of the most influential social factors in shaping

knowledge, attitudes, and health behaviors, including those related to oral health.¹⁸ In pregnant women, education plays a crucial role in enhancing understanding of the importance of maintaining oral hygiene, recognizing signs of periodontal disease, and raising awareness of the need for regular dental checkups during pregnancy.¹⁹

Based on this background, this study aims to analyze the effects of gravidity, gestational age, and educational level on the severity of gingivitis in pregnant women with malocclusion. This related research is still rarely explicitly focused on pregnant women with malocclusion. Researchers are interested in investigating the influence of gravidity, gestational age, and educational level on gingivitis severity.

RESEARCH METHODS

This study is an analytic observational study with a cross-sectional design. The sample consisted of 51 pregnant women with malocclusions who underwent routine prenatal checkups at the Sedati Community Health Center and met the following inclusion criteria: (1) aged 20–35 years, (2) in their first–third trimester of pregnancy, (3) having a class 1–3 malocclusion based on Angle's classification, and (4) willing to sign an informed consent. Exclusion criteria included the pregnant women's knowledge of gingivitis, periodontitis, and their impact on the mother and fetus, as well as their history of dental and oral health care within the past 6 months.

Data reliability was enhanced by examiner training and the use of tools such as a sterile mouth mirror, retractor, and periodontal probe. The team conducted examinations to ensure consistency, but statistical inter-examiner reliability testing was not performed, that, as limitation of study.

Oral and dental screenings were conducted on all subjects. The screening included identifying reddened gums, gingival hyperplasia, sulcus depth, gingival recession, gingival abscesses, gingival fistulas, dental calculus, loose teeth, and dental caries. The tools used include: disposable mouth mirrors, sterile retractor, flashlights, and sterile probes.

This study has obtained ethical clearance from the ethics committee of Dentistry at Universitas Muhammadiyah Sidoarjo, numbered 087.01/II.3.AU/14.00/

C/PER/IV/2025. Before data collection, written informed consent was obtained from all participants. Data were analyzed using the Chi-Square test with a significance level of confidence 5% ($p < 0.05$).

RESULT

Table 1 shows characteristics in assessing the potential factors incidence of gingivitis such as pregnancy status, education level, and oral cavity condition. The majority of respondents had a secondary education (high school). Based on the number of pregnancies (gravida), more than half of the respondents were pregnant women in their first pregnancy (52.9%). Nearly all respondents had Class 1 malocclusion (96.1%) and 1 case of Angle Class 3 malocclusion. The majority of respondents (80.4%) did not use braces, only 19.6% of respondents used them and a small number of them had regular dental check-ups.

Table 1. Characteristics of Research Subject

Characteristics	Category	F	%
Education	Elementary School	2	3,9
	Junior High School	4	7,8
	Senior High School	32	62,7
	D3	2	3,9
	S1	10	19,6
	S2	1	2,0
Gravida	1	27	52,9
	2	15	29,4
	3	6	11,8
	4	2	3,9
	5	1	2,0
Pregnancy Age	First Trimester	13	25,5
	Second Trimester	20	39,2
	Third Trimester	18	35,3
Classification of Malocclusion	Class 1	49	96,1
	Class 2	1	2,0
	Class 3	1	2,0
Orthodontic Appliance Bracket	No	41	80,4
	Yes	10	19,6
Last Control Bracket	No	45	88,2
	Yes	6	11,8

According to Table 2, it is evident that the majority of respondents exhibited signs of gingivitis. As many as 62.7% of pregnant

women showed redness on the gums. This suggests that more than half of the population has experienced gum inflammation, ranging from mild to moderate.

Local factors contributing to the development of gingivitis are also highly prevalent. The majority of respondents (94.1%) had dental plaque, indicating low oral hygiene levels, which is a leading cause of gum irritation and inflammation. Additionally, 76.5% of pregnant women have dental caries.

Gingival sulcus depth examinations showed that the majority of respondents (76.5%) were within normal limits at 2 mm.

Table 2. Oral Cavity Condition of Pregnant Women with Malocclusion

Oral Cavity Condition	Category	F	%
Gingival Redness	No	19	37.3
	Yes	32	62.7
Gingival Hyperplasia	No	26	51.0
	Yes	25	49.0
Tartar	No	3	5.9
	Yes	48	94.1
Dental Caries	No	12	23.5
	Yes	39	76.5
Stain	No	46	90.2
	Yes	5	9.8
Gingival Sulcus Depth	0	2	3.9
	2 mm	39	76.5
	3 mm	8	15.7
	4 mm	2	3.9
Gingival Recession	No	42	82.4
	Yes	9	17.6
Exudate/Blood Flow Present	No	48	94.1
	Yes	3	5.9
Gingival Abscess	No	50	9.8
	Yes	1	2.0
Gingival Fistel	No	50	98.0
	Yes	1	2.0
Rocking Teeth	No	40	78.4
	Yes	11	21.6

However, 15.7% had a depth of 3 mm and 3.9% had a depth of 4 mm, indicating progression toward periodontitis. A total of

17.6% of respondents reported experiencing gingival recession, indicating damage to the supporting tissues of their teeth. Additionally, 5.9% of respondents exhibited signs of exudate or pus flow, and 2% experienced abscesses or gingival fistulas, indicating active and progressive infection in the periodontal tissues, a characteristic of periodontitis. Loose teeth, as an advanced indicator of periodontal tissue damage, were found in 21.6% of respondents. This indicates that some pregnant women have experienced a loss of tooth support is compromised due to advanced periodontal disease.

Table 3 shows an analysis of the oral cavity condition based on the number of pregnancies (gravida), which most pregnant women, both primigravida and multigravida, experience various oral health problems. However, there is no statistically significant relationship between the variables. Gingival redness as an early sign of gingivitis was relatively high, particularly in gravida 2 (73.3%) and gravida 5 (100%), while gingival hyperplasia was commonly found in gravida 1 and 2. Dental calculus was the most common finding, present in nearly all respondents, with the highest prevalence in gravida 2 to 5. Dental caries also showed an increasing trend with the number of pregnancies in the first pregnancy in the fifth pregnancy, although this was not significantly relationship with gravida.

Table 3. The Relationship of Gravida to Gingivitis, Periodontitis, and Dental Caries in Pregnant Women with Malocclusion

Gravida	Gingivitis		Sig.
	No	Yes	
Primigravida	12 (44.4%)	15 (55.6%)	0.024
Multigravida	7 (29.2%)	17 (70.8%)	
Gravida	Periodontitis		Sig.
	No	Yes	
Primigravida	20 (74.1%)	7 (25.9%)	0.109
Multigravida	20 (83.3%)	4 (16.1%)	
Gravida	Dental Caries		Sig.
	No	Yes	
Primigravida	8 (29.6%)	19 (70.4%)	0.029
Multigravida	4 (16.7%)	20 (83.3%)	

Additionally, dental stains were found in a small proportion of respondents, particularly in the first and third pregnancies. Gingival sulcus depth was mostly normal, but there were a few cases in the first pregnancy showing pathological depth (4 mm). Gingival recession was more common in the first and second pregnancies, while exudate, abscesses, and fistulas were very rare. Loose teeth, as an indicator of damage to the supporting structures of the teeth, were more common in women with their first pregnancy (25.9%) and decreased in subsequent pregnancies.

Based on the table above, the significance value (Sig.) of 0.024 is lower than the 0.05 threshold. This indicates a significant relationship between pregnancy status (gravida) and the incidence of gingivitis. The table shows that 15 respondents (55.6%) with a history of primigravida (<2 pregnancies) experienced gingivitis, while 17 respondents (70.8%) with a history of multigravida (≥ 2 pregnancies) also experienced gingivitis.

The significance value (Sig.) of 0.109 is greater than the 0.05 threshold. This indicates no significant relationship between pregnancy status (gravida) and the incidence of periodontitis. The table shows that 20 respondents (71.4%) with a history of primigravida (<2 pregnancies) did not experience periodontitis, and 20 respondents (83.3%) with a history of multigravida (≥ 2 pregnancies) also did not experience periodontitis.

The significance value (Sig.) of 0.029 is smaller than the significance limit of 0.05. This indicates that there is a significant relationship between pregnancy status (gravida) and the incidence of dental caries. The table shows that 19 respondents (70.4%) with a history of primigravida pregnancies (<2 times) experienced dental caries, while 20 respondents (83.3%) with a history of multigravida pregnancies (≥ 2 times) also experienced dental caries.



Figure 1. Oral Condition of

Pregnant Women with Malocclusion Undergoing Orthodontic Treatment



Figure 2. Oral Condition of Pregnant Women with Malocclusion Untreated Orthodontic

Table 4. The Relationship of Pregnancy Age to Gingivitis, Periodontitis, and Dental Caries in Pregnant Women with Malocclusion

Pregnancy Age	Gingivitis		Sig.
	No	Yes	
Trimester 1	6 (46.2%)	7 (53.8%)	0.162
Trimester 2	6 (30.0%)	14 (70.0%)	
Trimester 3	7 (38.9%)	11 (61.1%)	
Pregnancy Age	Periodontitis		Sig.
	No	Yes	
Trimester 1	8 (61.5%)	5 (38.5%)	0.003
Trimester 2	17 (85.8%)	3 (15.0%)	
Trimester 3	15 (83.3%)	3 (16.7%)	
Pregnancy Age	Dental Caries		Sig.
	No	Yes	
Trimester 1	5 (38.5%)	8 (61.5%)	0.02
Trimester 2	5 (25.0%)	15 (75.0%)	
Trimester 3	2 (11.1%)	16 (88.9%)	

Based on the table 4 show the majority respondents (70.0%) in the second trimester (14–26 weeks) experienced gingivitis, and no significant relationship between pregnancy age with gingivitis. The significant relationship between gestational age and the incidence of periodontitis, with mostly respondents (38.5%) in first trimester (0–13 weeks) experienced periodontitis. The significant relationship between gestational age and the incidence of dental caries. The table shows that majority respondents (88.9%) in their third trimester (27–40 weeks) experienced dental caries.

Based on the table 5 shows that mostly respondents (65.8%) with low education levels (elementary, junior high, senior high/vocational high school) experienced gingivitis. The majority respondents (53.8%) with higher education levels (D3, D4, S1) also experienced gingivitis. A significant relationship between education level and incidence of dental caries.

Table 5. The Relationship of Education to Gingivitis, Periodontitis, and Dental Caries in Pregnant Women with Malocclusion

Education	Gingivitis		
	No	Yes	
Low	13 (34.2%)	25 (65.8%)	0.442
High	6 (46.2%)	7 (53.8%)	
Education	Periodontitis		
	No	Yes	
Low	31 (81.6%)	7 (18.4%)	0.35
High	9 (69.2%)	4 (21.6%)	
Education	Dental Caries		
	No	Yes	
Low	6 (15.8%)	32 (84.2%)	0.05
High	6 (46.2%)	7 (53.8%)	

DISCUSSION

This study shows that there is a significant relationship between gravida and the incidence of gingivitis and dental caries in pregnant women with malocclusion, but not with periodontitis.^{15,16}

This research aligns with research by Helmi et al. (2024), which showed that increasing the number of pregnancies can increase repeated hormonal exposure, contributing to the susceptibility of periodontal tissues to inflammation. This explains the increased incidence of gingivitis and caries in multigravida groups.²⁰

However, no significant association was found between pregnancy and periodontitis. This suggests that even if gingival inflammation occurs, it may not necessarily progress to more severe periodontal disease, especially if supporting factors such as oral hygiene remain adequate.²¹ This differs from research by Anadure et al. (2024), who found that pregnancy with periodontitis was significantly associated with premature birth and low birth weight (LBW) babies.²²

Gestational age has also been shown to be significantly associated with the incidence of periodontitis and dental caries, but not with gingivitis. This supports the theory that more significant hormonal changes occurring in the second and third trimesters lead to a higher inflammatory response and plaque accumulation, which may increase the risk of periodontitis and caries as gestational

age increases.^{2,17} Previous studies have shown that gestational age, particularly in cases of preterm birth, was significantly associated with increased incidence of periodontitis and dental caries, but showed no significant difference in gingivitis. This indicates that periodontitis and caries are more influenced by systemic changes during pregnancy, while gingivitis is localized and highly dependent on oral hygiene.²³

Meanwhile, education level showed no significant association with gingivitis or periodontitis, but it did have a significant association with the incidence of dental caries. Respondents with lower education levels had a higher prevalence of caries. This reinforces the role of education as a social determinant of oral health behavior.^{18,19}

In a study by Oliveira et al. in 2023, a significant association was found between the education level of pregnant women and the incidence of gingivitis. Mothers with lower education tended to have higher rates of gingivitis. This was related to a lack of knowledge about oral hygiene and periodontal health. A significant association was also found between education and periodontitis. The lower the education level, the greater the risk of pregnant women experiencing periodontitis. Lower education was correlated with a higher incidence of dental caries. Lack of knowledge about healthy eating patterns and proper tooth brushing techniques was the main contributing factor.²⁴

Malocclusion and orthodontic appliance use also influence oral health status. Although not the primary focus of the statistical analysis, the presence of malocclusion and the use of orthodontic brackets can theoretically worsen oral hygiene due to plaque retention.^{10,12}

Overall, these results demonstrate the importance of a promotive and preventive approach, as pregnant women with multiple pregnancies and advanced gestational age, especially those with low educational levels, to prevent the development of further periodontal disease and caries.

This study has several limitations that should be considered. First, the lack of a control group, such as non-pregnant mothers, prevented direct comparison of specific hormonal influences during pregnancy; thus, the results may not fully represent the effects

of hormones on oral health. Second, statistical inter-examiner reliability was not performed, therefore ensuring consistency of assessments between examiners.

Furthermore, not all local parameters were measured using validated standard scales or indices. For example, gingival redness and hyperplasia were assessed only visually, caries was identified based on the presence of active cavities, tooth staining was evaluated without a specific classification index, and although sulcus depth was measured with a periodontal probe, the measurements did not use the CPI index or complete periodontal records.

For further research, it is recommended to use a non-pregnant control group, implement validated standard indices such as the Gingival Index, DMF-T, or Plaque Index, and incorporate statistical inter-examiner reliability testing and calibration training to improve the validity and reliability of the data obtained.

CONCLUSION

Based on the results of this study, it can be concluded that there is a significant association between pregnancy status (gravida) and the incidence of gingivitis and dental caries. However, no significant association was found with the incidence of periodontitis. Furthermore, gestational age also showed a significant association with the incidence of periodontitis and dental caries, but not with gingivitis. Meanwhile, education level was not significantly associated with gingivitis and periodontitis, but was significantly related to the incidence of dental caries.

This study emphasizes the importance of regular monitoring and education regarding oral health during pregnancy, especially for multiple pregnancies, advanced gestational age, and lower educational levels, to prevent complications and improve the quality of oral health during pregnancy.

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