

Systematic Review

Prevalence and Risk Factors of Periodontal Disease During Pregnancy In Indonesia: A Literature Review

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ABSTRACT

Introduction: Periodontal disease during pregnancy continues to be a significant worldwide health concern with wide-ranging systemic effects. The association between maternal periodontitis and unfavourable pregnancy outcomes (APOs) has been shown by numerous systematic reviews. Studies conducted worldwide reveal significant variations in periodontitis prevalence and associated risk factors. This literature review aims to determine the prevalence and risk factors of periodontal disease during pregnancy in Indonesia. Article searches were conducted in 7 databases: PubMed, ProQuest, ScienceDirect, Scopus, Garuda, EBSCOhost, and Google Scholar.

Review: This study followed the predefined PEOS eligibility criteria, with a population consisting of pregnant women of all ages and trimesters in Indonesia, various risk factors associated with periodontal disease as the exposure, and periodontal disease as the outcome. Inclusion criteria were original research published between January 2015 and April 2026, written in English or Indonesian. A total of 312 studies were identified, and 18 studies were included. The reported prevalence of periodontal disease during pregnancy in Indonesia ranged from 4.4% to 100%. Several associated risk factors found are oral hygiene, particularly calculus accumulation, crowded teeth, frequency of toothbrushing, betel nut consumption, smoking status, level of education, living area, gestational age, stress, health motivation, and contraceptive use history.

Conclusion: The prevalence of periodontal disease during pregnancy in Indonesia has remained quite high over the past decade. The majority of pregnant women in Indonesia need intervention in the form of Dental Health Education (DHE) and dental scaling.

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INTRODUCTION

Periodontal disease remains a persistent global health challenge, with its prevalence exhibiting a concerning upward trend. According to the 2019 Global Burden of Disease (GBD) Study, severe periodontitis affected approximately 1.1 billion individuals, representing a nearly twofold increase since 1990. The consistent rise in age-standardized incidence and prevalence rates underscores the critical necessity for sustained research and targeted interventions. Beyond its clinical impact, the condition imposes a staggering economic burden; in 2018, direct healthcare expenditures in the US and Europe reached \$3.49 billion and €2.52 billion, respectively, while indirect costs escalated to an estimated \$150.57 billion and €156.12 billion.^{1,2}

Periodontal disease during pregnancy remains a major global health challenge with extensive systemic implications. Numerous systematic reviews have demonstrated a crucial connection between maternal periodontitis and adverse pregnancy outcomes (APOs), including an increased risk of preterm birth, Low Birth Weight (LBW), preeclampsia, and neonatal mortality.³⁻⁵ Periodontal disease during pregnancy contributes 5% - 38% to the incidence of preterm birth, 6% - 41% to the incidence of low birth weight (LBW), and 10% - 55% to the incidence of preeclampsia.⁴ Another study found an increased risk of preterm birth by 1.6 times ($p < 0.001$), incidence of LBW by 1.6 times ($p < 0.001$), and preterm birth with LBW by 3.4 times, after controlling for various confounding variables.³ Despite its clinical importance, epidemiological studies continue to show substantial variations in prevalence and risk factors across different global populations.^{6,7}

Global epidemiological data reveal significant disparities in periodontitis prevalence and its

associated risk factors. Recent studies report prevalence rates ranging from 37.1% and 38.8% in Colombia and Ethiopia to as high as 59.8% in China and 100% in certain Nigerian cohorts.⁶⁻⁹ These variations are driven by a complex interplay of socioeconomic status, geographic location, and pregnancy-specific factors, including parity, advancing trimesters, and physiological changes.^{10,11} Although routine dental visits and non-surgical periodontal therapies have demonstrated clinical efficacy, the optimal frequency and duration of such interventions remain subjects of ongoing evaluation.^{12,13}

Periodontal disease is the second most common dental and oral health issue in Indonesia, with a prevalence of over 70%.¹⁴ The Indonesian Dental Association states that periodontitis is a common dental and oral health issue during pregnancy in Indonesia.¹⁵ This condition requires attention, considering that 98.4% of Indonesian women aged 10–54 have a history of pregnancy, with 2.7% currently pregnant, according to national data.¹⁶ Recent study based on national surveys has identified periodontitis in 35% of pregnant women, citing education level, geographic location, gestational age, toothbrushing habits, and smoking status as significant predictors.¹⁷ The severity of this problem is further demonstrated by several studies, which show that up to 73% of pregnant women have gingival bleeding, and that the prevalence of 4–5 mm periodontal pockets increases significantly from the first trimester (12.1%) to the second (48.5%).¹⁸ Oral hygiene, dental calculus, crowding teeth, and toothbrushing frequency were found as the main determinants of disease progression in other regional studies that report even higher prevalence rates, ranging from 73.2% to 87.2%.¹⁹⁻²¹

According to the 2025 WHO Recommendations on Maternal Health, a mother's overall health during pregnancy, childbirth, and the postpartum period is associated with her dental health. The concepts of integrated care, which include promotive, preventative, and curative activities throughout the gestational timeframe, must be followed when providing maternal care.²² In the Indonesian context, however, the implementation of such integrated care faces significant challenges due to the fragmented nature of epidemiological data across diverse regions and demographics. While localized studies have identified various determinants of periodontal disease, the lack of a unified evidence base may hinder the development of a unified national strategy. Therefore, it is essential to synthesize existing evidence and clarify the potential risk factors unique to the Indonesian population. This literature review aims to evaluate the prevalence and risk factors associated with periodontal disease during pregnancy in Indonesia.

REVIEW

This study followed the guidelines outlined in the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) statement. Article searches were conducted by using PubMed, ProQuest, ScienceDirect, Scopus, Garuda, and EbscoHost databases, while Google Scholar was manually searched in order to add the articles. This study followed the predefined PEOS eligibility criteria. The study population consisted of pregnant women of all ages and trimesters in Indonesia. The exposure addressed various risk

factors associated with periodontal disease. The outcome was periodontal disease diagnosed using various clinical parameters or based on participants' self-reported periodontal conditions. For this review, the term periodontal disease encompassed both gingivitis and periodontitis because the included studies employed different diagnostic criteria, including the Community Periodontal Index of Treatment Needs (CPITN), Community Periodontal Index (CPI), Gingival Index (GI), periodontal pocket depth, bleeding on probing (BoP), or self-reported periodontal conditions. Inclusion criteria were original research with either observational or experimental study designs, published between January 1, 2015, and April 1, 2026, written in English or Indonesian, had undergone the peer review process, and were accessible in full text. Boolean search used was (pregnanc* OR gestation) AND (Risk Facto* OR Risk Factor Scor* OR Risk Scor* OR Social Risk Facto* OR Health Correlates) AND (Periodontal Diseas* OR Parodonto* OR Periodontit* OR Gingivit*) AND Indonesia. Two reviewers, LHA and IA, conducted the article selection procedure by reading each title and abstract independently. Full-text publications that meet all inclusion criteria and provide the required information are included in the analysis. The final judgement is left to the third reviewer (FS) in the event of a disagreement. A table that includes details about the authors, year of publication, study design, sample size, and key findings is used to extract data from each article.

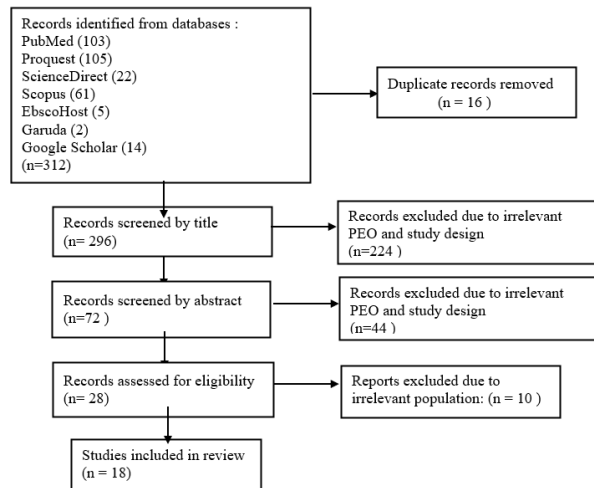


Figure 1. Prisma diagram

Seven databases yielded a total of 312 studies. Due to duplication, 16 articles were eliminated. After examining the titles of the remaining 296 papers, 224 that did not fit the PEO criteria and had inappropriate study designs were eliminated. After reviewing the abstracts of the remaining 72 papers, 44 that did not fit the PEO criteria and had unrelated study designs were eliminated. After reviewing the full texts of the remaining 28 articles, 18 included the necessary information.

This literature review comprises 18 publications, of which 17 are cross-sectional studies, and

1 is a quasi-experimental study. The Joanna Briggs Institute Critical Appraisal tools for use in the JBI Systematic Reviews Checklist for Analytical Cross-Sectional Studies and Quasi-Experimental Appraisal Tools were used to assess bias risk. Tables 1 and 2 present the findings of the study quality evaluation across different study designs. As many as 9 of the 17 cross-sectional studies have a low risk of bias, while 7 studies have a medium risk and 1 has a high risk. One included quasi-experimental study, however, has a low risk of bias.

Table 1. Risk of bias evaluation for cross-sectional studies

	1	2	3	4	5	6	7	8	Overall
Andayani et al. (2019)	+	+	+	×	+	+	×	+	Low
Setijanto et al. (2021)	+	+	+	+	+	+	+	+	Low
Ngadilah et al. (2022)	+	+	+	×	×	×	×	+	Medium
Oktarina et al. (2025)	+	+	+	×	+	+	×	+	Low
Rikawarastuti et al. (2016)	+	+	+	+	+	+	+	+	Low
Tedjosasongko et al (2019)	+	+	+	+	×	×	+	×	Medium
Azhria et al. (2024)	+	+	+	+	×	×	+	×	Medium
Novita et al. (2022)	+	+	+	+	×	×	+	+	Low
Hidayat et al. (2021)	+	+	+	+	×	×	+	+	Low
Imansyah et al. (2025)	+	+	+	+	×	×	+	+	Medium
Pujiastuti (2023)	+	+	-	+	×	×	+	+	Medium

Sumerti et al. (2019)	+	+	+	-	X	X	-	+	Medium
Rohmah et al. (2025)	+	+	+	+	X	X	+	+	Low
Sunarto et al. (2016)	+	+	+	+	X	X	-	+	Medium
Rosanti et al. (2023)	+	+	+	+	X	X	+	+	Low
Efiani et al. (2025)	-	+	-	+	X	X	+	-	High
Fuadiyah et al. (2024)	+	+	+	+	X	X	+	+	Low

1=Were the criteria for inclusion in the sample clearly defined; 2=Were the study subjects and the setting described in detail; 3=Was the exposure measured in a valid and reliable way; 4=Were objective, standard criteria used for measurement of the condition; 5=Were confounding factors identified; 6=Were strategies to deal with confounding factors stated; 7=Were the outcomes measured in a valid and reliable way; 8=Was appropriate statistical analysis used; Overall=Overall Risk of Bias

 = Yes;
  = Unclear;
  = No

Table 2. Risk of bias evaluation for quasi experimental study

	1	2	3	4	5	6	7	8	9	Overall
Firmansyah et al (2025)	+	-	+	X	X	+	+	+	+	Low

1= Is it clear in the study what is the 'cause' and what is the 'effect'; 2= Were the participants included in any comparisons similar; 3=Were the participants included in any comparisons receiving similar treatment/care, other than the exposure or intervention of interest; 4=Was there a control group; 5=Were there multiple measurements of the outcome both pre and post the intervention/exposure; 6=Was follow up complete and if not, were differences between groups in terms of their follow up adequately described and analyzed; 7=Were the outcomes of participants included in any comparisons measured in the same way; 8=Were outcomes measured reliably; 9=Was appropriate statistical analysis used; Overall=Overall Risk of Bias

 = Yes;
  = Unclear;
  = No

Table 3. Data extraction from eligible studies

Author (year)	Area/City	Number and Age of Samples	Study Design	Prevalence of Periodontal Disease	Main Result
Andayani et al. (2019)	Indonesia	1,733 (15-40 years)	Cross-sectional	4.4%	Risk factors associated with periodontal disease during pregnancy were : 1.Calculus (POR = 4.297; 95% CI=2.047-9.023) 2.Crowding Teeth (POR = 2.126; 95% CI= 1.232-3.669). 3.Toothbrushing Frequency (POR = 2.543; 95% CI=1.041-6.210).
Setijanto et al. (2021)	Surabaya	47 (17-45 years)	Cross- sectional	100%	All pregnant women in this study experienced periodontal disease, with the majority having a CPI score of 3 (70.2%) and a mean and standard deviation of 3.39 ± 1.344. There was a significant increase in the knowledge of pregnant women after using the mobile application (p = 0.000). The use of mobile applications in monitoring dental and oral health has proven effective in increasing the knowledge of oral health among pregnant women.
Ngadilah et al. (2022)	Kupang	40 (17-40 years)	Cross-sectional	66.1%	The majority of pregnant women have a high frequency of betel nut consumption, up to 5 times a day (63.9%). There is a significant relationship between the habit of consuming betel nut and the condition of periodontal tissue (p < 0.05). Pregnant women who consume betel nut tend to experience more severe gingival bleeding (p < 0.05).

Oktarina et al. (2025)	Indonesia	8,902 (13-54 years)	Cross-sectional	35%	Periodontal disease in pregnant women in Indonesia is significantly influenced by education level (AOR=1.25; 95% CI= 1.01-1.54; p=0.041), place of residence (AOR = 0.88; 95% CI= 0.80-0.96); p=0.005), gestational age (AOR=0.86; 95% CI=0.77-0.96; p=0.007), brushing time (AOR=0.56; 95% CI=0.49-0.65; p<0.001), and smoking habits (AOR=1.83; 95% CI=1.34-2.51; p<0.001).
Rikawarastuti et al. (2016)	Jakarta	101 (≥ 20 years)	Cross-sectional	73.2%	Up to 73.2% of pregnant women have periodontal disease, with 66.3% having calculus and 6.9% having 4-5 mm deep periodontal pockets. Oral hygiene has the greatest influence on periodontal health in pregnant women (OR=23.283; 95% CI=2.621-206.834; p=0.005).
Tedjosa-songko et al. (2019)	Surabaya	98	Cross-sectional	73.4%	Gingival bleeding affects up to 73.4% of pregnant women, with 34% having a pocket depth of 4–5 mm and 2% having a pocket depth greater than 6 mm. Between the first and second trimesters, the prevalence of a pocket depth of 4–5 mm rose from 12.1% to 48.5%, before marginally declining in the third trimester (39.4%).
Azhria et al. (2024)	Jember	70 (16-45 years)	Cross-sectional	100%	The majority of pregnant women have a CPITN score of 2 (75.71%), and the rest have a CPITN score of 3 (24.29%).
Novita et al. (2022)	Malang	102 (12-45 years)	Cross-sectional	87.3%	The majority of pregnant women (56.86%) have mild gingivitis. Gingivitis is significantly impacted by knowledge level (p = 0.016). Mothers with low knowledge tend to have worse gingival conditions. Gingivitis severity is most significantly influenced by oral hygiene status (p<0.001).
Hidayat et al. (2021)	Bandung	40 (17-45 years)	Cross-sectional	100%	The majority of responders (60%) had a CPI score of 2. Up to 97.5% of pregnant women require scaling and dental health education (TN II). The majority of pregnant women (70%) report moderate stress. There was a significant positive relationship between stress level and CPITN score (r=0.389; p = 0.013).
Imansyah et al. (2025)	Kediri	75	Cross-sectional	97.4%	The majority of pregnant women were aged between 24 and 29 years (44%) with a second-trimester pregnancy (45.3%). Most of them (62.7%) experienced moderate category gingivitis. There was a significant positive relationship between gestational age and gingivitis status (r=0.746; p<0.001).
Pujiastuti (2023)	Jember	50 (17-45 years)	Descriptive	100%	The average GI was 0.79 in the plantation area and 0.57 in the coastal area. The average CPITN was 2.2 in the plantation area and 2.12 in the coastal area. The average OHI-S was 2.23 in the plantation area and 2.19 in the coastal area.
Sumerti et al. (2019)	Bali	420	Cross-sectional	38.8%	Of the 163 pregnant women suffering from chronic periodontitis, the majority had a poor debris index (46.6%), a moderate calculus index (71.6%), consumed cariogenic

					food 3 times a day (46%), and were in the third trimester of pregnancy (40.5%). There was a significant relationship between the debris index ($r = 0.187$; $p = 0.017$) and the calculus index ($r = 0.783$; $p = 0.000$) with the occurrence of chronic periodontitis.
Rohmah et al. (2025)	Nganjuk	30	Cross-sectional	100%	The majority of pregnant women were moderately motivated to maintain good oral hygiene (56.7%) and had mild gingivitis (60%). There was a substantial and statistically significant correlation between motivation and gingivitis ($p = 0.714$; $p = 0.001$).
Sunarto et al. (2016)	Jakarta	105 (20-36 years)	Cross-sectional	66.7%	Haemoglobin (10.56 ± 0.89 g/dL) and erythrocyte (3.73 ± 0.71 million/mcL) levels in the gingivitis group showed a significant difference ($p < 0.05$). There is a strong correlation between hematologic levels in the first trimester of pregnancy and gingivitis.
Rosanti et al. (2023)	Jember	30 (16-40 years)	Cross-sectional	96.7%	Periodontal disease affected 33.3% of pregnant women who used hormonal injectable contraception every once per month. The incidence of gingivitis in pregnant women is significantly correlated with the history of contraceptive use ($p = 0.049$).
Efiani et al. (2025)	Kendari	20	Cross-sectional	75%	There is a relationship between knowledge regarding dental and oral health and gingival status in pregnant women ($p < 0.001$)
Fuadiyah et al. (2024)	Bangkalan, East Java	56 (17-44 years)	Cross-sectional	100%	No statistically significant relationship between pregnant women's knowledge of dental and oral health maintenance practices and their gingivitis status ($p = 0.519$)
Firmansyah et al. (2025)	Bangkalan, East Java	83	Quasi Experimental	100%	Gargling with the 10% green betel leaf decoction has a significant effect on reducing gingivitis in pregnant women ($p < 0.001$).

Prevalence of Periodontal Disease During Pregnancy in Indonesia

Studies in various regions of Indonesia show different prevalence rates of periodontal disease during pregnancy. On the island of Java, there was a variation in prevalence between regions: Jakarta (66.7% - 73.2%),^{19,23} Bandung (100%)²⁴, Surabaya (73.4% - 100%),^{18,25} Kediri (97.4%),²⁶ Malang (87.3%),²⁰ Nganjuk (100%),²⁷ Jember (96.7%-100%),²⁸⁻³⁰ and Bangkalan (100%).³¹⁻³² Outside of Java, there was a high prevalence in the city of Kupang (66.1%) and Kendari (75%), which was

very different from the prevalence in Bali (38.8%).³³⁻³⁵ These results are in line with a systematic review, which found that the global prevalence of pregnancy gingivitis indeed ranges from 30% to 100%.³⁶ A recent study also found an average prevalence of 60%–75% in a multiracial population.³⁷

The secondary data analysis from the National Basic Health Research (*Riskesdas*) shows an intriguing variation. A prevalence of 35% was found based on data from *Riskesdas* 2018, while a significantly lower prevalence (4.4%) was reported in the earlier study using *Riskesdas* 2013 data.^{17,21} The

various backgrounds of the data collectors and the methodologies used for data collection could be the cause of this discrepancy. The *Riskesdas* data gathering typically uses a broad visual assessment without a particular clinical parameter. This approach is less sensitive when it comes to early detection of periodontal disease.

A systematic review involving studies from various countries, including Brazil, Japan, Romania, China, and South Africa, found that the prevalence of periodontal disease during pregnancy ranged from 7.7% to 76.7%, depending on the diagnostic criteria employed.³⁸ Clinical parameters that integrate the assessment of probing pocket depth (PPD), clinical attachment loss (CAL), and bleeding on probing (BoP) exhibit higher specificity and are more suitable for confirming the disease. These criteria have also been widely utilized as the gold standard in collecting data on periodontal disease.³⁹ Conversely, self-reported criteria in other studies demonstrated low diagnostic accuracy, with sensitivity ranging only between 10.8% and 31.1%.³⁸ This global phenomenon demonstrates that visual examination methods or self-reported questionnaires can lead to underreported figures compared to examinations utilizing objective clinical parameters.

Risk Factors of Periodontal Disease During Pregnancy in Indonesia

Local factors remain the primary determinant of periodontal disease during pregnancy, despite biological hormonal fluctuations serving as a predisposing baseline. Debris and calculus accumulation have been identified as significant predictors across various regional studies—including those conducted in Jakarta, Malang, Jember, and Bali—as well as in national data.^{19,20,21,29,30,34} Pregnant women with poor oral hygiene exhibit an up to 23-fold

increased risk of developing periodontal tissue destruction.¹⁹ Furthermore, the presence of calculus increases the risk of periodontal disease in pregnant women by up to 4-fold.²¹ Dental calculus provides a favorable surface for plaque retention and bacterial colonization. This cannot be eradicated through conventional toothbrushing alone. Professional dental scaling should be considered when clinically indicated. Crowded teeth also increase the risk of gestational periodontal disease by up to 2-fold, as this anatomical condition compromises independent plaque control.²¹

Two studies found a significant relationship between gestational age and periodontal disease in pregnant women. According to the national data, third-trimester pregnant women experience a 14% reduction in risk compared to first-trimester pregnant women. These results differ from the findings in Kediri, which state that the severity of gingivitis increases with the progression of pregnancy trimesters.^{17,26} Pregnancy creates a physiologic environment that increases susceptibility to periodontal inflammation and periodontal tissue destruction due to the substantial fluctuations of estrogen and progesterone. The elevation of these two hormones induces vasodilation and stimulates the production of pro-inflammatory mediators, rendering the gingival tissues hypersensitive even in the presence of minimal plaque accumulation. Elevated progesterone levels also suppress the chemotactic and phagocytic activities of neutrophils, thereby diminishing host resistance against bacterial invasion. These hormonal shifts create a favorable intraoral microenvironment for the proliferation of pathogenic anaerobic bacteria, such as *Porphyromonas gingivalis*, *Bacteroides* spp., and *Prevotella intermedia*. These microorganisms trigger the formation of gingival pseudopockets and subsequent periodontal tissue degradation. This susceptibility is further

exacerbated by emesis gravidarum, or usually called morning sickness, with the accompanying nausea and vomiting inducing a more acidic intraoral environment.²⁶

A study in Jember demonstrated that the pre-pregnancy utilization of hormonal contraceptives also exhibits a significant association with the incidence of pregnancy gingivitis. Prolonged hormonal exposure is hypothesized to modify gingival vascular sensitivity before conception.²⁸ Another study by Sunarto et al. revealed a negative correlation between the severity of periodontal disease and maternal hematological status. Pregnant women suffering from gingivitis and periodontitis exhibited significantly lower levels of hemoglobin (Hb) and erythrocytes. Chronic periodontal infection triggers the release of pro-inflammatory cytokines, specifically interleukin-1 (IL-1), interleukin-6 (IL-6), and tumor necrosis factor-alpha (TNF-alpha), which can suppress bone marrow hematopoiesis, particularly during the initial trimester of pregnancy.²³

A study in Kendari identified a significant correlation between oral health knowledge and the gingival status of pregnant women.³⁴ Conversely, a study in Bangkalan yielded different results.³¹ Knowledge serves an essential role in modulating health behaviors. Pregnant women with higher health literacy demonstrate greater awareness regarding oral hygiene maintenance. However, an adequate level of oral health knowledge does not consistently correlate with a lower gingival inflammation index. This disparity may be attributed to the physical barriers associated with pregnancy, such as nausea and an exaggerated gag reflex during toothbrushing, which generate a discrepancy between theoretical understanding and routine self-care practices.

The deficiency in maternal oral health literacy is often compounded by misconceptions and

misleading myths. Examples include the erroneous belief that frequent toothbrushing weakens the enamel or that dental treatments exert a deleterious effect on fetal development.⁴⁰ Other literature notes a pervasive uncertainty among expectant mothers regarding the optimal gestational timing for seeking professional dental care. Interprofessional collaboration and repeated educational reinforcements from diverse healthcare practitioners would significantly benefit pregnant populations with low health literacy.⁴¹

Pregnant women with low educational attainment exhibit a 1.25-fold higher risk of developing periodontal disease. Low education limits information access, comprehension, and general health literacy.¹⁷ Conversely, higher health literacy is associated with better preventive oral health behaviors.

Varied findings have emerged regarding geographic location. Data from *Riskesdas* 2018 reported that pregnant women residing in rural areas experienced a 12% risk reduction for periodontal disease compared to their urban counterparts.¹⁷ This observation contrasts with a Colombian study, which indicated that rural pregnant women face higher social inequities and structural barriers to healthcare facilities, thereby increasing their vulnerability to periodontal disease.⁸ These conflicting data suggest that geographical characteristics exert disparate impacts across globally diverse populations.

A study in Jember revealed that pregnant women living in coastal regions present distinct dietary patterns characterized by a high intake of phosphate-rich seafood and the consumption of well water rich in calcium minerals. These dietary and environmental factors accelerate the mineralization of dental plaque into calculus, explaining why the prevalence of calculus in certain coastal regions reaches 100%.³⁰ Furthermore, another study in

Kupang determined that the traditional practice of betel nut chewing exacerbates periodontal tissue degradation in pregnant women. Arecoline, the primary active alkaloid in betel nut, exhibits cytotoxic effects on periodontal fibroblasts and impedes wound healing. Consequently, pregnant women who consume betel nut tend to experience more severe gingival bleeding compared to non-users.³³

A study in Bandung established a significant association between maternal stress levels—particularly during the third trimester prior to parturition—and increased periodontal pocket depth. Stress stimulates the adrenal cortex to release cortisol. High salivary cortisol levels can downregulate the localized gingival immune response, thereby facilitating plaque-induced bacterial inflammation. Additionally, pregnant women experiencing high levels of psychological stress often exhibit self-neglect, including the omission of daily toothbrushing, which further compromises oral health outcomes.²⁴

Pregnant women who fail to practice daily toothbrushing exhibit an up to 2.5-fold higher risk of developing periodontal disease. This behavioral deficit is often secondary to the physiological changes of pregnancy, such as heightened nausea and an exacerbated gag reflex, which discourage regular brushing.²¹ An intriguing finding in one of the studies indicated that pregnant women with incorrect toothbrushing timing demonstrated a 44% reduction in periodontal disease risk, a result that deviates from conventional literature.¹⁷ This anomaly suggests that efficacious toothbrushing behavior is not solely dependent on timing, but is heavily mediated by the use of fluoridated toothpaste, as well as proper technique and brushing duration.

A study in Nganjuk indicated that higher motivation for oral self-care correlates with superior gingival health. Motivation serves as a pivotal factor

in the success of oral health maintenance. Highly motivated pregnant women demonstrate greater compliance with toothbrushing regimens, thereby mitigating plaque accumulation. The majority of expectant mothers in their study exhibited moderate motivation levels, which may stem from a deficiency in localized oral health education. The study was situated in a rural area characterized by restricted access to oral health promotion programs and educational media, thereby limiting the adoption of consistent preventive behaviors.²⁷

Pregnant women who smoke have a 1.83-fold higher risk of developing periodontitis. Tobacco smoking induces alterations in the intraoral microenvironment that favor the proliferation of a pathogenic oral microbiome, thereby increasing the susceptibility of periodontal tissues to destructive inflammation. Nicotine has been shown to cause both direct and indirect cytotoxic damage to periodontal tissues.¹⁷

Finally, a study in Bangkalan proposed an innovative solution for pregnant women facing geographic or economic barriers to dental care. The utilization of a locally sourced, pregnancy-safe natural product—specifically a decoction of green betel leaf (*Piper betle* L.)—proved significantly effective in reducing both the prevalence and severity of pregnancy gingivitis. Green betel leaves are rich in active phytochemicals, including flavonoids and chavicol, which possess potent antiseptic and antibacterial properties. These compounds effectively inhibit the proliferation of periodontal pathogens such as *Porphyromonas gingivalis*. The application of this 10% green betel leaf decoction offers an affordable, safe, and easily accessible alternative intervention that can be independently managed at home by pregnant women.³²

CONCLUSION

The prevalence of periodontal disease during pregnancy in Indonesia has remained quite high over the past decade. Several associated risk factors found are oral hygiene, crowded teeth, frequency of toothbrushing, betel nut consumption, smoking status, level of education, living area, gestational age, stress, health motivation, and contraceptive use history. Oral hygiene, particularly calculus accumulation, is the most significant predictor of periodontal disease during pregnancy. Pregnant women in Indonesia still require dental health education and dental scaling to reduce calculus accumulation. Dental and oral health examinations should be integrated into the comprehensive antenatal care program starting from the first trimester.

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