World Journal of Advanced Research and Reviews
eISSN: 2581-9615 CODEN (USA): WJARAI
Cross Ref DOI: 10.30574/wjarr
Journal homepage: https://wjarr.com/

(REVIEW ARTICLE)

The relationship between pregnancy and the prevalence of periodontal disease and dental caries among pregnant women in Indonesia: A review article

Kalila Hafizah Haryanto * and Silvi Aurulia Aidatul Fitri

Undergraduate Student, Faculty of Dental Medicine, Universitas Airlangga, Surabaya, Indonesia.

World Journal of Advanced Research and Reviews, 2024, 24(03), 2288-2294

Publication history: Received on 14 November 2024; revised on 22 December 2024; accepted on 25 December 2024

Article DOI: https://doi.org/10.30574/wjarr.2024.24.3.3952

Abstract

Pregnancy is a physiologically complex state marked by significant hormonal and physiological changes, which heighten vulnerability to oral diseases, particularly dental caries and periodontal disease. These conditions represent critical oral health challenges among pregnant women in Indonesia. This review seeks to investigate the association between pregnancy and the prevalence of periodontal disease and dental caries in Indonesian pregnant women, emphasizing underlying risk factors, outcomes, and opportunities for intervention. A review article was conducted using reputable databases, including ScienceDirect, PubMed, and Google Scholar. Peer-reviewed articles published in English between 2019 and 2024 were included, supplemented by manual searches of cited references to ensure comprehensive coverage. The analysis identified a high prevalence of periodontal disease and dental caries among Indonesian pregnant women, driven by hormonal fluctuations, behavioral modifications, inadequate oral hygiene practices, and limited access to dental care. Elevated levels of estrogen and progesterone during pregnancy exacerbate gingival inflammation and tooth demineralization. Behavioral factors, including infrequent dental visits, increased vomiting, cravings for sugary foods, and suboptimal oral hygiene, further compound these conditions. Sociodemographic determinants such as education level and socioeconomic status significantly influence oral health outcomes. The high prevalence of oral diseases in Indonesian pregnant women stems from hormonal changes and factors like low education, smoking, vomiting, and inadequate dental care.

Keywords: Pregnancy; Periodontal Disease; Dental Caries; Oral health; Indonesia

1. Introduction

Pregnancy is a physiologically demanding condition marked by significant hormonal and physiological changes that increase the risk of oral diseases, particularly dental caries and periodontal disease, which represent the primary oral health concerns among pregnant women [14,12]. These physiological alterations influence the oral cavity through immune system modulation, microbial composition changes, reduced salivary pH, and mineral loss in teeth [10,12]. Furthermore, periodontitis in pregnant women has been linked to a complex interplay of hormonal, genetic, and behavioral factors, amplifying oral health challenges during this period [10]. Environmental determinants such as nutrition, oral hygiene, and socioeconomic status further exacerbate these risks, underscoring the multifactorial nature of oral disease pathogenesis in pregnancy [12].

In Indonesia, maternal oral health has emerged as a growing public health concern, with studies identifying poor oral hygiene as a significant driver of periodontal disease among pregnant women [9]. Behavioral shifts during pregnancy, including increased oral acidity due to vomiting and cravings for sweet foods, further heighten susceptibility to dental caries [1]. The pathogenesis of caries and periodontal disease is primarily driven by bacterial and microbial activity, with dental plaque acting as a critical etiological factor in the progression of these chronic conditions [8,13]. Persistent gingival

* Corresponding author: Kalila Hafizah Haryanto

inflammation resulting from inadequate oral hygiene can lead to periodontal infections, potentially affecting both maternal and fetal health [8].

Research in Indonesia has highlighted key determinants such as age, education level, and oral health behaviors as significant predictors of periodontal disease prevalence among pregnant women [3]. Socio-behavioral factors, including education and socioeconomic status, further complicate the relationship between parity and oral health, as they are strongly associated with the incidence of both periodontal disease and dental caries [11]. Despite the heightened risks associated with pregnancy, awareness and adherence to proper oral hygiene practices among Indonesian pregnant women remain limited, necessitating targeted public health interventions [3,9]. Addressing sociodemographic factors and encouraging positive oral health behaviors are crucial to reducing the incidence of these diseases in this vulnerable population.

2. Material and methods

The method employed in this review article involved a comprehensive search and analysis of various scholarly articles and journals sourced from reputable databases such as ScienceDirect, PubMed, and Google Scholar. Relevant publications were identified using a set of key terms, including “Pregnancy”, “Periodontal Disease”, "Dental Caries”, “Oral Health”, “Pregnant Women” and “Indonesia”. Only English-language articles published between 2019 and 2024 were included in the review. Additionally, the reference lists of the selected articles were manually reviewed to identify any potentially relevant publications that might have been missed during the database search, ensuring comprehensive coverage of the topic.

3. Results and discussion

Table 1 Summary of Articles and Journals’ Content

Title	Authors	Method	Results
Prevalence of Caries and Periodontal Disease among Indonesian Pregnant Women	Udijanto Tedjosasongko, Fridianty Anggraeni, Mok Li Wen, Satiti Kuntari, Mega Moeharyono Puteri (2019)	Cross-sectional study was conducted at several public health centers in Surabaya, Indonesia, from October to November 2017. Participants were randomly selected pregnant women in any trimester who were non-smokers, free from systemic diseases, and not taking medications affecting oral health. Periodontal status was assessed using a modified Community Periodontal Index (CPI), oral hygiene with a Simplified Oral Hygiene Index (OHI-S), and caries using the Decayed, Missing, Filling Teeth (DMF-T) index. Data on periodontal tissue and DMF-T before pregnancy were not collected.	Bleeding on probing (BOP) was observed in 27% of subjects. While 64% had no periodontal pockets, 34% had 4–5 mm pockets, and 2% had pockets ≥6 mm, found only in the third trimester. BOP prevalence increased with gestational age, peaking in the third trimester. The average OHI-S score indicated fair oral hygiene, with good scores most common in the second trimester and poor scores in the third. Most subjects (84.7%) had caries, with an average DMF-T index of 4.34, indicating moderate caries susceptibility. Dental visits were infrequent for 88.8% of participants.
Factors Related to Periodontal Diseases among Pregnant Women: A National Cross-Sectional Study in Indonesia	Oktarina Oktarina, Tumaji Tumaji, Betty Roosihermiatie, Suparmi, Yunefit Ulfa, Tin Afifah, Joko Irianto, Basuki Rachmat (2024)	Cross-sectional study used secondary data from the 2018 Riskesdas survey in Indonesia. A total of 8,902 pregnant women aged 13–54 were sampled from 30,000 census blocks selected using the probability proportional to size (PPS) method. Trained enumerators collected data via	The study revealed a 65.7% prevalence of periodontal disease among pregnant women in Indonesia. Mothers in the third trimester had a 12% lower risk compared to those in the first trimester, while low education levels increased the risk by 1.25 times. Pregnant women with a history of smoking have a 1.83-fold

		structured questionnaires after obtaining consent. Data entry was performed using CSPro 7.3 software.	higher risk of developing periodontal disease compared to non-smokers. Other factors, such as age, diabetes, and sweet food consumption, were not significant.
Determinants for Periodontal Disease during Pregnancy among Indonesian Women: A Cross-Sectional Study Using National Riskesdas 2013 Data	Lia Hapsari Andayani, Putri Bungsu, Nurhayati Prihartono (2019)	Cross-sectional study used 2013 Riskesdas data from 1,733 pregnant women across 33 provinces in Indonesia. Eligibility included ages 15–40, no hypertension, diabetes, or smoking history. Sociodemographic data, gestational age, and oral hygiene practices were collected via questionnaires, while dental nurses assessed gum health and caries using the DMFT index. Chi-square tests and logistic regression identified significant associations ($P<0.05$).	Periodontal disease was found in 4.4% of pregnant women. Local factors such as calculus and teeth crowding were linked to its occurrence. Tooth brushing frequency was a significant behavioral factor influencing periodontal disease during pregnancy.
Dental Caries Status of Pregnant Women in The Work Area of Cibeunying Health Center Bandung District	Marlin Himawati, Putri M, Bima Diaz Candra, Erindya Navika Rizkani, Sarah Aulia Rahmah, Putri Anjani, Gracia Astried Novania Putri (2023)	Cross-sectional study was conducted at the Cibeunying Health Center, Bandung Regency, from March 10 to 24, 2022, to assess the DMF-T index of pregnant women. A total of 103 randomly selected pregnant women across all trimesters from Cibeunying health center, Ciburial, Padasuka, and Cibeunying integrated service post participated. Only cooperative pregnant women present during the examination were eligible.	The DMF-T index at the Ciburial and Padasuka Integrated Service Posts was 7.9 and 7.3, respectively, while the Cibeunying Health Center recorded 9.6, all classified as *very high.* Meanwhile, the Cibeunying Integrated Service Post had a DMF-T index of 6.5, categorized as high.
Factors Associated with Dental Care Utilization among Pregnant Women at Klapanunggal Health Centre, Bogor, Indonesia	Itsna Widita, Sutanto Priyo Hastono (2019)	Cross-sectional study was conducted at Klapanunggal Health Center, Bogor, in April 2019, involving 60 pregnant women with confirmed pregnancies of more than 2 weeks. The primary outcome was dental care visits among pregnant women, while the independent variables included maternal age, educational attainment, employment status, family income, health insurance coverage, reported oral health problems, and knowledge of oral health.	The majority of pregnant women rated their oral health as good (35%) or average (35%). However, 55% reported experiencing at least one oral health issue, including bleeding gums (35%), dental cavities (33.3%), and tooth pain (10%). Despite this, only 23.3% visited a dentist during their current pregnancy. Factors significantly influencing dental visits were the presence of oral health problems and oral health knowledge during pregnancy, after accounting for education, employment, income, and health insurance.
Hormonal Changes as the Risk Factor That Modified Periodontal Disease in	Agus Susanto, Chandra Andi Bawono, Sindi Septihani Putri (2024)	Systematic review included English-language articles published between 2013 and 2023 examining the effects of estrogen and progesterone in pregnant women. The inclusion criteria	Eight of the nine included studies found a positive relationship between hormone levels and periodontal health in pregnant women. In conclusion, elevated hormone levels during pregnancy are identified as

Pregnant Women: A Systemic Review		encompassed cross-sectional studies, randomized controlled trials (RCTs), and cohort studies. Studies involving non-human subjects and review articles were excluded.	risk factors influencing clinical parameters, including Periodontal Pocket Depth (PPD) and Clinical Attachment Loss (CAL), and biological changes, including biofilm composition and proinflammatory cytokines level.
Knowledge of Five Different Types of Indonesian Health Workers Regarding Oral Health Services for Pregnant Women	Anne A. Suwargiani, Erry M. Arief, Dudi Aripin, Sunardhi Widyaputra, Sri Susilawati (2021)	A cross-sectional descriptive study was conducted among five categories of healthcare professionals in Indonesia, utilizing a Google Form questionnaire. The survey explored topics such as regulations and education on oral health for pregnant women, the recommended frequency of prenatal visits, the necessity of oral health examinations, available oral health treatment packages, and guidance for pregnant women on oral care. The participants included five key health professionals: dentists, general practitioners, gynecologists, health promotion officers, and midwives. A non-probability consecutive sampling method was employed, with data collection occurring between August and September 2019.	Of the 191 healthcare workers who completed the questionnaire, only 14.1% reported familiarity with relevant laws and regulations concerning oral health for pregnant women. Furthermore, only 21.5% were aware of the socialization efforts related to governmental regulations. While 77% were knowledgeable about the recommended number of prenatal visits, only 9.4% recognized the necessity of oral health assessments during pregnancy. In contrast, 72.4% were aware of the available prenatal oral health treatment packages, and 84.9% understood the importance of advising pregnant women to undergo oral health examinations. Only 24.1% knew about the manual for maintaining oral health during pregnancy, and just 4.7% were aware of its socialization. In conclusion, 69% of health workers lacked knowledge in nine out of thirteen criteria regarding oral health services for pregnant women.

Recent studies conducted by Tedjosasongko et al. (2019) and Susanto et al. (2024) [1,6] highlight the significant influence of reproductive hormone fluctuations on periodontal health during pregnancy, particularly on indicators such as probing pocket depth (PPD), bleeding on probing (BOP), and clinical attachment loss (CAL). Tedjosasongko et al. (2019) [1] reported a progressive increase in BOP as gestational age advances, which can be attributed to elevated reproductive hormone levels. These hormonal changes increase the gingival blood vessel permeability, thereby increasing susceptibility to local irritants, including plaque, calculus, and caries. Supporting this finding, Susanto et al. (2024) [6] observed that elevated concentrations of estrogen and progesterone during pregnancy exacerbate gingival inflammation by increasing vascular permeability. This process facilitates the diffusion of bacteria and their products into inflamed gingival tissues, a phenomenon more pronounced in compromised periodontal conditions compared to healthy tissue. As a result, BOP tends to be more severe during pregnancy relative to pre-pregnancy and postpartum periods.

Susanto et al. (2024) [6] reported a significant relationship between hormonal changes during pregnancy and biofilm quantity in periodontal tissues. Their findings revealed a positive correlation between the total subgingival bacterial load and the progression of clinical periodontal diagnosis in pregnant women. Similarly, Tedjosasongko et al. (2019) [1] indicated that the prevalence of periodontitis across pregnancy trimesters is influenced by shifts in the proportional composition of subgingival anaerobic and aerobic bacteria, regulated by fluctuations in plasma estrogen and progesterone levels. The study demonstrated that periodontitis with PPD of 4–5 mm was most prevalent in the second trimester, followed by a reduction in the third trimester. This increase in PPD was associated with elevated levels of microorganisms, including *Bacteroides*, *Prevotella*, and *Porphyromonas*. *Fusobacterium nucleatum* also exhibited a positive correlation with hormone concentrations, as reported by Susanto et al. (2024) [6]. The second trimester showed a significant increase in the subgingival anaerobic-aerobic bacterial ratios, particularly involving *Prevotella intermedia*,

which reached peak levels before declining in the third trimester. This period leads to increased estrogen and progesterone accumulation in subgingival plaque. While the highest prevalence of periodontitis with PPD of 4–5 mm was observed in the second trimester, PPD exceeding 6 mm was only observed in the third trimester [1,6]. However, these findings were contradicted by Oktarina et al. (2024) [2], who reported a lower risk of periodontal disease in third-trimester pregnant women compared to those in the first trimester.

Pregnancy-associated hormonal changes, particularly the elevated production of estrogen and progesterone, significantly alter the release of proinflammatory cytokines, which may potentially act as biomarkers for periodontal inflammation. Susanto et al. (2024) [6] reported that elevated levels of these hormones stimulate human gingival fibroblasts to secrete higher amounts of proinflammatory cytokines, including interleukin-6 (IL-6) and interleukin-8 (IL-8), thereby triggering and exacerbating inflammatory processes in periodontal tissue. Reduced salivary interleukin-1β (IL-1β) and interferon-gamma (IFN-γ) levels, along with an increase in tumor necrosis factor-alpha (TNF-α) occur during pregnancy. TNF-α, a critical proinflammatory mediator, facilitates increased vascular permeability in the gingival sulcus, leading to fluid extravasation and periodontal tissue destruction [6].

In addition to hormonal influences, various other factors have been implicated in the prevalence of periodontal diseases among pregnant women in Indonesia. Oktarina et al. (2024) and Andayani et al. (2019) [2,3] highlighted these contributing factors in their studies. Oktarina et al. (2024) [2] emphasized that low education and smoking are the most significant risk factors for periodontal disease among pregnant women in Indonesia. Pregnant women with limited education are at significantly higher risk for periodontal disease, largely due to lower health literacy, improper brushing techniques, greater plaque accumulation, and reduced engagement in preventive oral health behaviors. Smoking further exacerbates this risk by altering the oral microbiome, promoting the growth of pathogenic microorganisms, and thereby enhancing susceptibility to periodontal disease. Moreover, nicotine has been shown to cause both direct and indirect destruction to periodontal tissues, especially when combined with other contributing factors. Andayani et al. (2019) [3] identified local factors, such as calculus accumulation and teeth crowding, as well as behavioral factors like tooth brushing frequency, as significant contributors to periodontal disease among pregnant women in Indonesia. Self-reported adherence to optimal oral hygiene practices, including brushing twice daily and flossing, was strongly associated with a decreased risk of periodontal disease.

An increased risk and prevalence of dental caries are exhibited by pregnant women, partly attributed to hormonal fluctuations during pregnancy, as reported by Tedjosasongko et al. (2019) and Himawati et al. (2023) [1,4]. Estrogen plays an essential role in regulating cell proliferation, differentiation, and keratinization which results in the oral mucosa desquamation. The desquamated cells provide nutrients that promote microbial growth and establish an environment favorable for bacterial proliferation. At the same time, progesterone affects gingival microvascularization and modifies the production of collagen. Elevated progesterone levels can lead to a reduction in plasma bicarbonate concentration, subsequently lowering salivary pH. This acidic environment, exacerbated by poor oral hygiene, accelerates the development of dental caries. Furthermore, higher progesterone levels reduce salivary flow rates, which, along with altered salivary composition, compromises the immune defenses of saliva, contributing to both caries development and inflammation of the oral mucosa [1,4].

Beside hormonal influences, Tedjosasongko et al. (2019) and Himawati et al. (2023) [1,4] identified vomiting behavior during pregnancy as a significant contributor to the increased risk of dental caries. Frequent vomiting lowers the pH of the oral cavity, creating an acidic environment that promotes the demineralization of tooth enamel. Moreover, nausea and vomiting often discourage pregnant women from practicing proper oral hygiene due to the fear or discomfort of triggering nausea during tooth brushing. Consequently, the accumulation of dental plaque, combined with the acidity from vomiting, accelerates the caries progression [1,4].

According to Tedjosasongko et al. (2019) [1], psychological changes during pregnancy also contribute to an elevated risk and prevalence of dental caries. Pregnant women often exhibit increased cravings for sweet and sour foods, which exacerbate the already acidic environment in the oral cavity due to vomiting. Furthermore, psychological influences such as mood swings and increased anxiety regarding the health of the unborn child, particularly in the third trimester, may alter oral hygiene practices, thereby potentially increasing the risk of developing dental problems [1].

The prevalence of dental caries has been shown to increase progressively with increasing gestational age, with a particularly high prevalence observed during the second and third trimesters of pregnancy. This trend is closely attributed to the hormonal fluctuations, as progesterone and estrogen levels progressively rise, peaking in the eight month of pregnancy. While progesterone levels stabilizes during the final month, estrogen levels persist in rising. During the third trimester, a marked reduction in salivary pH and buffering capacity occurs, establishing an environment

favorable for the growth of *Streptococcus mutans* and significantly increasing the risk of caries [1]. In addition, Tedjosasongko et al. (2019) [1] reported that the third trimester is associated with the poorest OHI-s scores, likely due to inadequate oral hygiene practises during pregnancy.

The infrequent dental examinations during pregnancy significantly contributes to the elevated prevalence of dental caries and periodontal disease among pregnant women in Indonesia. According to Widita and Hastono (2019) [5], the utilization of oral healthcare services among pregnant women in Indonesia remains notably low. Dental visits among pregnant women are often limited to those experiencing oral health issues or possessing adequate knowledge of oral health, with barriers including concerns over the safety of dental treatments during pregnancy, fear, and the perception that oral health is not a priority. Similarly, Tedjosasongko et al. (2019) [1] identified the lack of routine dental check-ups among pregnant women in Indonesia is largely attributable to insufficient knowledge or awareness regarding oral health and poor oral hygiene practices. Furthermore, Suwargiani et al. (2021) [7] highlighted that only a small proportion of healthcare providers in Indonesia possess sufficient knowledge of proper oral health services for pregnant women. Healthcare providers demonstrated insufficient familiarity with laws and regulations pertaining to oral health for pregnant women, limited awareness of governmental socialization initiatives, inadequate understanding of the importance of oral health assessments during pregnancy, and a lack of knowledge regarding guidelines for maintaining oral health during pregnancy.

4. Conclusion

The high prevalence of periodontal disease and dental caries among pregnant women in Indonesia is primarily attributed to hormonal changes during pregnancy, particularly fluctuations in progesterone and estrogen levels. Additionally, several other factors contribute to this elevated prevalence, including low levels of education, smoking, vomiting behavior, psychological changes, a lack of routine dental check-ups during pregnancy, and insufficient knowledge among healthcare providers regarding appropriate oral health services for pregnant women.

Compliance with ethical standards

Acknowledgements

The authors express their gratitude to the reviewers for their insightful contributions and for providing highly constructive feedback on this manuscript.

Disclosure of conflict of interest

The authors affirm that they have no conflicts of interest pertaining to the publication of this manuscript.

References

[1] Tedjosasongko U, Anggraeni F, Wen ML, Kuntari S, Puteri MM. Prevalence of caries and periodontal disease among Indonesian pregnant women. Pesquisa Brasileira em Odontopediatria e Clínica Integrada. 2019;19:e4533.

[2] Oktarina O, Tumaji T, Roosihermiatie B, Ulfa Y, Afifah T, Irianto J, Rachmat B. Factors related to periodontal diseases among pregnant women: A national cross-sectional study in Indonesia. Journal of Population and Social Studies [JPSS]. 2025;33:472-90.

[3] Andayani LH, Bungsu P, Prihartono N. Determinants for periodontal disease during pregnancy among Indonesian women: A cross-sectional study using National Riskesdas 2013 data. Journal of International Dental and Medical Research. 2019;12(1):337-43.

[4] Himawati M, Putri M, Candra BD, Rizkani EN, Rahmah SA, Anjani P, Putri GA. DENTAL CARIES STATUS OF PREGNANT WOMEN IN THE WORK AREA OF CIBEUNYING HEALTH CENTER BANDUNG DISTRICT. Journal of Health and Dental Sciences. 2023;2(3):479-88.

[5] Widita I, Hastono SP. Factors Associated with Dental Care Utilization among Pregnant Women at Klapanunggal Health Centre, Bogor, Indonesia. Journal of Health Promotion and Behavior. 2019;4(2):145-52.

[6] Susanto A, Bawono CA, Putri SS. Hormonal changes as the risk factor that modified periodontal disease in pregnant women: A systematic review. Journal of International Oral Health. 2024;16(3):189-95.

[7] Suwargiani AA, Arief EM, Aripin D, Widyaputra S, Susilawati S. Knowledge of five different types of Indonesian health workers regarding Oral health Services for Pregnant Women. The Open Dentistry Journal. 2021;15(1).

[8] Sumerti NN, Sirat NI. Factors related to the chronic periodontitis occurrence on the pregnant women in the public health centres at tabanan regency at 2018. 2019;7(3):1088-95.

[9] Febriani M, Lugito MD, Puspita SR, Mutiara RR. EDUCATION AND DENTAL-ORAL HEALTH EXAMINATIONS FOR PREGNANT WOMEN AT THE KAMPUNG SAWAH HEALTH CENTER, CIPUTAT, SOUTH TANGERANG. In: ICCD. 2023;5(1):417-421.

[10] Katarzyńska-Konwa M, Obersztyn I, Trzcionka A, Mocny-Pachońska K, Mosler B, Tanasiewicz M. Oral status in pregnant women from post-industrial areas of upper Silesia in reference to occurrence of: Preterm labors, low birth weight and type of labor. InHealthcare 2020; 8(4):528).

[11] Morelli EL, Broadbent JM, Knight ET, Leichter JW, Thomson WM. Does having children affect women's oral health? A longitudinal study. Journal of public health dentistry. 2022;82(1):31-9.

[12] Yilmaz F, Carti Dorterler O, Eren Halici S, Kasap B, Demirbas A. The effects of pregnancy on oral health, salivary ph and flow rate. BMC Oral Health. 2024;24(1):1286.

[13] Hu W, Wang Y, Chen R, Pan T. Application of a systematic oral health promotion model for pregnant women: A randomised controlled study. Oral Health & Preventive Dentistry. 2022;20:b3555989.

[14] Javed MQ, Bhatti UA, Riaz A, Chaudhary FA. Predictors of periodontal and caries related perinatal oral healthcare, investigation of dentists' practices: a cross-sectional study. PeerJ. 2021;9:e12080.