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Gingival Health Status among Pregnant Women Attending Maternity Hospital in Erbil City: A Cross-Sectional Study

Maysam Jasm Murad[(1)] , Dildar Abdullah Othman[(1)]

ABSTRACT

Background and Objectives: The notable changes in circulating hormones during pregnancy are known to detrimentally affect the oral cavity detrimentally, leading to the manifestation of conditions like gingival overgrowth and inflammatory periodontal disease. This investigation specifically evaluated the state of gingival health among expectant mothers receiving care at the Erbil City Maternity Hospital and analyzed their reported dental care routines.

Methods: The cross-sectional data collection took place over three months, from November 2024 through January 2025, enrolling 90 pregnant women across all trimesters. Data collection included clinical oral examinations and a structured questionnaire addressing oral hygiene habits, supplement intake, and gingival health. The Plaque Index (PI), Gingival Index (GI), Bleeding on Probing (BOP), and Gingival Overgrowth (GOG) were utilized to evaluate oral health. Statistical analyses comprised one-way ANOVA and descriptive statistics.

Results: Plaque accumulation remained stable across trimesters (PI: p=0.934), whereas gingival inflammation increased significantly as pregnancy advanced (GI: p=0.040). Bleeding on probing (BOP) was present in over half of participants, with higher prevalence in the second and third trimesters (BOP: p=0.144). Gingival overgrowth (GOG) increased gradually, though not to a statistically significant degree (GOG: p=0.129). Oral hygiene practices were generally inadequate: 86.6% reported daily brushing, but only 31.1% used dental floss, and 40% used a tongue scraper. Supplement use was prevalent, with 75.5% of women regularly taking folic acid and vitamins.

Conclusion: There is a high prevalence of gingival inflammation and periodontal diseases among pregnant women, with severity escalating as pregnancy progresses. Enhanced oral hygiene practices and increased awareness of oral care during pregnancy are necessary to prevent oral health complications. Regular dental checkups should be promoted to support the health of both mother and fetus.

Keywords: Pregnancy, Gingival Inflammation, Gingival Overgrowth, Plaque Index, Bleeding on Probing, Dental Hygiene Practices

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Affiliation Info

[(1)]College of Dentistry, Hawler Medical University, Kurdistan Region, Iraq.
Corresponding Author: Maysam Jasm Murad.
Email: MaysamJmurad@gmail.com

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INTRODUCTION

The state of pregnancy represents a unique phase of life characterized by fundamental physiological alterations with consequences for diverse systems throughout the body, notably the oral environment.[1] Increased levels of estrogen and progesterone primarily influence these changes.[2] During a typical pregnancy, estrogen levels rise tenfold, while progesterone levels increase by 30 times.[3] Such hormonal shifts contribute to several oral health alterations, including gingival hyperplasia, gingivitis, pyogenic granulomas, dental caries, enamel erosion, and variations in the composition and flow of saliva.[4] Estrogen and progesterone have been identified within human gingival tissue, indicating their central involvement in the intensification of gingival inflammation. Studies estimate that between 30% and 75% of pregnant women experience some degree of gingivitis. The widespread occurrence of oral health complications during gestation is attributable to multiple contributing factors. Many women who previously maintained satisfactory oral hygiene may unknowingly neglect their dental care due to common pregnancy-related discomforts such as nausea, vomiting, fatigue, and insomnia. When combined with hormonal changes, these factors can lead to significant oral health deterioration.[5]

Periodontal pathologies, such as gingivitis and periodontitis, are recognized globally as highly common chronic inflammatory disorders. Gingivitis, the milder form of periodontal disease, is reversible, whereas periodontitis can lead to permanent damage to the supporting structures of the teeth.6 The inflammation of the gums during pregnancy, often referred to as "pregnancy gingivitis," results from plaque buildup and is exacerbated by hormonal fluctuations.[7] The manifestation of symptoms generally begins in the second month of gestation, reaches maximum severity near the eighth month, and typically remits postpartum following the normalization of hormone concentrations. While pregnancy gingivitis does not progress to periodontitis, it is characterized by swollen, red gums that bleed easily, indicating vascular changes and inflammation.[8,9] Although the exact mechanisms behind increased gingival inflammation during pregnancy remain unclear, factors such as altered neutrophil function, immune system modulation, hormonal effects on cell activity, and changes in microbial composition contribute to this condition.[2] Investigative findings indicate that sex hormones promote the biosynthesis of prostaglandins, specifically PGE1 and PGE2, functioning as persistent mediators of the inflammatory process. [5]

With a composition exceeding 600 bacterial taxa, including genera like streptococci, lactobacilli, and staphylococci, the oral cavity sustains the second-highest level of microbial diversity in the human body.[8] It has been documented that the oral bacterial load is significantly greater during pregnancy. This is accompanied by an increased identification rate of key pathogens, such as P. gingivalis, A. actinomycetemcomitans, and several Streptococci, Staphylococci, and Candida species, with this effect being most pronounced early in the first and second trimesters.[10] Several studies have also linked periodontitis to adverse pregnancy outcomes, including research that demonstrates a connection between periodontal disease and negative maternal-fetal events, specifically preterm birth, low birth weight, and the risk of spontaneous abortion. This evidence stands in contrast to the popular misconception that pregnancy inherently results in dental attrition (tooth loss), a claim lacking scientific validation. Although there is a common belief that a woman loses a tooth with each pregnancy, no scientific evidence supports this claim. However, pregnancy-related gingivitis may cause gum discomfort, making routine dental care challenging and potentially increasing the risk of tooth decay and eventual tooth loss.[3]

The primary objective of this research is to assess the condition of gingival health in a cohort of pregnant women receiving care at the Maternity Hospital in Erbil City.

METHODS

This study assessed the gingival health of randomly selected pregnant women who visited the Maternity Hospital in Erbil City. This investigation spanned the period from November 2024 to January 2025, enrolling a total cohort of 90 pregnant women sampled across all three trimesters of gestation. Participants were divided into three groups of 30 women each, corresponding to the first, second, and third trimesters. The inclusion criteria included individuals aged 18 to 35 years, healthy participants, and those visiting the government hospital. The exclusion criteria included women with systemic diseases, individuals taking antibiotics, those with fewer than 20 teeth, those who had undergone periodontal treatment within the

previous 3 to 6 months, and those diagnosed with periodontitis. Before commencing the study, ethical clearance was successfully acquired from the Erbil Health Directorate Ethics Committee (Reference No. HMUD/2425050, approved on 22/12/2024). Furthermore, informed consent was obtained from every participant after a comprehensive briefing on the investigative protocol.

Data were collected through direct clinical oral examinations, utilizing mouth mirrors and periodontal probes. The observations were systematically documented within a structured questionnaire. The questionnaire included information on participants' names, ages, educational levels, gestational ages, tooth-brushing habits, brushing frequency, use of oral hygiene aids (such as mouthwash, interdental flosses, and tongue scrapers), experience of bleeding during brushing, and intake of supplements (including folic acid and vitamins) during pregnancy.

Clinical evaluation of the gingiva was conducted using the Williams periodontal probe along with a disposable dental mirror. The assessment included the following clinical parameters: Plaque Index (PI), Gingival Index (GI), Bleeding on Probing (BOP) index, and Gingival Overgrowth Index (GOG). Measurements for PI, GI, and BOP were taken from the Ramfjord index teeth (16, 21, 24, 36, 41, and 44), which serve as representative indicators for the entire dentition. In cases where any of these specific teeth were absent, no substitutions were made according to the method described by Silness and Loe (1963).[15]

The collected data were managed and stored digitally using Microsoft Excel 2019 and GraphPad Prism v. 10.4.1. Subsequent statistical analysis was performed using descriptive statistics and a one-way Analysis of Variance (ANOVA).

RESULTS

The study analyzed the gingival health of pregnant women across three trimesters using four indices: Plaque Index (PI), Gingival Index (GI), Bleeding on Probing (BOP), and Gingival Overgrowth (GOG). The mean and standard deviation (SD) values for each index are presented below (Table 1):

- **Plaque Index (PI):** The mean PI scores were 1.705± 0.432, 1.693± 0.444, and 1.686± 0.526 for the first, second, and third trimesters, respectively. The statistical analysis showed no significant difference among the groups (F = 0.067, p = 0.934).
- **Gingival Index (GI):** Gingival Index (GI) scores demonstrated a statistically significant progressive increase throughout the course of gestation (F=3.335, p=0.040). Mean GI values rose sequentially from 0.863±0.496 in the first trimester to 1.028±0.478 in the second, reaching 1.192±0.575 by the third. Indicating intensification of the gingival inflammation as pregnancy advances.
- **Bleeding on Probing (BOP):** The BOP index values were 0.176± 0.212, 0.226± 0.313, and 0.346± 0.372 in the first, second, and third trimesters, respectively. Despite the upward trend in BOP scores, the differences were not statistically significant (F = 1.979, p = 0.144).
- **Gingival Overgrowth (GOG):** The GOG index showed a progressive increase across the trimesters, with mean values of 0.002± 0.012, 0.051± 0.171, and 0.159± 0.328in the first, second, and third trimesters, respectively, without statistical significance (F=2.087, p=0.129).

These findings indicate that while the level of plaque accumulation remained stable across the gestational period, gingival inflammation (GI) significantly escalated as pregnancy progressed. Furthermore, although the Bleeding on Probing (BOP) and Gingival Overgrowth Grade (GOG) indices demonstrated an upward trend, the observed increase did not achieve statistical significance (p=0.129). This highlights a disparity between stable plaque levels and the pronounced inflammatory response.

Beyond the clinical parameters, the research also examined the reported oral health behaviors and intake of dietary supplements within the cohort of expectant mothers. The majority of participants (86.6%) reported brushing their teeth daily. Among those who brushed daily, 45.5% brushed once a day, whereas 41.1% brushed twice a day. More than half of the pregnant women (57.7%) experienced bleeding while brushing. A significant proportion of participants (75.5%) reported taking supplements such as folic acid and vitamins during pregnancy. Only 25.5% of pregnant women used mouthwashes as part of their oral hygiene routine. About 31.1% of participants used dental floss. A total of 40% of pregnant women used a tongue scraper, as presented in Table 2.

These results indicate that while the majority of

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pregnant women practiced daily brushing, a substantial proportion did not adhere to a twice-daily brushing regimen or incorporate supplementary oral hygiene aids, such as mouthwashes, dental flosses, or tongue scrapers. Furthermore, over fifty percent of the participants reported experiencing gingival bleeding during brushing, a finding that strongly suggests the presence of underlying gingival inflammation.

DISCUSSION

Table 1. Comparison of various parameters between the three trimesters of pregnancy using the one-way ANOVA test

Indices	Groups	Mean ±SD	F-value	p-value
PI	1st	1.705±0.4320	0.067	0.934
	2nd	1.693±0.444		
	3rd	1.686±0.526		
GI	1st	0.863±0.496	3.335	0.040
	2nd	1.028±0.478		
	3rd	1.192±0.575		
BOP	1st	0.176±0.212	1.979	0.144
	2nd	0.226±0.313		
	3rd	0.346±0.372		
GOG	1st	0.002±0.012	2.087	0.129
	2nd	0.051±0.171		
	3rd	0.159±0.328		

Table 2. Oral hygiene practices and supplement intake among pregnant women

Variables		No. of pregnant	Percentage (%)
Daily Brushing	Yes	78	86.6
	No	12	13.3
Frequency of Brushing	Once	41	45.5
	Twice	37	41.1
Bleeding during Brushing	Yes	52	57.7
	No	38	42.2
Taking Supplements	Yes	68	75.5
	No	22	24.4
Mouth Wash	Yes	23	25.5
	No	67	74.4
Floss	Yes	28	31.1
	No	62	68.8
Tongue Scraper	Yes	36	40
	No	54	60

A cross-sectional methodology was utilized at the Maternity Hospital in Erbil City to assess the extent and seriousness of gingival inflammation among pregnant women. The findings indicate that most pregnant women exhibited suboptimal oral hygiene. While definitive causality cannot be established by this design, this finding may be correlated with external factors such as low socioeconomic status or a lack of systematic inclusion in preventative oral healthcare programs focused on plaque control. Further investigation is warranted to determine the specific predictors of poor oral hygiene adherence within this population.

Regarding the Plaque Index, a slight decrease was observed as pregnancy progressed, suggesting that early gastrointestinal symptoms, such as nausea and vomiting, may hinder oral hygiene, while their resolution in later trimesters contributes to improved dental care practices, which aligns with Hugosons findings, where a decline in the viable count of microorganisms was noted in the later stages of pregnancy.[11,12] However, this contrasts with studies by Khalid, Abdulkareem, and Chenar, who reported an increase in plaque levels throughout pregnancy.[13] In a comparable study, Yalcin et al. assessed the periodontal status of 61 pregnant subjects throughout all three trimesters and documented a sequential increase in Plaque Index scores.[14] In contrast, Loe and Silness (1964) observed no significant fluctuations in the plaque index among pregnant women.[15] Based on the Gingival Index, our study demonstrated varying degrees of gingival inflammation across all three trimesters, with an overall increase in inflammation during pregnancy. Several previous studies on pregnant women support these findings, including those by Löe and Silness,[15] Hugoson,[11] and Khalid, Abdulkareem, and Chenar.[13] The severity of periodontal inflammation during pregnancy can be linked to heightened levels of estrogen and progesterone, which exert an effect by modifying both blood vessel function and the turnover of supporting connective tissue. These hormonal changes interact with inflammatory mediators, potentially explaining the increased gingival inflammation seen during pregnancy.[16] However, some studies have reported conflicting results. Kornman found that gingival disease was most pronounced during the second trimester,[12] whereas Jonsson observed no significant association between pregnancy and gingival inflammation.[17]

The current study revealed a high prevalence of bleeding on probing (BOP) during pregnancy. A greater occurrence was observed in the second and third trimesters, likely due to prolonged inflammation. BOP was less frequent in the first trimester, which aligns with the findings of Khalid, Abdulkareem, and Chenar.[13] Our findings align with Pindborg's prior research, which established that gingival alterations and a heightened propensity for bleeding commonly manifest by the conclusion of the first trimester and continue until parturition (delivery).[18] The results align with data from a limited cohort of 19 women, which demonstrated a reduction in BOP rates (from 41.2% at 12 weeks to 26.6% after birth), a change that occurred without the implementation of active periodontal treatment.[19]

Gingival hyperplasia was more frequently diagnosed in the later trimesters, specifically at 5.13% in the second trimester and 16.1% in the third. This is in accordance with the literature, such as the report by Nsahli et al., which also noted increased gingival inflammation as gestation progressed. The heightened severity is postulated to result from the markedly increased levels of estrogen and progesterone during the third trimester, creating an intensified hormonal dysregulation within the oral environment that exacerbates the hyperplastic response. Additionally, inadequate brushing techniques can leave certain areas of the mouth more prone to plaque buildup, thereby influencing both the site and severity of gingival hyperplasia.

As a conclusion, the majority of participants (86.6%) reported daily tooth brushing. However, a significant portion of the participants (45.5%) brushed their teeth only once a day, while 41.1% brushed their teeth twice a day. The present results align with the observations of Nsahlai and colleagues, who documented that 51.1% of expectant mothers brushed once per day, while 46.8% did so twice daily. Nsahlai et al. posited that insufficient brushing frequency was often due to pregnancy-related discomforts such as nausea, vomiting, and fatigue. This deficit in appropriate oral hygiene practices may therefore partially explain the elevated plaque levels and the corresponding increase in gingival hyperplasia noted in our patient cohort.[20]

The oral health care practices were unfavorable. Only 31.1% of pregnant women used dental flosses, 40% used tongue scrapers, and only 25.5% of participants mentioned the use of mouthwashes as

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a component of their established oral hygiene regimen. These results align with a study by Roberto et al., which found that most participants did not use dental flosses.[21] Many respondents lacked the understanding of the importance of using dental flosses, mouthwashes, and tongue cleaners, possibly due to insufficient information provided to them. Incorrect brushing techniques and the absence of dental floss in daily routines can lead to inadequate oral hygiene, contributing to gingival inflammation. It is imperative that dental professionals counsel pregnant patients on the critical role of tongue scraping for removing the acidic residue that adheres to the lingual papillae following episodes of emesis. Furthermore, healthcare providers must furnish more exhaustive instruction regarding the necessity of comprehensive oral care throughout gestation to optimize the overall oral hygiene status of expectant mothers.

Out of the sample, 75.5% of expectant mothers reported utilizing prescribed dietary supplements during their pregnancy, reflecting high adherence to healthcare recommendations. According to Hanan et al., 71.5% of women in Saudi Arabia used supplements during pregnancy.[22] A report from Egypt indicated that 88% of women took supplements.[23] Moreover, a study conducted in Jordan indicated a remarkably high rate of supplement consumption, with 96.8% of the pregnant women reporting use across the entirety of their three trimesters of gestation.[24] The differences in these rates across countries may be influenced by variations in healthcare systems, education levels, family income, and the number of children in each family. These findings imply that while supplement intake may support general health, it does not appear to mitigate pregnancy-related oral changes without consistent and comprehensive oral hygiene practices. The limited use of flosses, mouthwashes, and tongue scrapers" despite high brushing rates" may contribute to the progression of gingival conditions. This underscores the importance of integrating oral health education into prenatal care, emphasizing not only nutritional support but also effective hygiene behaviors to maintain periodontal health throughout pregnancy.

A restricted sample size and the lack of long-term follow-up are the major limitations of this study. Future research should address these deficiencies by conducting longitudinal investigations with an expanded cohort. Furthermore, the inclusion of biochemical analysis for hormonal levels is recommended to establish a definitive correlation between systemic hormonal fluctuations and changes in oral health status.

Another limitation of this study is its cross-sectional design, which restricts the ability to examine the chronological sequence of events, thereby precluding the determination of causation and effect. The data represent a singular snapshot of oral health among pregnant women at the study site. Furthermore, the findings indicate that a substantial number of expectant mothers had gingival inflammation; this condition is commonly associated with a high bacterial load, which introduces the potential risk of vertical transmission of periodontopathic bacteria to the neonate.

Based on these findings, it is recommended:

1. **Before Pregnancy**, women should undergo clinical examinations and receive necessary dental and gingival treatments. It is incumbent upon obstetric and midwifery professionals to integrate and highlight this critical dimension within their maternal care protocols.
2. **Throughout Gestation**, oral hygiene education should be integrated into routine maternal care. Additionally, expectant mothers should be encouraged to take responsibility for their newborns' oral health from an early stage.

CONCLUSIONS

Pregnant women exhibit increased vulnerability to poor oral health practices and commensurate elevations in gingival inflammation, culminating in a high incidence of periodontal disease. A critical finding is the progressive deterioration of oral health status throughout the pregnancy, which is associated with a greater likelihood of negative health consequences for the mother and fetus. Since prevention is highly effective for these conditions, comprehensive educational efforts stressing the importance of effective oral hygiene are indispensable. Consequently, the integration of regular dental checkups into prenatal care is unequivocally recommended as the foundational approach to supporting optimal maternal and fetal health.

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CONFLICTS OF INTEREST

The authors declare that they have no competing interests related to this work.

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