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Editor Speech of IC - BTI 2025

The International Conference on Business, Technology, and Innovation (IC-BTI 2025) is the 14th international interdisciplinary peer-reviewed conference which publishes the works of scientists as well as practitioners in the areas where UBT is active in education, research, and development. The UBT aims to implement an integrated strategy to establish itself as an internationally competitive, research-intensive institution, committed to the transfer of knowledge and the provision of a world-class education to the most talented students from all backgrounds. It is delivering diverse academic programs across science, management, and technology, fostering innovation and excellence in research. This year we proudly celebrate our 24th Anniversary as an institution dedicated to advancing science, education, and global collaboration. The main perspective of the conference is to connect scientists and practitioners from different disciplines in one place, make them aware of the recent advancements across research fields, and provide them with a unique forum to share their experiences. It is also an important platform to support new academic staff in conducting research and publishing their work at international standards.

This conference consists of sub-conferences in various fields, including but not limited to:

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This conference is the major scientific event of UBT. It is organized annually and supported by an extensive network of regional and international academic, institutional, and professional partners, whose collaboration enriches the scientific quality and global reach of the conference.

We would like to express our sincere gratitude to all authors, partners, sponsors, reviewers, and the conference organizing team for making this year's event a truly international scientific gathering. In 2025, we have seen increased participation, submissions, and publications, demonstrating the growing relevance and impact of IC-UBT.

Congratulations! Edmond Hajrizi,
Rector of UBT and Chair of IC - BTI 2025

CONTENTS

Subjective complaints of pregnant women regarding their periodontal health

Petrovski Mihajlo[1], Lumturije Asllani [2]

[1] Faculty of Medical Sciences, Goce Delcev University, Stip, North Macedonia
mihajlo.petrovski@ugd.edu.mk
[2] Faculty of Medical Sciences, Goce Delcev University, Stip, North Macedonia
lumturie.31175@student.ugd.edu.mk

Abstract. The periodontal status is one of the most important segments of oral health during pregnancy. Based on the possible connection between pregnancy and periodontal health, as well as the large number of complaints by pregnant women about their periodontal health, the main goal of this study was set - to assess the subjective complaints related to periodontal health among pregnant women. To fulfill the goal of the research, an anonymous survey on 40 pregnant women was conducted. Based on the processed data, most of the subjects complained of gum-bleeding during brushing teeth and fetor ex ore, as well as dental hypersensitivity. More than half pregnant women with gingival bleeding during brushing is a worrying factor, considering that the subjects belong to the relatively young population. This further highlights the importance of planning, creating and implementing an appropriate preventive program and education of pregnant women to improve their oral health.
Keywords: pregnancy, periodontal health, pregnancy gingivitis, gingival health

Introduction

Pregnancy results in multiple changes in the physiology of female patients. These changes can sometimes be subtle, yet they may lead to various complications if appropriate actions are not taken during dental treatment.

Pregnant women are prone to a numerous oral health issue that can be harmful to their health and the health of their baby. [1]

While pregnancy is not a risk factor for periodontal disease, it is well recognized that gingival and periodontal disorders can manifest in mothers during the second and third trimesters. Thus, it is vital for pregnant women to achieve proper control of dental plaque and to have the chance to undergo preventive periodontal care.

Oral changes that occur during pregnancy consist of: development of gingivitis, gingival hyperplasia, pyogenic granuloma, variations in salivation, increased facial pigmentation, and others. The rise in circulating estrogen levels, which leads to greater capillary permeability, makes pregnant women more vulnerable to gingivitis and gingival hyperplasia. While pregnancy does not induce periodontitis, it can worsen the condition if it is already present. Increased angiogenesis, due to sex hormones, along with gingival irritation from local factors such as dental plaque, is believed to cause pyogenic granuloma in 1-5% of patients, typically occurring during the first and second trimesters and resolving after delivery. Changes in the composition of saliva are characterized by decreased sodium and pH, and increased potassium, protein, and estrogen levels. The elevation of salivary estrogen levels promotes the proliferation and growth of oral mucosal cells, creating a favorable environment for bacterial growth, which predisposes pregnant women to dental caries and periodontitis. Patients are advised to practice good oral hygiene to reduce or prevent the progression of inflammatory oral changes associated with hormonal levels.[2]

Additionally, morning sickness and nausea related to pregnancy can have a considerable impact on oral, dental, and periodontal health. Nevertheless, morning sickness typically subsides after

the first trimester, allowing women to undergo dental treatment thereafter, like any other female patient.[3]

Gingivitis or periodontitis that are present before pregnancy may result in increased sensitivity to certain stimuli, due to an already compromised soft tissue infection. The occurrence of gingival recession is most commonly associated with the development of dentin hypersensitivity.

Oral bacteria that enter the bloodstream and amniotic fluid can lead to amniochorionic infection, which is a significant risk factor for premature birth.[4] Physiological changes that occur during pregnancy include inflammatory pathways in the reproductive organs prior to delivery; additionally, hormonal changes stimulate the release of proinflammatory cytokines, such as interleukin-1, interleukin-6, and tumor necrosis factor.[5] Inflammatory mediators, including cytokines that are elevated during periodontal disease, circulate from periodontal tissue and reach the fetoplacental unit. This is thought to induce early contractions and result in a variety of adverse pregnancy outcomes.[6]

Periodontitis is characterized as a condition involving inflammation of the structures that support the teeth, which is accompanied by edema and gingival bleeding. This clinical manifestation begins in the gingival tissue and subsequently spreads, affecting the alveolar bone tissue, leading to resorption and destruction of both cementum and the periodontal ligament. Recent research has indicated that pregnant women suffering from periodontal disease exhibit a higher incidence of premature births compared to those without periodontal disease.[7]

Gestational gingivitis is an inflammatory condition of the gingival tissue resulting from hormonal changes. Initially, the estrogen to progesterone ratio during pregnancy is 100:1, but it shifts to 1:1 in the final month.[8]

Throughout pregnancy, there is an elevation in progesterone and estrogen levels, which, by the end of the third trimester, are 10 times higher for progesterone and 30 times higher for estrogen compared to levels observed during the menstrual cycle.[9]

Gingival enlargement during pregnancy occurs due to bacterial plaque; however, the state of pregnancy itself enhances the response of the gingival tissue, thereby altering the clinical picture.

Periodontal disease is recognized as a risk factor for complications during pregnancy. Over the past twenty years, numerous researchers have explored the connection between periodontal disease and various adverse pregnancy outcomes. The exact mechanisms by which periodontal disease may influence pregnancy outcomes remain incompletely understood.[10] Nonetheless, it is important to note that periodontal infections lead to increased levels of cytokines in the host, which in turn raises serum and/or amniotic fluid concentrations of proinflammatory cytokines, including IL-1, IL-6, and TNF-α. These cytokines can promote the production of prostaglandins in the chorion, linked to intra-amniotic inflammation. Furthermore, the spread of periodontal pathogens through the bloodstream can result in metastatic infections affecting the feto-placental unit. Additionally, during pregnancy, heightened levels of female sex hormones contribute to increased vascular permeability, which is clinically associated with higher oral plaque levels and subsequent scores for gingival bleeding.[11]

Based on previously presented data, which indicate the connection between pregnancy and periodontal changes, as well as the large number of complaints by pregnant women regarding their periodontal health, the main goal of this paper was set - to assess the subjective complaints related to the periodontium in pregnant women.

2 Material and method

To fulfill the defined objective, a survey was done in the period from August to October 2024. The survey was conducted in Skopje and Prilep, Republic of North Macedonia in four specialized clinics in gynecology and obstetrics.

Based on the literature, as well as the necessity to create a general evaluation of the subjective challenges associated with the periodontium, a survey questionnaire was formulated. This questionnaire included the most prevalent changes noted in contemporary literature as potential

occurrences or complications. The printed survey questionnaire was handed directly to the subjects.

The survey was conducted anonymously and included 40 pregnant women, without regard to their trimester. In preparing the survey questionnaire, care was taken to avoid the use of professional terms that might pose difficulties for the respondents. Furthermore, if necessary, appropriate verbal assistance was provided to elucidate the questions further.

The questionnaire consisted of the following questions:

1. During pregnancy, have you noticed a pronounced burning/itching of the gums, due to morning sickness?
2. During pregnancy, have you noticed increased sensitivity of the teeth to hot, cold, sour, mild?
3. Have you noticed bleeding gums when brushing your teeth?
4. Have you noticed an unpleasant odor from the mouth?
5. Have you noticed any changes in the mouth (tongue, cheek, gums), if Yes, which ones?
6. Are your teeth more mobile (wobble, feel unstable) during pregnancy?
7. Have you noticed changes in the gums such as swelling or color change?

3 Results

Upon evaluating the findings from the first question, which relates to subjective symptoms of the gums, it is noted that 9 patients (22.5% of the respondents) reported experiencing burning or itching sensations in their gums, correlated to morning sickness. In contrast, the remaining 31 respondents, or 77.5%, did not indicate any such sensations, suggesting no changes or discomfort in the gums associated with morning sickness. (Fig. No.1.)

Regarding the second question - whether they have noticed an increase in tooth sensitivity during pregnancy when exposed to hot, cold, sour, and/or mild stimuli, 14 (35%) answered affirmatively, indicating that they have experienced increased sensitivity to certain flavors. The remaining 26 respondents, or 65%, did not report any significant increase in sensitivity to the types of flavors listed. (Fig. No. 2.)

According to the responses regarding the frequency of gum bleeding during tooth brushing, 25 respondents, representing 62.5%, answered in the affirmative. Based on prior discussions, it is highly probable that those who answered yes have an existing microbial imbalance, which may stem from inadequate oral hygiene practices that were either performed or neglected prior to pregnancy. Conversely, 15 respondents, or 37.5%, did not report any gum bleeding during tooth brushing.(Fig. No. 3.)

From the analyzed data, it is observed that 18 respondents (45%) reported experiencing halitosis, while the remaining 22 respondents (55%) stated that they did not notice any changes concerning unpleasant mouth odor.(Fig. No. 4.)

17.5% of the subjects confirmed that they had some changes in their mouth. Only 1 respondent mentioned that there were changes accompanied by erythema and slight pain that increased with heat. The remaining 33 respondents denied any changes in their mouth, tongue, cheek, and this percentage is 82.5%. (Fig. No. 5.)

Of the total number of respondents, 4 respondents (10%) indicated a subjective increase in tooth mobility during pregnancy, while 36 of them (90%) said that they had no changes in context of tooth instability and mobility. (Table No. 6.)

According to the analysis of the data gathered from the survey conducted, it is observed that 9 subjects, representing 22.5% of the total, reported a perceived change in the discoloration of the gingiva or swelling, which aligns with the clinical presentation of gingivitis. Conversely, the remaining 77.5% of subjects did not report any subjective changes of this nature.(Fig. No. 7.)

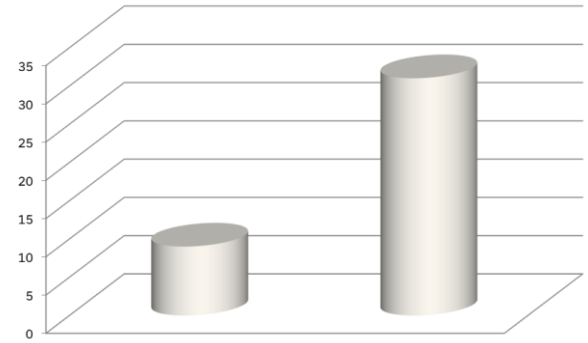

Fig. No. 1. Analysis of the answers to question no. 1. During pregnancy, have you noticed a pronounced burning/itching of the gums due to morning sickness?

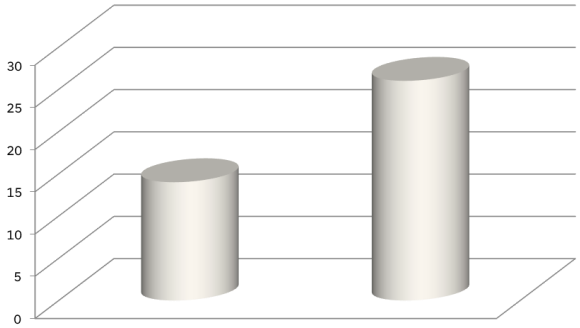

Fig. No. 2. Analysis of the answers to question no. 2. During pregnancy, have you noticed increase-d sensitivity of your teeth to hot, cold, sour, or mild foods?

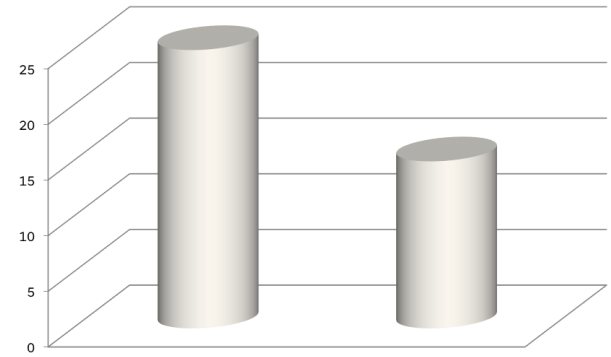

Fig. No. 3. Analysis of the answers to question no. 3. Have you noticed bleeding gums during brushing your teeth?

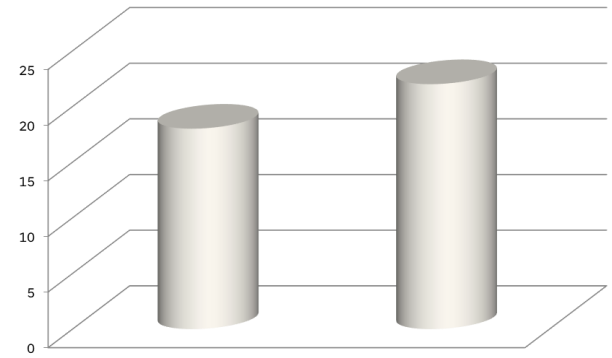

Fig. No. 4. Analysis of the answers to question no. 4. Have you noticed an unpleasant odor from your mouth?

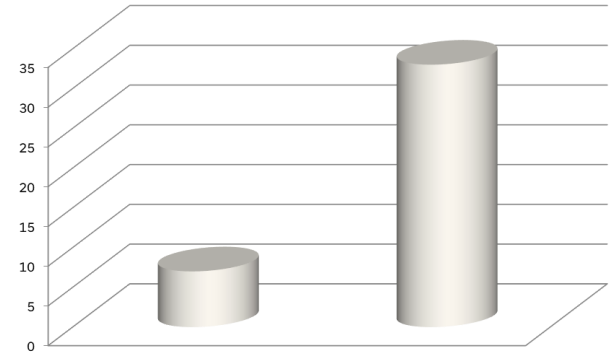

Fig. No. 5. Analysis of the answers to question no. 5. Have you noticed any changes in your mouth (tongue, cheek, gums), if yes, which ones?

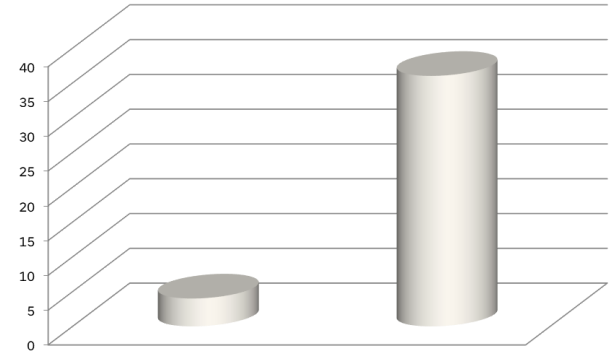

Fig. No. 6. Analysis of the answers to question no. 6. Are your teeth more mobile (wobble, feel unstable) during pregnancy?

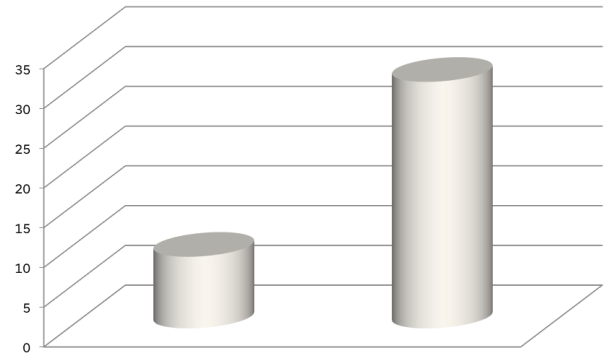

Fig. No. 7. Analysis of the answers to question no. 7. Have you noticed any changes in your gums such as swelling or discoloration?

4 Discussion

This study focuses on the subjective changes associated with the periodontium during pregnancy. It is a cross-sectional study that utilizes a questionnaire.

Gingivitis, or inflammation of gingiva, represents a non-destructive form of inflammatory disease that solely impacts the gingiva, which is part of the supporting tissues of the tooth. This condition is marked by typical signs such as redness, swelling, and the loss of the coral surface, along with alterations in the morphological characteristics and positioning of the gingiva. In this scenario, there is no loss of bone or mobility of the teeth. False periodontal pockets may develop, resulting from gingival edema, which can be either edematous or fibrous in nature. During pregnancy, in addition to the primary etiological factor - dental plaque, significant hormonal level discrepancies are also associated with this condition.

In a study from 2020, women emphasized that gingivitis and bleeding when probing or brushing were among the most significant issues. Additionally, the occurrence of tumors during pregnancy was another concern. According to the same authors, finding blood in the mouth or spitting blood after brushing causes anxiety in women, which have negative effects on their routine oral hygiene practices.[12]

The processed data indicates that subjective symptoms like gum itching and discomfort related to morning sickness are reported by fewer than 25% of subjects (22.5% from subjects).

In relation to the hypersensitivity of teeth that patients express concern about, it should be noted that this condition is present in 35% of the subjects. The nature of this condition is predominantly multifactorial and cannot be completely attributed to changes that occurred during pregnancy; rather, it is more closely related to previous habits and the condition of the teeth. Dental hypersensitivity during this time is most frequently observed in individuals with gingival recession. Hormonal disorders can lead to alterations in vascular permeability, which in turn causes gingival edema and an increased inflammatory response to dental plaque. Additionally, the subgingival microflora may be altered, with a predominance of Prevotella intermedia. The clinical signs and symptoms vary. Most often, patients report gingival enlargement, which is typically generalized and localized interproximally, much more than on vestibular and oral. The gingiva appears bright red or purple, is soft and loose, and has a smooth, shiny surface. Bleeding can occur spontaneously or after minimal provocation. Most importantly, the enlargement does not occur in the absence of dental plaque.[13]

It is essential to highlight that gingivitis may have been present before pregnancy, advanced, and displayed symptoms such as bleeding during brushing or spontaneous bleeding. In a longitudinal study by Fakheran et al., [12] it was noted that a significant majority of respondents (59.9%) answered positively to the question concerning gingival bleeding during

brushing, which correlates with the findings of this study, where the prevalence of gingival bleeding during brushing is reported to be at a notably high level of 62.5%.
When questioned about the occurrence or existence of bad breath, known as halitosis, the results are nearly equal in percentage: 45% responded affirmatively, while 55% answered negatively. It is believed that this condition is caused by certain microbial strains. Halitosis may also arise from poor oral hygiene and the presence of deposits on the tongue.[14] The subjective indication of oral changes on the cheeks, tongue, and lips was confirmed by 17.5% of the respondents. We believe that this low percentage could be due to inadequate education, a lack of interest among pregnant women in prioritizing their oral health, or the difficulty in detecting these changes due to their inaccessible locations.
The assessment of increased tooth mobility during pregnancy, based on subjective criteria, is relatively low, with only 10% of participants reporting this condition. However, the measurement of tooth mobility in this study is based on subjective evaluations without the benefit of a thorough clinical examination, which may account for the observed low percentage.[15] Inflammatory processes affecting the gingiva lead to changes in color, size, shape, and texture, along with bleeding from the gingiva. The swelling and alteration of the surface structure and texture of the gingiva are consequences of the loss of fibrous connective tissue and the semi-liquid consistency of the interfibrillar substance. Changes in the surface structure of the gingiva occur due to gingival edema, atrophy of the gingival epithelium, and the breakdown of gingival collagen fiber bundles. Chronic gingivitis is linked to spontaneous bleeding or bleeding during probing of the gingiva. Furthermore, bleeding gums can be induced by applying pressure to the gums, whether during probing, brushing, or consuming solid foods.[16]
Alterations in the supporting tissues of the teeth that patients perceive as swelling or discoloration of the gingiva are observed in 22.5% of subjects, suggesting that gingival inflammation is present in roughly a quarter of pregnant women.
It is essential to acknowledge specific limitations that it encompasses, namely:
- The total number of participants is 40, which is considered a relatively small sample size from an epidemiological standpoint. However, it still constitutes a sufficiently representative sample that can be used by appropriate initial conclusions and, certainly, encourage additional research.
- One additional limiting factor is that the trimester of pregnancy was not noted during the survey. The results were based on the overall changes observed throughout the full duration of the pregnancy, which included the first, second, and third trimesters, as well as the changes that occurred over a 9-month period.
- Another limitation is that the study is founded exclusively on the subjective responses of the participants, without considering the objective evidence that could be acquired through a clinical investigation.

5 Conclusion

Various pregnancy-related alterations in gingival physiology and salivary composition can detrimentally affect oral health, influencing both the gingiva and the teeth. Gingival changes are more readily observable, as the gingiva is susceptible to bleeding, and the symptoms align well with hormonal changes. These alterations are usually limited to the gingiva and typically subside or resolve within a few months following delivery, assuming local irritants are eliminated. Fortunately, most pregnancy-related oral health issues can be prevented by maintaining excellent oral hygiene.
From this research, it can be observed that numerous subjective issues are associated with periodontal disease in pregnant women, including the burning of the gums, halitosis, increased tooth mobility, and dental hypersensitivity. A notable conclusion from this study is that over 50% of participants report gingival bleeding during brushing, which is concerning, particularly as the respondents are part of a relatively young population during pregnancy. This highlights the critical need for the planning, development, and implementation of an appropriate

preventive program, as well as the education of pregnant women regarding the maintenance and improvement of their oral health.

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