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Influence of Sociodemographic, Dietary, and Oral Hygiene Factors on Gingivitis in Pregnant Women of Bangladesh: A Cross-Sectional Study

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Abstract

Background: Gingivitis is relatively widespread among pregnant women, particularly in low- and middle-income nations like Bangladesh. This health outcome is inadequately acknowledged in maternal health programs. This study evaluated the influence of sociodemographic, nutritional, and dental hygiene factors on gingivitis status among pregnant women of Bangladesh.

Methods: Three randomly chosen tertiary government hospitals in Dhaka were the sites of a cross-sectional study involving three hundred pregnant women, ranging in age from eighteen to thirty-four, who were receiving antenatal outpatient care. A convenient sampling strategy was used to recruit respondents. The data was gathered by clinical oral examinations and a modified, pre-tested, semi-structured questionnaire. The relationships between gingivitis and explanatory variables were identified using descriptive statistics and chi-square testing.

Results: Of those who took part, 73.7% had gingivitis. A lower income ($p < 0.01$), lower education level ($p < 0.01$), and a younger age ($p = 0.05$) were substantially linked to a positive gingivitis status. Negative habits of eating, such as eating eggs, milk, fruits, and vegetables infrequently and eating a lot of sugar, were associated with a higher prevalence of gingivitis. Gingivitis status was also substantially related with indications of poor oral hygiene, such as calculus ($p = 0.01$) and food debris ($p = 0.02$).

Conclusion: Socioeconomic inequalities, unhealthy eating habits, and lack of dental cleanliness contribute to the high rate of gingivitis among pregnant women in Bangladesh. To improve mother health and decrease periodontal disease, prenatal care must immediately incorporate measures such as oral health education, nutritional counseling, and regular dental exams.

Keywords: Pregnancy, Gingivitis, Oral Health, Dietary Patterns, Socioeconomic Factors, Bangladesh, Public Health

Introduction

The state of one's teeth and gums affect one's overall health, which in turn affects one's ability to lead a balanced diet and overall wellness [1]. Oral health status can be affected by the particular physiological, hormonal, and immunological changes that occur during pregnancy [2]. The oral



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cavity is more susceptible to infections during pregnancy because of reversible and irreversible changes caused by fluctuations in estrogen and progesterone levels. These changes include swollen blood vessels, poor circulation, and a reduced immune system [3-4].

Oral health is often disregarded in low- and middle-income countries (LMICs) [5], despite the fact that periodontal health is acknowledged as a crucial component of overall wellness. Preterm delivery, low birth weight, and preeclampsia are among the negative pregnancy outcomes linked to poor oral health during pregnancy, in addition to discomfort and bleeding gums [6-7].

Recognizing oral diseases as a substantial non-communicable disease burden, the World Health Organization (WHO) worldwide promotes incorporating oral health promotion into maternal and child health programs [8]. Oral health screenings during pregnancy are a standard part of prenatal treatment in many industrialized nations. Integrated Management of Childhood Illness (IMCI) and the Expanded Programme on Immunization (EPI) have increased access to pediatric and maternal health care in Bangladesh, but public health activities pertaining to dental health have been severely underfunded and neglected [9]. Gingivitis is common during pregnancy; in fact, one study found that 70% of pregnant women get gingival inflammation of some kind, which is often worsened by careless brushing and general ignorance [10].

Dental caries and periodontal disorders are surprisingly common among pregnant women in nearby South Asian nations, according to the available literature [10-11]. *Streptococcus mutans* has been found to be a major player in tooth decay, which highlights the function of microbes and suggests that antimicrobials derived from plants could be a good way to avoid getting cavities [12]. Nevertheless, prevention of gingivitis among pregnant women in the country is hindered by a lack of data that is particular to the setting.

Behavioral variables, including food habits and dental hygiene routines, have a substantial impact on oral health throughout pregnancy [13], in addition to hormonal changes. During pregnancy, a woman's desires for sugary foods tend to increase, she may be too tired or in pain to wash her teeth as often, and she may have trouble prioritizing dental appointments [14]. There is an increased risk of dental issues associated with these changes in behavior. Even more so, preexisting discrepancies in oral health outcomes during pregnancy might be exacerbated by socioeconomic factors such as income and education levels, which can limit access to dental care [15].

In light of the above, the present study intends to investigate the relationships between socio-demographic variables, food habits, and clinical outcomes; and to evaluate the oral hygiene practices, nutritional patterns, and oral health status of pregnant women in chosen hospitals in Bangladesh. Additionally, this study aspires to support the incorporation of prenatal care (ANC) programs that focus on improving dental health into current programs. This study intends to



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address the lack of local data by providing a more complete picture of the ways in which pregnant women's dental health is affected by their everyday habits and contextual circumstances.

Medical professionals and government officials may find this study's conclusions helpful. We can enhance the oral health of pregnant women with straightforward, focused health messages or programs if we identify the factors that increase their risk of gum issues. These findings may one day help direct initiatives at the community level and promote regular prenatal dental exams. As a whole, the research may lend credence to the idea that Bangladesh could benefit from improved maternal health outcomes.

Methods

2.1 Study design

Among pregnant women of any trimester who sought treatment at certain hospitals in Dhaka city between January 1, 2024, and July 30, 2024, researchers used a quantitative approach to perform a descriptive cross-sectional study. Socio-demographic, pregnancy-related, clinical, nutritional, oral hygiene, gingivitis, and orodental status information was gathered from pregnant women in the Dhaka area of Bangladesh using semi-structured data.

2.2 Study participants, sampling and sample size

Selected hospitals in Dhaka city admitted 300 pregnant ladies, ranging in age from 18 to 34. Because of its abundance of top-notch medical facilities, Dhaka was chosen as the site. The researchers in this study used a convenience sampling strategy that is not probability based to pick their participants. The research population consisted of pregnant women residing in the city of Dhaka. Exit interviews were used to gather data from pregnant women who visited the Gynae outpatient departments (OPDs) of three government hospitals in Dhaka city: Dhaka Medical College Hospital, Shaheed Suhrawardy Medical College and Hospital, and Kurmitola General Hospital. Patients at these three well-known public hospitals represent the typical fundamental criteria of low- and middle-income Bangladeshi families [16,17,18], with a range of ages, genders, and socioeconomic backgrounds.

With a standard normal variable of 1.96, a proportion of 0.94 (based on another study finding a gingivitis status of 94% among pregnant women of Dhaka, Bangladesh) [19], and a degree of error of 0.05, the formula $n = Z^2pq/d^2$ was used to determine an initial sample size of 87 for each hospital. An extra 15% of the computed amount was added to cover non-response and any questionnaire mistakes. As a result, we settled on a sample size of 300 from three randomly chosen public hospitals in Dhaka city, with 100 patients each facility. Pregnancy confirmation, absence of serious systemic disorders, and consent to participate were the inclusion criteria. Preexisting oral illnesses that were detected before pregnancy were used as an exclusion criterion.



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2.3 Data collection

The pregnant women were interviewed face-to-face to obtain quantitative data using a pre-tested and semi-structured questionnaire. The interview session for this survey ran from 10 February 2024 through 25 April 2024. In order to prevent interviewer bias, the study team actively supervised and trained the data collectors. Using an observation checklist, clinical parameters were extracted from the hospital's medical record file. Skilled registered dental surgeons examined patients' oral health utilizing specialized dental toolkits. The interviewer only spent fifteen to twenty minutes filling out the survey. Whether it was during or after data collection, all writers had access to the information pertaining to participants. With the full backing of the hospital's administrative authority, the survey was conducted in the easily intelligible local Bengali language.

2.4 Questionnaire design

The authors of this study reviewed the semi-structured questionnaire, which was based on variables found in previous literature. Nine pregnant ladies from the Gynae OPD department of Azimpur Maternity Hospital Dhaka were pre-tested using the instruments. The women were selected based on inclusion and exclusion criteria and were in different trimesters of their pregnancies. The questionnaire was refined and improved based on the comments made during the pre-test. In the local context, this procedure helped to improve the instrument's face validity and content validity. The use of a semi-structured style allowed for the thorough collection of information. The main parts of the survey were as follows: (i) age, education, and monthly household income; (ii) pregnancy and clinical characteristics, including the stage of the pregnancy and the presence or absence of any comorbidities; (iii) dietary intake, including the frequency with which foods like eggs, fish, vegetables, sweets, milk, and fruit were consumed; (iv) oral hygiene status, including the presence or absence of calculus and food debris; and (v) gingivitis status. The registered dental surgeons used dental toolkits to check for gingivitis, food debris calculus, and other oral health issues.

2.5 Data analysis

Statistical Package for the Social Sciences (SPSS) software, version 21.0, was used to examine and analyze the obtained data. The study's features were summarized using descriptive statistics, which include proportions and frequency tables.

For socio-demographic continuous variables like age and monthly family income, the mid-values of the percentage scores were utilized as cut-off points [20]. The presence of calculus and food debris was graded from 0 to 3. There should be no or very little calculus or debris on the teeth (score 0), but if there is, it should cover no more than one-third of the tooth surface (score 1), some calculus or soft debris (score 2) should cover more than one-third but less than two-thirds of the



exposed tooth surface (score 3), and hard calculus (score 3) should cover more than two-thirds of the exposed tooth surface (score 2) [21].

Measures of dispersion and central tendency, such as the correlation coefficient, were used to characterize the variables, in addition to frequency and percentage. Age, education level, monthly family income, frequency of food group intake, and oral hygiene status were the variables shown to be substantially linked with the dependent variable by multivariate cross-tabulation analysis. The p-value was deemed significant at ≤ 0.05 , and the test significance was established using 95% CI.

2.6 Ethical considerations

Following the principles outlined in the Declaration of Helsinki, this research was approved on December 5, 2023, by the Ethical Review Committee of Northern University Bangladesh's Department of Public Health (NUB/DPH/EC/2023/29). Voluntary and anonymous participation was maintained. Participants were given the freedom to withdraw from the study at any moment because written informed consent was obtained from them at the start of the survey.

Results

3.1 Prevalence and severity of gingivitis

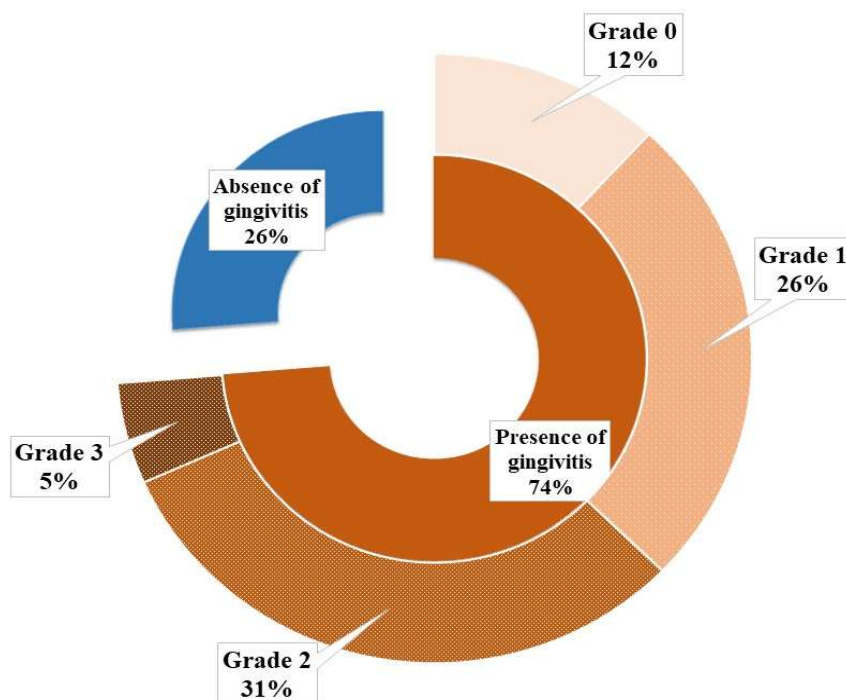


Figure 1. *Distribution of the pregnant women by the status of gingivitis (n = 300)*



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The results showed that 73.7% of the 300 pregnant women tested had gingivitis, while 26.3% showed no symptoms at all (Fig. 1). Here is the distribution by severity of those with gingivitis ($n = 221$): The percentages for Grade 2, 1, 5, 3, and 0 were as follows: 31.0%, 26.0%, 5.0%, and 12.0%.

3.2 Presence and grading of food debris

Of the subjects examined intraorally, 93.3% ($n = 280$) had food debris visible, while 6.7% ($n = 20$) had no visible debris at all (Table 1). According to Table 2, 46.3% of the 280 participants tested positive for food debris, 37.1% tested positive for grade 1, 10.4% tested positive for grade 2, and 2.9% tested positive for grade 3 debris.

Table 1. Distribution of the pregnant women according to the presence or absence of food debris during intraoral examination ($n = 300$)

Food debris	Frequency	Percentage
Present	280	93.3
Absent	20	6.7
Total	300	100.0

Table 2. Distribution of the pregnant women according to the grading of food debris ($n = 280$)

Grading of food debris	Frequency	Percentage
Grade 0	139	46.3
Grade 1	104	37.1
Grade 2	29	10.4
Grade 3	8	2.9
Total	280	100.0

3.3 Factors associated with gingivitis status

Associations between gingivitis status and various socio-demographic, dietary, and oral hygiene-related factors are presented in Table 3.



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Table 3. Factors influencing gingivitis status among the respondents (n=300)

Background characteristics		Gingivitis status			χ^2 /p-value
		Presence	Absence	Total,	
		n (%)	n (%)	N (%)	
Socio-demographic characteristics					
Age group	≤ 20	36 (83.7)	7 (16.3)	43 (14.3)	2.56/0.05*
	21-24	67 (65.7)	35(34.3)	102 (34)	
	25-28	63 (77.8)	18 (22.2)	81 (27)	
	≥ 29	55 (74.32)	19 (25.68)	74 (24.7)	
Monthly family income (in BDT)	Less than 9000	25 (64.1)	14 (35.9)	39 (13)	4.51<0.01*
	9001-12000	134 (85.4)	23 (14.6)	157 (52.3)	
	12001-15000	54 (65.1)	29 (34.9)	83 (27.7)	
	Above 15000	8 (38.1)	13 (61.9)	21 (7)	
Educational qualification	Up to primary	107(90.7)	11(9.3)	118 (39.3)	6.12<0.01*
	Up to secondary	104(66.2)	53(33.8)	157 (52.3)	
	Up to higher Secondary	10 (40.0)	15 (60.0)	25 (8.3)	
Frequency of dietary intake					
Egg intake	Once or no intake	70 (55.12)	57 (44.88)	127 (42.3)	23.21<0.01*
	Twice or more	151 (87.28)	22 (12.72)	173 (57.7)	
Fish intake	3 times or below	159 (73.27)	58 (26.73)	217 (72.3)	0.71/0.2
	4 times or above	62 (74.70)	21 (25.30)	83 (27.7)	
Vegetable intake	3 times or below	156 (69.96)	67 (30.04)	223 (74.3)	9.12/0.03*
	4 times or above	65 (84.42)	12 (15.58)	77 (25.7)	
Sweet intake	No intake	200 (71.94)	78 (28.05)	278 (92.7)	4.20/0.02*
	Intake	21 (95.45)	1 (4.55)	22 (7.3)	
Milk intake	Once or no intake	183 (82.06)	40 (17.94)	223 (74.3)	3.21<0.01*
	2-3 times	38 (49.35)	39 (50.65)	77 (25.7)	
Fruit intake	No intake	196 (76.26)	61 (23.74)	257 (85.7)	4.23/0.01*
	Intake	25 (58.14)	18 (41.86)	43 (14.3)	
Oral hygiene status					
Presence of food debris	Presence	200 (71.4)	80 (28.6)	280 (93.3)	11.56/0.02*
	Absence	5 (25)	15 (75)	20 (6.7)	



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Presence of calculus	Presence	220 (92.1)	19 (7.9)	239 (79.7)	13.12/0.01*
	Absence	10 (16.4)	51 (83.6)	61 (20.3)	

**Statistically significant at 95% CI and chi-square analysis was done to assess the association.*

3.3.1 Sociodemographic characteristics

There was a significant correlation between age and gingivitis ($p = 0.05$), with 83.7% of cases occurring in women aged 20 years and younger. The frequency of gingivitis was highest among participants with an income below BDT 9,000 (64.1%) and lowest among those earning above BDT 15,000 (38.1%), indicating a robust connection between monthly household income and gingivitis ($p < 0.01$). There was a strong relationship between educational level and gingivitis prevalence (90.7% for women with only a primary education; $p < 0.01$).

3.3.2 Dietary habits

Gingivitis and varied eating behaviors were found to be significantly associated. Those who ate eggs less frequently (one or not at all per week) had a greater gingivitis prevalence (55.12%) compared to those who ate eggs twice or more (87.28%) ($p < 0.01$). Similarly, compared to women with higher vegetable consumption ($p = 0.03$), those with lower intake (69.96%) were more likely to have gingivitis. Gingivitis was more common in those who regularly consumed sweets (95.45% of sweet eaters had gingivitis; $p = 0.02$). The prevalence of gingivitis was lower (49.35%) among people who consumed milk two to three times weekly, suggesting a protective link ($p < 0.01$). Gingivitis was more common in people who ate fruit (76.26% vs. 58.14%), suggesting a strong correlation between fruit consumption and the disease ($p = 0.01$).

3.3.3 Oral hygiene indicators

Gingivitis was substantially linked with calculus ($p = 0.01$) and food debris ($p = 0.02$). Gingivitis affected 71.4% of women who had food debris and only 25% of women who did not. In contrast to the 16.4% of those who did not have calculus, 92.1% of those who did have gingivitis.

Discussion

Among pregnant women in Bangladesh, this cross-sectional study looked at the frequency of gingivitis and the factors related to it, such as sociodemographics, food, and oral hygiene. The results highlight the significant incidence of gingivitis in the community, as 73.7% of those who participated in the survey showed symptoms of the disease. Consistent with previous research in low-resource settings, this conclusion suggests that maternal oral health is still an underserved area of healthcare [22, 23].

Gingivitis was found to be significantly associated with a number of sociodemographic factors in this study. Gingivitis was most common among women aged 20 and younger (83.7%), suggesting



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that there may be gaps in oral hygiene behaviors or access to care among this demographic. Gingivitis rates were considerably higher among women from lower-income households (<9,000 BDT/month) and those with only a primary-level education. These results corroborate previous research that has shown a correlation between low socioeconomic position and a lack of education and negative dental health outcomes [24, 25]. These findings highlight the importance of implementing focused programs to eliminate financial and educational obstacles to dental care.

Gingival health was also greatly impacted by dietary patterns. A considerably decreased incidence of gingivitis was observed among respondents who frequently ingested nutrient-rich meals such as eggs, milk, fruits, and vegetables. On the other hand, gingivitis was significantly more common in those who consumed sweets (95.45%). Previous studies have shown that sugar can exacerbate gum inflammation and tooth decay [26, 27], and our results corroborate these findings. On the flip side, the calcium, antioxidants, and anti-inflammatory micronutrients found in milk and fruits, when consumed on a regular basis, provided extra protection [28]. In order to lessen the impact of oral disease, these findings support the inclusion of nutritional counseling in prenatal programs.

Gingivitis was highly related to inadequate dental cleanliness, especially when food debris and calculus were present. Signs of gingivitis were present in 71.4% of those who had visible food debris and only 25% of those who did not. Similarly, gingivitis was far more likely to occur in cases when calculus was present (92.1% prevalence). Consistent with the known pathophysiology of periodontal disease, these results show that inflammation and tissue breakdown follow inadequate plaque control, which in turn promotes bacterial buildup [29–31]. The alarmingly high rates of food debris (93.3% of cases) and calculus (93.7% of cases) among pregnant women highlight the urgent need to improve their oral hygiene and preventive treatment.

Important voids in current maternal healthcare policy are brought to light by the high incidence of gingivitis and the several variables that are associated with it. These results highlight the importance of oral health education as part of standard prenatal care, especially in countries with limited resources like Bangladesh. Periodontal diseases and other negative pregnancy outcomes could be lessened with the implementation of targeted oral health education, dietary guidance, and inexpensive dental care services throughout pregnancy. The findings of this study emphasize the need for dental practitioners, public health officials, and providers of maternal health services to work together across sectors to address oral health as an essential part of health equity.

A number of caveats should be noted, despite the fact that this study offers helpful information. For starters, we can not draw any firm conclusions about cause and effect because it is cross-sectional. Two, the results might not apply to the general public because the participants were picked at random from a list of hospitals using convenience sampling. There is a possibility of recollection or social desirability bias in self-reported data regarding cleanliness and nutrition.



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Although there are some limitations, the study's methodological rigor is strengthened and a valid, unbiased assessment of oral health is provided by include clinical oral examinations.

To further understand the role of behavioral factors in the development of gingivitis over the course of a pregnancy, future studies should use longitudinal designs. Improved generalizability may result from using bigger, more geographically representative samples. Prioritizing research on interventions to modify behavior, cost-effective preventative strategies, and oral health literacy is also important. Health care providers should be trained to provide oral health education, pregnant women should have access to both preventative and restorative dental treatment, and oral health examinations should be a standard part of prenatal exams. Campaigns aimed at pregnant women should raise knowledge about simple nutrition and hygiene habits that help mothers' teeth and gums.

Conclusion

Pregnant women in Bangladesh have an alarmingly high prevalence of dental and oral health issues. The importance of oral health care in Bangladeshi maternal and child health programs should be immediately recognized by this study. The high prevalence of dental disorders, especially gingivitis, among pregnant women is mostly attributable to socioeconomic inequalities, insufficient oral hygiene practices, and poor food habits. Advocating for policy reforms that acknowledge oral health as critical to maternal health, increasing awareness among pregnant women about the importance of good oral hygiene and nutrition, and including dental health screenings into normal antenatal services are all urgently needed.

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Author Contribution Statement

Ommay Salma Mitu: Conceived and designed the study; performed the study; analyzed and interpreted the data; contributed materials, analysis tools, or data; wrote and reviewed the paper.

Farhana Faruque: Performed the study; analyzed and interpreted the data; contributed materials, analysis tools, or data; wrote and reviewed the paper.

Nasrin Akter: Conceived and designed the study; performed the study; analyzed and interpreted the data; contributed materials, analysis tools, or data; wrote and reviewed the paper.

Fatema Afrin Kanta: Conceived and designed the study; performed the study; analyzed and interpreted the data; contributed materials, analysis tools, or data; wrote and reviewed the paper.



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Md. Rifat Uddin: Performed the study; analyzed and interpreted the data; contributed materials, analysis tools, or data; wrote and reviewed the paper.

Nadia Nusreen: Performed the study; analyzed and interpreted the data; contributed materials, analysis tools, or data; wrote and reviewed the paper.

Sarder Mahmud Hossain: Performed the study; analyzed and interpreted the data; contributed materials, analysis tools, or data; wrote and reviewed the paper.

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Conflict of interest

None declared.

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