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Article

Oral hygiene and salivary IgA in relation to gingival condition in pregnant women

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ABSTRACT

Pregnancy is a physiological state that causes changes in many parts of the body, including the oral cavity. Gingivitis has been reported to be the most common oral manifestation during pregnancy, most likely due to an exaggerated inflammatory response to the dental plaque. This study aims to investigate oral hygiene and salivary IgA concerning gingival conditions in pregnant women. In this study, the total sample included was 80 women. The study group consisted of 40 pregnant women: 20 females in the first and 20 in the third trimester, while the control group included 40 non-pregnant women. Between 9 and 11 a.m., unstimulated saliva was collected. The rate of salivary flow and concentration of salivary immunoglobulin A were measured. Dental plaque, calculus and gingivitis were assessed. Results demonstrated that plaque, calculus and gingival indices were higher in a pregnant group, with significant differences in plaque index only. In contrast, salivary flow rate was lower in pregnant women with no significant difference. Salivary IgA was the highest level in the pregnant group during the third trimester, with no statistical difference. In conclusion, the pregnant women revealed a poor oral hygiene status and alteration in salivary parameters, leading to an increased prevalence of gingivitis in pregnant women.

Keywords: Gingivitis, salivary flow rate, Pregnant women, Salivary IgA.

INTRODUCTION

Pregnancy is a state of physiological condition that affects numerous organ systems and causes changes in numerous body areas, including the oral cavity.[1] A state of hormonal, metabolic, and immunological alteration in the body characterizes it.[2] Gingivitis was noted to be the most prevalent oral symptom during pregnancy, with a prevalence of between 35 and 100 percent.[3] This is likely caused by an increased estrogen and progesterone level that affects the gingival vasculature,[4] a suppressed immune response, an enhanced inflammatory response to dental plaque and changes in the composition of the oral microbiome.[5,6] Along with poor dental hygiene, which is demonstrated by the fact that pregnant women

have more plaque than non-pregnant women [7]. It has been established that the primary cause of gingivitis is dental plaque.[8] Previous studies on pregnant women reported that dental plaque was abundant in the Prevotella intermedia, Prevotella melaninogenica, and Porphyromonas gingivalis, and these species had shown association with gingivitis. [9-11] Furthermore, calculus plays an important role in maintaining and exacerbating periodontal disease by keeping plaque in close contact with the tooth surface and gingival tissue, causing numerous pathological alterations and producing places where plaque removal is impossible.[12] Salivary flow rate (FR) affected during pregnancy, several Iraqi studies reported decreased salivary flow rate in pregnant women that harmed gingival health.[13,14] Stressful conditions during pregnancy can be induced by increased cortisol levels, resulting in a decrease in the number of salivary immunoglobulins (especially IgA), which supports the growth of oral bacteria and leads to increased adherence capability and biofilm production on dental surfaces, as well as increased sensitivity to gingivitis.[15] Gingivitis is characterized by gingival redness, edema and the absence of periodontal attachment loss and is initiated by dental biofilm.[16] If left untreated, it can progress to periodontitis in susceptible individuals.[17] Therefore, managing gingivitis is a primary preventive strategy for periodontitis.

This study examined gingival conditions in relation to selected salivary parameters in pregnant women.

MATERIALS AND METHODS

Sample Selection

Before starting the study, approval was achieved from the ethical committee at the University of Baghdad, College of Dentistry (No. 487, 19/ 1/ 2022). Informed consent was obtained from all participant women. The present research was conducted between the beginning of March (2022) and mid-May. In this comparative cross-sectional study, all women participating attended the Primary Health Care Centers in Baghdad city in the AL-Rusafa sector. They were with the age ranged from (21-30) years old. The total sample included was 80 women. The study group consisted of 40 pregnant women: 20 females in the first trimester and 20 in the third trimester, while the control group included 40 married non-pregnant women. Exclusion criteria include women with systemic diseases, smokers and those receiving any medication.

Data collection

The collected unstimulated saliva occurred between 9 and 11 a.m. by passively drooling for five minutes into the graduated saliva collection tube.[18] Salivary flow rate was calculated by dividing the volume of collected saliva per time needed for collection. The secretion rate was measured milliliters per minute (ml/min). Then, salivary samples were centrifuged for 20 minutes at 3000 rpm and stored at (-20°C) until the assessment. The samples were then transported to the laboratory for biochemical analysis. The concentration of salivary secretory immunoglobulin A was measured using an ELISA kit. Dental plaque and calculus were recorded according to the simplified oral hygiene index described by Greene and Vermillion.[19] Gingival health condition was assessed by using the gingival index according to Loe.[20]

Statistical analysis

The Statistical Package for Social Science was used for data description, analysis, and presentation (SPSS version -22, Chicago, Illinois, USA). Descriptive statistics were calculated for the variables, including mean and standard deviation values. Pearson used the correlation coefficient (r) to measure and compare correlations. The significance threshold was chosen at $p<0.05$.

RESULTS

Results demonstrated that both PlI and CalI were higher in the first trimester than the other two groups and lower in the control group, with a significant differences in PlI and no significance in CalI, as shown in Table 1.

Variables	Control		1st		3rd		F	P value
	Mean	±SE	Mean	±SE	Mean	±SE		
PlI	0.444	0.051	0.700	0.074	0.533	0.079	3.848	0.027*
ClI	0.073	0.024	0.152	0.035	0.089	0.037	1.675	0.196

Table 1. Descriptive and statistical test of oral health cleanliness among groups.*=significant at p<0.05

Concerning the gingival index, the control group had the lowest gingival inflammation, then increased in the first trimester. After that, it decreased, but still no significant finding, as shown in Table 2.

Groups	Mean	±SE	F	P value
Control	0.365	0.059	0.808	0.450^
1st	0.471	0.057		
3rd	0.418	0.044		

Table 2. Descriptive and statistical test of GI among groups.^=not significant at p>0.05

Table 3 reveals the mean values of salivary flow rate, which was lesser in pregnant than non-pregnant women, and the third trimester had the lowest value with no significant difference.

Variables	Control		1st		3rd			
	Mean	±SE	Mean	±SE	Mean	±SE	F	P value
FR	0.472	0.050	0.422	0.044	0.344	0.042	1.528	0.227^

Table 3. Descriptive and statistical test of FR among groups.^=not significant at p>0.05

The mean value of salivary immunoglobulin A is illustrated in Table 4. The mean value of salivary s-IgA was lowest in the first trimester, followed by control, while it was highest in the third trimester but with no significant difference.

Varia-bles	Control		1st		3rd			
	Mean	±SE	Mean	±SE	Mean	±SE	F	P value
S-IgA	0.546	0.045	0.516	0.051	0.958	0.351	1.390	0.272^

Table 4. Descriptive and statistical test of s-IgA groups.^=not significant at p>0.05

The correlations between PlI, CalI, and GI by groups were found to be mostly weak positive insignificant, except between PlI and GI in the control and first trimester, which were weak positive and strong positive significant correlations, respectively. Also, weak positive significant correlations of PlI with CalI and GI with CalI in the control group were recorded, as demonstrated in Table 5.

Trimester		GI		CalI	
		r	p	r	p
Control	PlI	0.472	0.002*	0.395	0.012*
	GI			0.316	0.047*
1st	PlI	0.529	0.017*	0.023	0.923
	GI			0.256	0.276
3rd	PlI	0.403	0.078	-0.174	0.463
	GI			0.102	0.669

Table 5. Correlation between PlI, CalI, and GI by groups.*=significant at p<0.05

Table 6 shows a correlation between PlI, GI, with FR by groups that showed strong negative significant correlations between GI and flow rate in the third trimester.

Variables	FR					
	Trimester					
	Control		1st		3rd	
	r	p	r	p	r	p
PlI	0.113	0.486	0.057	0.813	0.159	0.503
GI	-0.063	0.698	-0.230	0.329	-0.569	0.009*

Table 6. Correlation between PlI, GI and SFR by groups.*=significant at p<0.05

Table 7 explains the correlation between PlI and GI with s-IgA by groups.Most correlations between PlI and GI with s-IgA were weakly positive, not significant correlations except between PlI and s-IgA in the third trimester, which had a strong positive significant correlation.

Variables	S-IgA					
	Trimester					
	Control		1st		3rd	
	r	P	r	p	R	p
PlI	0.247	0.125	0.385	0.094	0.588	0.006*
GI	0.142	0.380	0.078	0.744	0.281	0.231

Table 7. Correlation between PlI and GI with s-IgA by groups.*=significant at p<0.05

DISCUSSION

Pregnancy brings about significant and complicated changes for the mother. These changes make the woman more vulnerable to infection, including periodontal disease,[20] and poor oral hygiene (represented by plaque and calculus indices plays an essential role in periodontal disease pathogenesis.[22,23] In the current study, the plaque index was higher among pregnant than non-pregnant women, with a significant difference. Others also reported [the same results 24-27]. On the other hand, other studies,[13,28], reported lower PlI values among pregnant women compared to non-pregnant. However, the difference was statistically not significant. Regarding the trimester of pregnancy, the current study reported that dental plaque was highest in the first trimester, and Al-Zaidi,26, reported the same result. This is inconsistent with the other Iraqi studies, which found the highest values in the third trimester. [14,24,25] The higher value of dental plaque could be attributed to bad oral hygiene among pregnant women compared to non-pregnant controls. This could be explained by the fact that pregnancy is a stressful situation accompanied by numerous physiological and psychological processes that lead to increased self-neglect.[30,31] No significant difference was found for the calculus index among the three groups. This agrees with other studies,[28,32] opposite results recorded by others [26].

During pregnancy, there is an increase in the severity of periodontal diseases, especially gingivitis.[33] This was also recorded in the current study as gingival inflammation was more common among pregnant females than non-pregnant females, with no significant variance. Others reported the same result.[24,25,34] This contrasts the results of Mirza, [25] Mutlak, [26] Kashetty et al.[27,] which reported a significant difference. It has been established that dental plaque is the primary cause of gingivitis [8]. This fact is supported by a significant positive relationship between dental plaque and gingivitis in this study, and others also reported the same correlation.[13,26,29] This disagrees with the results reported by Hameed,[15] which found that dental plaque had no significant relation with gingival index. Higher plaque in the first trimester explains higher gingivitis among pregnant women in the first trimester. There is also a statistically significant positive association between dental plaque and gingivitis with dental calculus in the control group recorded in this study. This could be explained by the fact that calculus is a chief contributing factor in developing periodontal diseases.[35] Numerous factors are connected to calculus formation, including increased bacterial plaque reten-

tion, and accumulation of bacterial toxins, and its surface roughness preventing adequate plaque elimination, leading to difficulty in maintaining oral hygiene.[36] This causes an increase in gingivitis. On the other hand, gingivitis can make brushing and routine dental care difficult, hastening the deposition of local irritants such as debris and calculus. This is supported by current findings, which reported a positive significant correlation of CalI with GI. Thus, good hygiene measures can aid in maintaining a healthy gingiva despite the alterations during pregnancy and the rise in hormone levels.[33]

Saliva is the main factor that guarantees homeostasis of the oral cavity: any changes in its flow or composition affect the local and general health of the individual.[37] The current study showed that the salivary flow rate was reduced in pregnant women than non-pregnant females, with no significant difference. Reducing the salivary flow rate would affect salivary washing action and clearance of food debris and microbes in the oral cavity.[38] In addition, any reduction in salivary flow rate would affect the protective components found in saliva,[39] increasing gingival inflammation. This is confirmed by the current study, which demonstrated a significant negative association between salivary flow rate and gingival index in the third-trimester group.

The secretory IgA (s-IgA) is crucial in maintaining oral homeostasis. S-IgA interacts with bacteria from the dental biofilm and bacteria that colonize the oral mucous membrane to enhance the mouth's adaptive immunity and regulate oral disease.[40] In the present study, the salivary concentration of s-IgA was found to be highest in the third trimester and lowest in the first trimester, with no significant difference. Because the synthesis of estrogen and progesterone steadily increases until the eighth month of pregnancy and both hormones affect the immune system during the gestational period, the hormonal changes during pregnancy may have changed the IgA levels.[41] Higher amounts of IgA in the saliva may provide better protection against infections during pregnancy. Another study reported the same findings 42. However, it was contraindicated with another study by Issa And El-Samarrai,[28], which reported that salivary IgA levels were highest in the pregnant group and lowest in the control group, with a statistically significant difference between the two groups. A strong positive significant correlation between PlI and s-IgA in the ^{third} trimester was found in this study. This could be explained by the fact that more microbial plaque biofilm on the teeth means more microbial toxin and more microbial antigens that illicit the immune system to produce more s-IgA.[43] This was disagreed by Hameed,[15] which found no significant correlation between salivary IgA and plaque index in the third trimester. Regarding the relation of GI with salivary, IgA was a positive non-significant correlation. This is due to the increased production of IgA due to antigenic stimulation by periodontopathogenic bacteria in patients with gingivitis.[44]

CONCLUSIONS

The pregnant women showed poor oral hygiene status along with alteration in salivary parameters, leading to an increased prevalence of gingivitis in pregnant women. Proper oral hygiene practice can prevent this disease and its complications.

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Conflicts of Interest: there is no conflict

Data Availability: The data used to support this study's findings are available from the corresponding author.

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