



## Dental Health-Related Practices and Periodontal Disease among Pregnant Women in Diyala Center, Diyala Governorate, Iraq.

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### ABSTRACT:

The necessity for treatment as support and epidemiological data are crucial for the evaluation of the causes of periodontal disease for the planning of community dental attention. Utilizing the community periodontal index to assess the incidence of periodontal diseases amongst pregnant women across the medical centers in Diyala Center, Diyala Governorate, Iraq. 515 pregnant women between the ages of (20–40) years, in all trimesters, participated in a cross-sectional study. Stratified random sampling was employed to divide the sample evenly across the eight medical health centers, and simple random sampling was used to choose the pregnant women from each health center. Using the Community Periodontal Index for Treatment Needs (CPITN), data on dental health practices and the findings of clinical periodontal examinations were collected. According to the study's findings, 87.38% of pregnant women had periodontal disease overall, including bleeding, calculus, shallow, and deep pockets. This greater prevalence rate and substantial correlation between toothbrush type, tooth brushing frequency before and during pregnancy, tooth brushing technique, usage of interdental aids of various kinds, and mouthwash use. A higher incidence rate of PDs. was reported among pregnant women in the Diyala governorate, accompanied by a limited understanding of periodontal health status and insufficient access to appropriate periodontal treatments. So, it is very necessary recommended for adequate PDs. awareness.

**Keywords:** Diyala governorate, teeth cleaning, inter-dental aids, CPITN E-probe, Periodontal disease, Pregnancy.

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## 1. Introduction:

Periodontal diseases (PDs) are inflammatory disease processes affecting the structures that support teeth in its place (Gasner & Schure, 2020). They are the second most common oral disease affecting humans and have significant health and economic impacts, right behind dental caries (Peres et al., 2019). Gingivitis and periodontitis, two of the most common human diseases, make up the PDs. (Tonetti et al., 2017). When the biofilm is unremoved and accumulated especially at a dento-gingival margin, with time will form dental plaque (DP.) which contains bacteria like *Staphylococcus* spp., *Enterobacteriaceae* spp., *Streptococcus* spp., *Acinetobacter* spp., *Neisseria* spp., *Bacillus* spp., *Corynebacterium* spp., *Pseudomonas* spp., (Sulaiman, 2019; Hussein and Sattar, 2023) and other species of microbes, including viruses, fungi, and parasites, these species adhere to teeth surfaces and when DP. not removed within 2-4 days will stimulate an early immune inflammatory response that considered as a physiological protective mechanism against microbial species (Cekici et al., 2014) to produce inflammatory cells infiltrate that develops initial lesion of healthy gingival tissue (Preethanath et al., 2020) and after that gingival inflammation will happen known as gingivitis (Papapanou et al., 2018). There are links between Epithelial-mesenchymal transition and periodontitis (Saliem and Abdullah et al., 2022). Nutrition is one of the most important modifiable risk factors for periodontitis (Martinon et al., 2021) and there was a direct relationship between periodontal condition and malnutrition (Inaam M Suhail, 2014). Subjects with osteoporosis had greater levels of salivary TNF- $\alpha$  and a decrease in the level of salivary Osteoprotegerin (OPG) compared with similar patients under alendronate treatment. Alendronate treatment for women with osteoporosis and periodontal disease may have beneficial outcomes (Ibraheem and Mohammed, 2018).

Pregnancy is an ever-changing, highly individual, and intricate time in a woman's life. Changes in her psychological and social life also accompany her medical, pathological, and physiological symptoms (Kumar et al., 2021). The pregnancy period increases gingivitis and periodontitis, suggesting that it is during pregnancy, the multiple vascular and hormonal changes that modify the sensitivity of gingival tissue to dental plaque (Hou et al., 2022) and increase the initiation and progression of PDs. because these changes influence the host's immune responses and make it more susceptible to micro-organisms (Antony and Rajasekar, 2022), therefore the prevalence of PDs. increased in these periods (Ali, Bacima G., et al 2005 and Chen et al., 2022). The Community Periodontal Index for Treatment Needs (CPITN) was developed by the Oral Health Unit of the World Health Organization (WHO) in collaboration with the Federation Dentaire International (FDI) to assess periodontal health status. Since it is a simple and quick technique to determine the treatment requirements (TNs) of a specific population group, it has acted as the primary indicator in a number of recent, influential epidemiological studies on the occurrence of PDs. (Diab et al., 2017 and Kashetty et al., 2018). The population in Diyala governorate is more than 1,768,920 and it is located in northeast Iraq, because there is no previous epidemiological data pertaining to periodontal health status from the population of Diyala governorate generally and among pregnant women specially therefore, it was decided to carry out a periodontal health status survey among pregnant women in Diyala health centers. So, the goal of the study is to evaluate the prevalence of periodontal diseases among pregnant women by investigate the relationship between dental health-related practices and periodontal disease. So, the aim of the study is evaluation the association between dental health-related practices with pregnant women's periodontal health status, and treatment needs in Diyala center, Diyala governorate, Iraq.

## 2. Methods

### 2.1 Study Design, Settings, and Population:

To better understand the prevalence of periodontal health status and TNs. among pregnant women in Diyala governorate, Iraq, a 2021 observational analytic cross-sectional study was devised by the University of Baghdad, College of Dentistry, Department of Periodontics. The study population consisted of pregnant women from Diyala center, Diyala governorate, Iraq. Diyala center contains eight health centers attended by pregnant women, the age of the pregnant women ranged between (20-40 years old) and all the pregnant women in the three trimesters , also pregnant women with a partial denture, crown, bridge, implant, and orthodontic appliance are included in the study but if pregnant women not willing to participate in the study, or with medically compromised conditions such as Acquired immune deficiency syndrome, or with any medical conditions which may influence their periodontal health status such as rheumatoid arthritis, or who take medications affecting periodontium such as hypertension drugs, and pregnant women missing all index teeth when examined should be excluded. The total number of pregnant women in the year 2021 was 13,203, (Diyala health department, 2021). The time frame for data collection and recording was from March until July 2022.

### 2.2 Sample Size and Sampling Methodology:

Due to a lack of baseline information on periodontal disease prevalence in the Diyala governorate, pilot research was conducted to collect the necessary data for determining the final sample size. Also, to check the feasibility, applicability of the questionnaire and clinical periodontal examination. The pilot study was conducted in January 2022, on 80 pregnant women from three health centers in Diyala center through two visits for two weeks (one visit each week) by using two-step systematic random sampling (WHO, 2013); and the result of the prevalence of periodontal disease was 62% (codes 0, 1, 2, and, code3), while code 4 and code x not presented. Therefore, the strategy that was utilized to select pregnant women from each health center by utilizing simple random sampling (Turner, 2019). Select the number of pregnant women from each health center randomly throughout the course of five visits spaced across five months (one visit each month). The number of pregnant women from each center, at each visit was decided by the equation (Sample size from each center /No. of visits = No. of pregnant women)

And at each visit, the following steps were done to select the number of pregnant women from each health center:

1. All pregnant women who attended the health center were identified with the numbers 1i to....n i. (i= the pregnant woman) (n= number of the pregnant woman).
2. Choose 1<sup>st</sup>, 3<sup>rd</sup>, 6<sup>th</sup>, 9<sup>th</sup>, 12<sup>th</sup>..... etc until a total number of pregnant women were chosen at each visit from each health center.
3. In the following visit, previously examined pregnant women should be excluded.

### Equipment, Materials, and Instruments

The equipment, materials, and instruments used in this study include the following:

1. Medical gown, face mask, face shield, and gauze.
2. Disposable medical examination gloves, patient towels, table towels, and dental mirror.
3. Alcohol disinfectant.
4. The CPITN-E probe which is manufactured by Perfection-Plus company in the United Kingdom.
5. Autoclave sterilizer.

6. Sterilizing plastic pouches and kidney dish.
7. Pregnant women's consent form, structured close-ended questionnaire, and CPITN chart box.

### **Ethical Committee Clearance, Official Permission, and Study Group Consent Form:**

The study protocol was approved by the ethical committee of the College of Dentistry/University of Baghdad. And the permission and the approval of this study to examine the pregnant women were acquired from the directorate of the health centers in Diyala governorate. Each pregnant woman has gained informed consent to assign it if accepted to participate in the study.

### **Questionnaire and Variables**

A specially prepared questionnaire that contains the variables which includes dental health-related practices:

1. Teeth cleaning (yes or no).
2. Frequency of teeth cleaning before pregnancy period (once/day, twice/day, three times/day, more than three times/day, and occasionally).
3. Frequency of teeth cleaning during pregnancy period (once/day, twice/day, three times/day, more than three times/day, and occasionally).
4. Method of teeth cleaning (toothbrush, miswak, finger, and others such as salt or charcoal).
5. Type of toothbrush (powered or manual toothbrush).
6. Technique of teeth brushing (horizontal, vertical, scrubbing, and circular).
7. Use of Interdental aids (yes or no).
8. Type of interdental aids (dental floss, toothpick, and interdental brush).
9. Use of mouthwash (yes or no).

### **Periodontal Health Status and Treatment Needs**

#### **Examiner Alignment and Assessment**

For each pregnant participant in the trial, the researcher recorded the CPITN codes. Before the clinical alignment session, which took place in January 2022, the researcher examined and discussed the criteria of the utilized index (Ainamo et al., 1982) with an experienced examiner. When using CPITN to examine pregnant women, the researcher's accuracy and reproducibility were evaluated by (Hefti and Preshaw, 2012):

1. Inter-examiner alignment and assessment:  
Ten subjects having the same study criteria were examined by the researcher and experienced examiner.
2. Intra-examiner alignment and assessment:

Ten subjects were examined on two occasions over two successive days by the researcher. According to the six levels of the nomenclature of agreement, the measures were calculated using kappa statistics after being derived from inter- and intra-examiner alignment (Landis and Koch, 1977), (Table 1).

Table (1): The agreement of Inter and Intra-examiner alignment.

Test	Inter-examiner	intra-examiner
<b>Kappa Value</b>	<b>0.75</b>	<b>0.83</b>
<b>Agreement</b>	<b>Perfect</b>	<b>Perfect</b>

### Examination Settings and Principles

Each primary care clinic's dental department examined and recorded information on pregnant patients using a single-use CPITN-E probe and a disposable mouth mirror. The pregnant women were examined while they were seated on the dental chair and the light of the dental chair was used during the examination. A box chart was used by the researcher for recording CPITN data (Scribd, 2019). After dividing the mouth into six sextants based on the World Health Organization (WHO), the guidelines recommend examining the teeth in the following order: upper right posterior sextant, upper anterior sextant, upper left posterior sextant, lower left posterior sextant, lower anterior sextant, and lower right posterior sextant to get a full picture of periodontal health, for the pregnant women age (20 years and above), only ten specified index teeth were examined (17,16,26,27,31,36,37,46 and 47) and the highest code for each sextant was determined (Scribd, 2019). By using the CPITN-E probe for detecting 6-, 5-, and 4-mm pocket depth, subgingival calculus, plaque retentive factors, and bleeding on probing response (BOP) in that specific order (Marya, 2012). The scoring criteria were followed as suggested by (Ainamo et al., 1982) a code from 0 to 4 was given as follows: Code 0 = healthy tissue; code 1 = bleeding on probing; code 2 = Calculus or other plaque retentive factors such as ill-fitting crowns; code 3 = there is a pocket with a depth of 4–5 mm; code 4 = there is a pocket with a depth of more than 6 mm.

### Statistical Analysis

The data were checked and analyzed for significance detection; the Pearson chi-square ( $\chi^2$ ) test was used for qualitative data A P-value (P) of less than 5% was considered significant.

### 3. Results

Higher prevalence percentage of periodontal disease among pregnant women in Diyala center and it was (87.38%). the pregnant women with healthy periodontium were (12.62%), and bleeding on probing was (35.34%), the pregnant women with calculus represented the highest percentage of the sample (45.05%), while the pregnant women with 4-5 mm pocket depth was (4.47%), and the least percentage of pregnant women had 6mm or more pocket depth (2.52%). According to the type of treatment needed for every pregnant woman Figure (1) display the clinical periodontal findings evaluation.

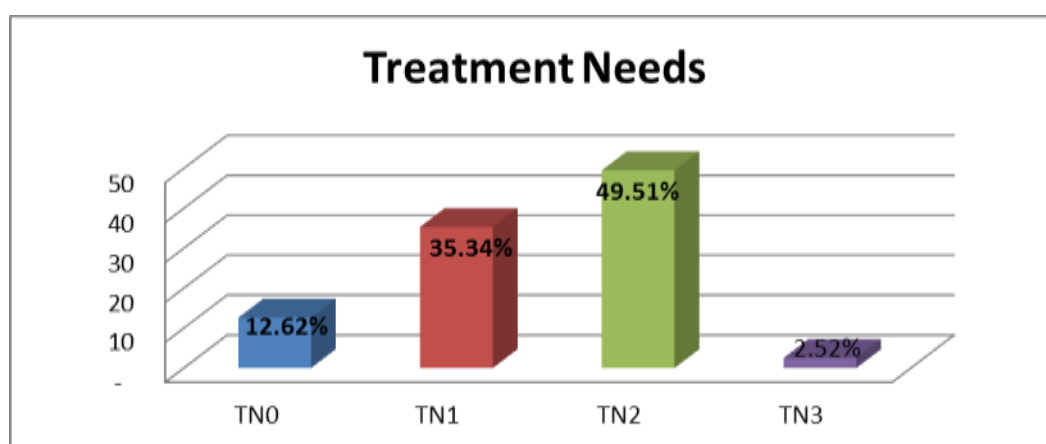


Figure (1): Bar chart for pregnant women's treatment needs by using CPITN.

Pregnant women numbers were not selected uniformly from the eight medical health centers as the following as from Al-Rahmah, Al-Yarmouk, Shifttah, AL-Hodaid, Al-Sarrai, Al-Mustafa, Al-Tahrir one, and Al-Tahrir two health centers were accounting for 80(15.53%),

70(13.59%), 50(9.71%), 65(12.62%), 75(14.56%), 50(9.71%), 65(12.62%), and 60(11.65%) respectively.

### 3.1 Association between Highest CPITN Codes with Dental Health-Related Practices

Table (2) displays the distribution of pregnant women and the statistical analysis in relation to dental or oral health-related behaviors or practices.

**3.2 Teeth cleaning:** Regarding teeth cleaning, the percentage of pregnant women with healthy periodontium is higher in pregnant women who cleaned their teeth (12.89%). Pregnant women who neglected to brush their teeth had greater percentages of bleeding (36.36%), calculus (45.45%), pocket depth 4-5mm (9.09%), and pocket depth 6mm or more (9.09%) than those who did. The relationship between teeth cleaning and the highest CPITN codes was statistically significant ( $P \leq 0.05$ ).

**3.3 Method of Cleaning Teeth:** In terms of the method employed for dental hygiene, pregnant women who utilized the toothbrush demonstrated the largest percentage (79.37%) of the sample and exhibited the highest percentage of healthy periodontium (15%). Conversely, pregnant women who utilized miswak had the highest percentage of bleeding (38.75%). The pregnant women who utilized an alternative teeth cleaning method, such as using pin or hair pliers, exhibited the highest percentage of calculus (66.67%). Conversely, pregnant women who utilized their finger had the highest percentages of pockets depths measuring 4-5mm (47.62%) and 6mm or more (42.86%). The relationship between the method of teeth cleaning and the highest CPITN codes was statistically significant ( $P \leq 0.05$ ).

**3.4 Technique of Teeth Brushing:** Among pregnant women, the highest percentage of healthy periodontium (62.5%) was associated with the scrubbing technique for teeth brushing. Conversely, the highest percentage of bleeding (44.44%) was shown in the circular technique for teeth brushing. The highest percentage of calculus (75%) was found in pregnant women who used vertical technique for teeth brushing, while the highest percentages of pockets depths 4-5 mm (9.23%) and 6 mm or more (6.15%) was shown in pregnant women who used horizontal technique for teeth brushing. The relationship between the technique of teeth brushing and the highest CPITN codes was statistically significant ( $P \leq 0.05$ ).

**3.5 Type of Toothbrush:** The highest percentage of healthy periodontium (100%) was showed in pregnant women who used powered toothbrushes, while the highest percentages of bleeding (32.75%), calculus (39.04%), pocket depth 4-5mm (6.30%) and pocket depth 6 mm or more (3.78%) was showed in pregnant women who used manual toothbrushes. The association between the type of toothbrush and the highest CPITN codes was statistically significant ( $P \leq 0.05$ ).

**3.6 Frequency of Teeth Cleaning Per Day Before the Pregnancy Period:** Pregnant women who cleaned their teeth three times and more than three times per day exhibited the highest percentage of healthy periodontium (100%). Conversely, pregnant women who cleaned their teeth once daily had the highest percentage of bleeding (49.71%). Pregnant women who cleaned their teeth twice-daily had a significantly the highest percentage of calculus (73.26%). Conversely, pregnant women who occasionally cleaned their teeth demonstrated the highest percentages of pockets depths of 4-5mm (40%) and 6mm or more (50%). Furthermore, the relationship between the frequency of teeth cleaning per day before the pregnancy period and the highest CPITN codes was statistically significant ( $P \leq 0.05$ ).

**3.7 Frequency of Teeth Cleaning Per Day During the Pregnancy Period:** Pregnant women who cleaned their teeth three times per day exhibited the highest percentage of healthy periodontium (69.62%). Conversely, pregnant women who cleaned their teeth once per day demonstrated the highest percentage of bleeding (57.14%). Pregnant women who cleaned their teeth twice daily exhibited a significantly the highest percentage of calculus (79.05%). Conversely, pregnant women who occasionally cleaned their teeth demonstrated the highest percentages of pocket depth of 4-5mm (33.33%) and pocket depth of 6mm or more (33.33%). The relationship between the frequency of teeth cleaning per day during the pregnancy period and the highest CPITN codes was statistically significant ( $P \leq 0.05$ ).

**3.8 Use of Inter-Dental Aids:** Regarding the use of interdental aids, the highest percentage of pregnant women who used them had healthy periodontium (60.40%), whereas those who never used of them had the highest percentages of bleeding (38.89%), calculus (54.35%), pockets depths ranging from 4-5mm (4.35%), and 6mm or greater (1.45%). The relationship between the use of inter-dental aids the and the highest CPITN codes was statistically significant ( $P \leq 0.05$ ).

**3.9 Type of Inter-Dental Aids:** Regarding the category of interdental aids, it was seen the pregnant women who utilized the interdental brush had the highest percentage of healthy periodontium (77.14%). Conversely, the pregnant women who opted for dental floss had the highest percentage of bleeding (33.33%). The pregnant women who utilized toothpick had the highest percentages of calculus (31.25%), pocket depth 4-5 mm (31.25%), and pocket depth 6mm or more (37.5%). The relationship between the type of inter-dental aids the and the highest CPITN codes was statistically significant ( $P \leq 0.05$ ).

**3.10 Use of mouthwash:** The percentage of Pregnant women who used mouthwash had the highest percentage of healthy periodontium (81.4%) than those who didn't use it which had the highest percentages of bleeding (37.5%), calculus (48.52%), pockets depths 4-5mm (4.87%), and 6mm or more (2.75%). The relationship between the use of mouthwash and the highest CPITN codes was statistically significant ( $P \leq 0.05$ ).

Table (2): Distribution of pregnant women and statistical analysis based on their highest CPITN codes by dental or oral health-related practices.

Dental health-related practices	CPITN Codes					Total No.(%)	Statistical analysis
	Code 0 No.(%)	Code 1 No.(%)	Code 2 No.(%)	Code 3 No.(%)	Code 4 No.(%)		
Teeth cleaning							
Yes	65(12.89%)	178(35.32%)	227(45.04%)	22(4.37%)	12(2.38%)	504(97.86%)	$\chi^2 = 3.88$ DF. = 4 ( $P \leq 0.05$ ) (S)
No	0(0%)	4(36.36%)	5(45.45%)	1(9.09%)	1(9.09%)	11(2.14%)	
						515(100%)	
Method of teeth cleaning							
Toothbr	60(15%)	144(36%)	194(48.5)	2(0.5%)	0(0%)	400(79.)	$\chi^2 =$

ush	)		(%)			37%)	<b>292.68</b> <b>DF. = 12</b> <b>(P ≤ 0.05)</b> <b>(S)</b>
Finger	0(0%)	1(4.8%)	1(4.8%)	10(47.62%)	9(42.86%)	21(4.17%)	
Miswak	5(6.25%)	31(38.75%)	30(37.5%)	11(13.75%)	3(3.75%)	80(15.87%)	
Others	0(0%)	0(0%)	2(66.67%)	0(0%)	1(33.33%)	3(0.60%)	
						515(100%)	
<b>Technique of teeth brushing</b>							
Horizon tal	8(6.15%)	32(24.62%)	70(53.85%)	12(9.23%)	8(6.15%)	130(32.5%)	<b><math>\chi^2 = 196.28</math></b> <b>DF. = 12</b> <b>(P ≤ 0.05)</b> <b>(S)</b>
Vertical	6(6%)	7(7%)	75(75%)	6(6%)	6(6%)	100(25%)	
Circular	35(38.89%)	40(44.44%)	10(11.11%)	3(3.33%)	2(2.22%)	90(22.5%)	
Scrubbing	50(62.5%)	20(25%)	10(12.5%)	0(0%)	0(0%)	80(20%)	
						400(100%)	
<b>Type of toothbrush</b>							
Manual	72(18.14%)	130(32.75%)	155(39.04%)	25(6.30%)	15(3.78%)	397(99.25%)	<b><math>\chi^2 = 13.10</math></b> <b>DF. = 4</b> <b>(P ≤ 0.05)</b> <b>(S)</b>
Powered	3(100%)	0(0%)	0(0%)	0(0%)	0(0%)	3(0.75%)	
						400(100%)	
<b>Frequency of teeth cleaning/day before pregnancy period</b>							
Once/day	0(0%)	172(49.71%)	167(48.27%)	4(1.16%)	3(0.87%)	346(68.65%)	<b><math>\chi^2 = 73.211</math></b> <b>DF. = 16</b> <b>(P ≤ 0.05)</b> <b>(S)</b>
Twice/day	3(3.49%)	10(11.63%)	63(73.26%)	10(11.63%)	0(0%)	86(17.1%)	
Three/day	55(100%)	0(0%)	0(0%)	0(0%)	0(0%)	55(10.91%)	
More than three/day	7(100%)	0(0%)	0(0%)	0(0%)	0(0%)	7(1.39%)	
Occasional ly	0(0%)	0(0%)	1(10%)	4(40%)	5(50%)	10(1.98%)	
						504(100%)	
<b>Frequency of teeth cleaning/day during pregnancy period</b>							
Once/day	0(0%)	172(57.14%)	114(37.87%)	10(3.32%)	5(1.66%)	301(59.72%)	<b><math>\chi^2 = 443.6</math></b>



Twice/day	3(2.86%)	10(9.52%)	83(79.05%)	7(6.67%)	2(1.90%)	105(20.83%)	<b>3 DF. = 16 (P ≤ 0.05) (S)</b>
Three/day	55(69.62%)	0(0%)	24(30.38%)	0(0%)	0(0%)	79(15.67%)	
More than three/day	7(53.85%)	0(0%)	6(46.15%)	0(0%)	0(0%)	13(2.58%)	
Occasionally	0(0%)	0(0%)	2(33.33%)	2(33.33%)	2(33.33%)	10(1.19%)	
						504(100%)	
Use of interdental aids							
Yes	61(60.40%)	21(20.8%)	7(6.93%)	5(4.95%)	7(6.93%)	101(19.61%)	<b>χ<sup>2</sup>=28 4.98 DF. = 4 (P ≤ 0.05) (S)</b>
No	4(0.97%)	161(38.89%)	225(54.35%)	18(4.35%)	6(1.45%)	414(80.39%)	
						515(100%)	
Type of interdental aids							
Dental floss	7(46.67%)	5(33.33%)	2(13.33%)	0(0%)	1(6.67%)	15(14.9%)	<b>χ<sup>2</sup>=90. 37 DF. = 8 (P ≤ 0.05) (S)</b>
Toothpick	0(0%)	0(0%)	5(31.25%)	5(31.25%)	6(37.5%)	16(15.84%)	
Interdental brush	54(77.14%)	16(22.86%)	0(0%)	0(0%)	0(0%)	70(69.31%)	
						101(100%)	
Use of mouthwash							
Yes	35(81.4%)	5(11.63%)	3(6.98%)	0(0%)	0(0%)	43(8.35%)	<b>χ<sup>2</sup> =201.6 6 DF. = 4 (P ≤ 0.05) (S)</b>
No	30(6.36%)	177(37.5%)	229(48.52%)	23(4.87%)	13(2.75%)	472(91.65%)	
						515(100%)	

DF. (Degree of freedom)

#### 4. Discussion

The Oral Health Unit of the World Health Organization (WHO) and the Federation Dentaria International (FDI) developed the Community Periodontal Index for Treatment Needs

(CPITN) to assess people's periodontal health. The present study is the first study in Diyala governorate. The overall prevalence rate of PDs in the present study was (87.38%). that is considered as a high prevalence rate due to lack of awareness among the pregnant women about PDs, use of interdental aids, use of mouthwash, frequency of teeth brushing also fear, stress and anxiety during pregnancy towards the dental treatment which have the highest effect on periodontal health status. This high prevalence rate also similar research done in Pakistan by (Tariq et al., 2023) on 44 pregnant women with age ranged between (23-35 years) reflected prevalence rate of PDs. was (76%). Regarding the CPITN codes, the code that appeared most frequently in this study was code 2, which represents calculus. and lastly code 4, indicating a pocket depth of 6mm or greater. These findings mostly agreed with a study done in Brazil by (Kruger et al., 2017) on 311 pregnant women, and the result was that code 4 had the lowest percentage (3.7%), while code 2 had the highest percentage (46.6%).

### **Association between Highest CPITN Codes with Dental Health-Related Practices.**

**Teeth Cleaning:** The current study demonstrated significant correlation between the highest CPITN codes and teeth cleaning practices, hence the occurrence of PDs. such as bleeding, calculus, and both shallow and deep pockets were shown as in a higher percentage in pregnant women who did not practice the teeth cleaning, whereas a greater proportion in pregnant women who maintained teeth cleaning demonstrated a healthy periodontium. The findings in the current study are consistent with previous research conducted by (Thompson et al.,2013; Gomes et al., 2015; Rahmani et al., 2019). Also, other studies found that there was a significant relationship between teeth cleaning habits and lower CPITN codes (Fahima et al., 2015; Sekhon et al., 2015 and Kumari et al., 2021).

**Frequency of Teeth Cleaning Before and During Pregnancy Period:** The current study shown significant correlations between the frequency of teeth cleaning practises prior to and during pregnancy, with the highest recorded CPITN codes. The majority of pregnant women typically engage in teethbrushing once per day. However, pregnant women who engage in teethbrushing three times or more than three times per day exhibited the highest proportion of healthy periodontium. This finding is consistent with a study conducted by (Archana et al., 2018) revealed that cleaning the teeth two times a day or more improved the periodontal health condition. Hence, the higher the frequency of teeth cleaning the lower the rate of plaque formation and its accumulation, therefore, the lower the tendency for gingival inflammations which lead to the periodontal pockets formation and finally loss of teeth.

**Method of Teeth Cleaning:** The study presented significant correlation between the method of teeth cleaning used and highest CPITN codes. The most method used by pregnant women for cleaning of teeth was a toothbrush and the result of the present study was agreed with other studies done by (Batra et al.,2014; Soroye and Dosumu,2021) which showed a significant difference between the method of teeth cleaning used and periodontal health status. The subjects who used tooth brush with tooth paste revealed good oral hygiene and healthier periodontium (Butera et al., 2021; Altindal et al., 2022) but the subjects who used fingers as a method of teeth cleaning demonstrated poor oral hygiene and highest CPITN codes (Devi et al., 2022).

**Type of Toothbrush:** The current study revealed significant correlation between the highest CPITN codes and the type of toothbrushes. A majority of the pregnant women participating in this study reported using a manual toothbrush, while a very small proportion reported using a powered toothbrush. Notably, pregnant women who used manual toothbrushes

exhibited the highest percentages of bleeding, calculus, shallow pockets, and deep pockets. Conversely, pregnant women who used powered toothbrushes demonstrated the highest percentages of healthy periodontium. These results agreed with other studies that showed the difference between type of toothbrushes used and their effectiveness on the periodontal health status (Elkerbout et al., 2020; Sälzer et al., 2020 and Rawlinson et al., 2021). Also, other studies showed benefits of powered toothbrush in reduction of plaque accumulation, reduction of CAL loss progression, and increasing the number of teeth retained after it is use (Pitchika et al., 2019; Sager et al., 2023).

### **Techniques of Teeth Brushing**

The current study revealed significant correlation between the highest CPITN codes with teeth brushing techniques. A majority of the pregnant women in this study utilized the horizontal technique, while those who utilized the scrubbing technique exhibited the highest percentage of healthy periodontium. These findings align with previous research conducted by (Wawrzyn-Sobczak et al., 2005) which also identified a significant association between teeth brushing techniques and periodontal health status.

### **Use of Interdental Aids**

The current study revealed significant correlation between the utilization of interdental aids with the highest CPITN codes. Pregnant women who incorporated interdental aids into their oral hygiene routine exhibited less instances of bleeding and calculus, ultimately resulting in a healthier periodontium compared to those who did not utilize such aids. This finding aligns with previous research conducted by (Poklepovic et al., 2013; Archnana et al., 2018; Marchesan et al., 2018; Gallie, 2019; Ng and Lim, 2019) hence, all these studies collectively demonstrate the significance of utilizing interdental cleaning devices or aids in order to maintain optimal oral hygiene and prevent the development of PDs. and dental caries by effectively remove and prevent the accumulation of interproximal bacterial plaque.

### **Type of Interdental Aids**

The current study revealed significant correlation between the type of various interdental aids with the highest CPITN codes. Specifically, pregnant women who utilized interdental brushes had a more favorable periodontal condition compared to those who utilized alternative forms of interdental aids. This result agreed with other studies done by (Rams and Loesche, 2017; Kim and Han, 2022; and Bakri et al., 2023). There are various types of inter-dental cleaning aids have been discovered and developed such as toothpick, interdental floss and interdental brushes to prevent accumulation of debris and bacterial plaque in interproximal areas of all sextants of mouth (Kumar et al., 2019; Funna et al., 2023). hence the best one of these interdental mechanical cleaning devices that are used to obtain good interproximal plaque control are interdental brushes (Chongcharoen et al., 2012; Hallapa et al., 2015; Harrison ,2017, Ng and Lim, 2019; Fugazzaro et al., 2020; Guzeldemir- Wehner et al., 2021and Sultani et al., 2020).

### **Use of Mouth Wash**

The current study shown significant correlation between the use of mouthwash with the highest CPITN codes. Specifically, pregnant women who utilized mouthwash exhibited reduced levels of calculus, bleeding, no shallow and deep pockets compared to pregnant women who did not utilize mouthwash. The use of mouthwash yielded a substantial decrease in plaque index, gingivitis score, and periodontitis (Herrera, 2013 and Abed, 2019) through the ability to prevent the bacterial growth therefore it was used in prevention and treatment of oral diseases such as a reduction of oral inflammation (Eliot et al., 2013), also prevent and

decreased halitosis associated with PDs. (Altindal et al., 2023) and preventing caries (Elsa et al., 2023). Hence, mouth wash used as adjuncts to brushing and flossing in areas of mouth which cannot be reached by dental cleaning devices (Oliveira et al.,2021). All the mouthwashes used revealed antimicrobial activity against the microorganisms used even when these mouthwashes were diluted but the concentrated mouthwash had the strongest antimicrobial activity, hence the sensitivity of *Streptococcus mutans* was higher to pomegranate peels aqueous extract at concentrations (50mg/ml, 75mg/ml) than chlorhexidine (Aldhafer, 2013). Chlorhexidine remains the benchmark control as an adjunct to periodontal therapy but Aloe vera can be used as an alternative to chlorhexidine when it cannot be used (Abed, 2019).

## 5. Conclusions

Pregnant women in the Diyala center have been shown to have a high prevalence rate of periodontal disease and a need for periodontal treatment. Thus, governorate of Diyala must have sufficient dental staff coverage for promoting enough knowledge about oral hygiene care, particularly preventative measures. Furthermore, dental clinics require specialists for prevention and treating any complex and type of periodontal disease.

### Suggestion

1. Conduct research with a similar methodology to assess the periodontal health state and treatment requirements of women throughout the menopausal phase in Diyala governorate, Iraq.
2. Study to assess the periodontal health condition and treatment requirements of undergraduate and postgraduate students in Diyala governorate, Iraq.

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### Consent to Participate

Every participant was given informed permission.

### Authorship

Data gathering, analysis, and the original paper's authoring were all assisted by MQH. The final validation was provided by MAA, who also revised the analysis that they had written.

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