Research Article

Salivary vitamin D3 in relation to dental caries among pregnant women in Baghdad city

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Abstract: Background: Vitamin D deficiency is a problem for pregnant women, and it affects general and oral health. This problem increases as vitamin D requirements increase during pregnancy. This study was conducted among pregnant women in urban and rural areas in order to assess the relation between salivary vitamin D3 and dental caries. Materials and methods: In this comparative cross-sectional study, all women participating were attending the primary Health Care Centers in Baghdad city in AL-Karkh sector, they were with age ranged from (15-44) years old. The total number 90 pregnant women in the second trimester only which include: The first group consists of (45) pregnant women attendance seeking dental treatment in urban areas, The second group consists of (45) pregnant women attendance seeking dental treatment in rural areas. Collection of the unstimulated saliva was done according to Tenovuo (1996). After that the clinical examination of Dental caries DMFT/S was performed according to the world health organization in (2013). Results: The findings of this study revealed that the percentage of pregnant women in the age range of 15–29 years was higher in the rural areas than in the urban areas. While those in the age range of 30–44 years were higher in the urban areas. Regarding the age, the percentage of dental caries experience was increased with age. Regarding the area, the percentage of dental caries was higher in the urban area than in the rural area. The highest mean value of DMFT was found in the urban area, with no significant differences. While the highest mean value of DMFS was found in the rural areas with no statistically significant difference, except the FS, where was statistically significant and higher in the urban areas. The mean value of salivary vitamin D3 was found to be higher in rural areas than in urban areas, although statistically non-significant. The correlation between dental caries experience (DMFT/S) and salivary vitamin D3 level was statistically non-significant among urban and rural pregnant women, except in the urban areas where the DMFS was found to be significant with salivary vitamin D3. Conclusions: According to the results of this study, there was a non-significant negative correlation between dental caries and salivary vitamin D3 among pregnant women in urban and rural areas. Except, the correlation between dental caries experience by surfaces and salivary vitamin D3 was negative and significant among urban pregnant women.

Keywords: Dental caries, Pregnant women, Vitamin D3.

Introduction

"Dental caries is a localized, chemical dissolution of a tooth surface brought about by metabolic activity in a microbial deposits (a dental biofilm) overing a at any given time"[(1)]. It affects people of all ages, races, and genders [(2)]. This process was aided by a number of bacteria, especially streptococcus mutans, which are highly cariogenic. Dental caries, on the other hand, is not thought to be a classic infectious disease; rather, it is seen as a multifactorial disease involving a variety of risk factors. It occurs when there is an environmental disturbance inside the oral cavity, which is supplemented by other external influences [(3)].

Vitamin D plays an important role in calcium absorption and musculoskeletal health regulation[4]. It has also been linked to cardiovascular health, immunological response, wound healing, and prevention of cancer [5-9].

Teeth are mineralized organs surrounded by alveolar bone and formed by enamel, dentin, and cementum, which are three distinct hard tissues. While tooth mineralization is similar to skeletal mineralization, if mineral metabolism is disrupted, failures similar to those seen in bone tissue will occur.Vitamin D is essential for bone and tooth mineralization, and when levels aren't controlled, it can result in the "rachitic tooth," a deficient and hypomineralized organ that's prone to fracture and decay [10,11].

Two mechanisms for vitamin D's effect on caries have been proposed. Vitamin D is thought to work through the vitamin D receptor, and polymorphisms in this gene have been linked to tooth decay[12]. Low vitamin D levels can promote topical demineralization of teeth, similar to its known effect on bone, by lowering calcium and phosphate ions concentrations. Vitamin D can influence caries through immunological factors like cathelicidins[13,14]. Iraqi study worked among nutritional rickets children revealed the dmfs was lower than control group[15].Pregnancy is a stressful disorder that causes significant changes in metabolic and physiological functions extent[16]. As a result, the most significant physiological and hormonal changes in a woman's life occur during pregnancy[17]. And one of the focus areas for these changes is the oral cavity[18]. Pregnant women are more likely to develop tooth decay for a variety of reasons, including a decrease in salivary pH in the oral cavity, sweet food preferences, and a lack of focus on oral health[16,18,19]. Unfortunately, becoming pregnant can lead to unhealthy behaviors. These behaviors may include a preference for certain food groups at the expense of others, as well as snacking on harmful foods, such as candy, on a regular basis in order to relieve nausea, Increased consumption of processed carbohydrates will give a favorable environment for cariogenic bacteria, potentially increasing the risk of tooth decay in certain people [20]. In Iraq, research compared pregnant women to non-pregnant women and found that pregnant women had more dental caries than non-pregnant women [21-25].

As far as, no Iraqi study has been carried out to measure the level of salivary vitamin D3 and its relation to dental caries among pregnant women in urban and rural areas. Therefore, this study was conducted. We suggest the null hypothesis that there is no relation between the salivary vitamin D3 level and dental caries.

Materials and Methods

The present research was carried out between 13th of April and the 8th of September. The pregnant women were examined during this time; the saliva samples were collected. Before starting the study, approval was achieved from the Ministry of Health for women examinations Verbal consents were obtained from all women and the ethical committee had accepted the study's protocol in University of Baghdad, College of Dentistry. In this comparative cross sectional study, all women participating in this study were attending the primary Health Care Centers in Baghdad city in AL-Karkh sector, They were with the age ranged from (15-44) years. The total number 90 pregnant women in the second trimester only which include. The first group consists of (45) pregnant women attendance seeking dental treatment in urban areas, The second group consists of (45) pregnant women attendance seeking dental treatment in rural areas. Collection of the un-stimulated saliva were done according to Tenovuo.[26]The saliva is allowed to accumulate in the floor of the mouth and the pregnant woman spits out it into the disposable graduated test tube. Saliva samples were taken to a lab at a primary health care center and centrifuged for 15-20 minutes at (3000) rpm. The clear samples was collected by a micropipette and stored into eppendrouftubes at (-20 C) in a deep freeze until the time of biochemical analysis. After collection of saliva the clinical examination of Dental caries DMFT/S was performed according to WHO.[27]

The concentration of salivary vitamin D3 was detected by an enzyme linked immune-sorbent assay (ELISA) using a salivary vitamin D3 kit.

Exclusion criteria: The pregnant women should be:

- Free from any systemic diseases
- Not receiving any multivitamins, calcium and vitamin D3 supplements
- Non smokers

Statistical analysis:

The Statistical Package for Social Science was used to conduct the statistical analysis (SPSS version -22, Chicago, Illionis, USA). The mean and standard error were calculated using descriptive analysis with a simple chart bar. The difference between two groups was tested using inferential analysis as an independent sample T test parametric test. For the linear correlation between two quantitative variables, the Pearson correlation parametric test was used.

Results

The results showed that the percentage of pregnant women in the age range of 15–29 years was higher in the rural areas than in the urban areas. While those in the age range of 30–44 years were higher in the urban areas. As shown in the table 1.

Table 1: The distribution of pregnant women according to the age and area

	Area			
Age (years)	**Urban**		**Rural**	
15-29	30	44.78%	37	55.22%
30-44	15	65.21%	8	34.78%

Regarding the descriptive and statistical tests of age by area, the mean value of age in urban pregnant women was found to be 26.20 and the mean value of age in rural pregnant women was found to be 23.4 as shown in table (2).

Table 2: Descriptive and statistical tests of pregnant women in the second trimester regarding age by area

Pregnancy	**Area**	**Mean**	**SE**
2nd trimester	**Urban**	26.20	1.041
	Rural	23.41	0.774

The results of the distribution of caries among pregnant women by age and area were reported that pregnant women in the age range of 30–44 were found to have higher percentages of caries than those in the age range of 15–29**.** Regarding area, the percentage of caries was higher in the urban area than in the rural area table 3.

Table 3: Distribution of Caries status by age and area

	Vars.	**N.**	**%**
Age (years)	15-29	53	79.10
	30-44	22	95.65
	Urban	41	91.11
Area	Rural	34	75.56

The results demonstrated that the highest mean value of DMFT was found in the urban area, with no significant differences as shown in the table 4.

Table 4: Descriptive and statistical tests of dental caries experience (DMFT) among pregnant women by area

Pregnancy		Area					
		Urban		Rural			
		Mean	±SE	Mean	±SE	T test	P value
2nd tri-mester	DT	0.696	0.234	1.614	0.440	1.864	0.066
	MT	0.717	0.169	0.614	0.244	0.352	0.726
	FT	2.065	0.435	1.068	0.267	1.935	0.056
	DMFT	3.478	0.499	3.295	0.640	0.226	0.821

Concerning dental caries experience by surfaces the results show that the highest mean values of DMFS were found in the rural areas with no statistically significant difference, except the FS, where was statistically significant and higher in the urban areas. Descriptive and statistical tests of caries experience by surfaces and areas are shown in Table 5.

Table 5: Descriptive and statistical tests of dental caries experience (DMFS) among pregnant women by area.

Pregnancy		Area					
		Urban		Rural			
		Mean	±SE	Mean	±SE	T test	P value
2nd trimester	DS	2.304	0.993	4.864	1.746	1.289	0.201
	MS	3.543	0.829	3.068	1.219	0.325	0.746
	FS	3.543	0.721	1.750	0.517	2.005	0.048*
	DMFS	9.391	1.555	9.682	2.484	0.100	0.921

*=significant statistically at p<0.05.

In reference to vitamin D3 the findings revealed that the mean values and standard error of salivary Vitamin D3 were found to be higher in rural areas than in urban areas, although statistically non-significant, as shown in Figure 1.

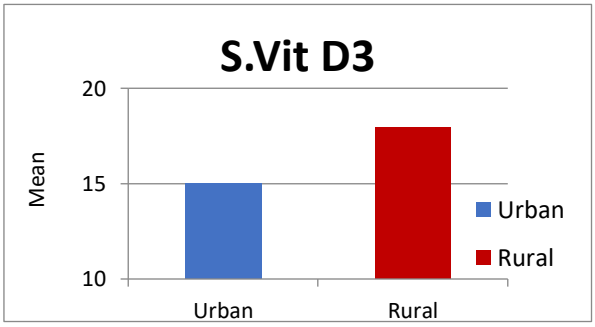

Figure 1: *Descriptive and statistical tests of Vitamin D3 among area.*

The correlation of salivary vitamin D3 with all variables in the urban and rural areas was negative and weak, but not significant. Except in the urban areas, the DMFS was found to be significant with vitamin D3 as shown in table 6.

Table 6: *Correlation between dental caries experience by teeth, dental caries experience by surfaces and Salivary vitamin D3.*

Area		VitD3	
		r	P value
Urban	DT	-0.186	0.216
	MT	-0.111	0.463
	FT	-0.184	0.220
	DMFT	-0.285	0.055
	DS	-0.240	0.108
	MS	-0.109	0.472
	FS	-0.205	0.171
	DMFS	-0.306	0.038*
Rural	DT	0.051	0.742
	MT	-0.172	0.264
	FT	-0.097	0.531
	DMFT	-0.071	0.647
	DS	-0.073	0.639
	MS	-0.172	0.264
	FS	-0.051	0.744
	DMFS	-0.146	0.344

Discussion

This study looked at the relation between salivary vitamin D3 and dental caries among pregnant women in urban and rural areas. Regarding the personal characteristics, most pregnant women were under 30 years of age. Dental caries was measured by DMFT/S and they were grouped according to WHO.[27]In terms of age, the present study's findings revealed that dental caries increase with age, which was consistent with Iraqi study.[28] this could be explained by the fact that age is the major risk factor for dental caries.[29] also be related to the accumulative and irreversible nature of dental caries.[30]Regarding to the area where the percentage of dental caries was higher in the urban area and this disagreed with study by Siddiqui et al. (2018) where the highest percentage of dental caries was in the rural areas.[31]And this may be related to the low level of vitamin D3 in urban areas in this study. As a result, a deficiency in this vitamin causes a variety of issues, including changes in the composition and mineralization of teeth and bones. [32]

Regarding to the caries experience by teeth and surfaces where the DMFT higher in urban pregnant women and this could be related to the FT mean value which was higher than other components of DMFT and this good indication that the women visit the dentist for filling. While the DMFS was higher in the rural pregnant women and this may be related to the DS mean value where was higher than other

components of DMFS. Rural women's negative attitudes toward dental treatment during pregnancy related to a reduced use of dental services and a high frequency of untreated dental caries.[33]despite this the dental caries is remains a multifactorial disease.[34]In reference to Vitamin D3. The findings reported that the mean value in the rural areas was higher than those in the urban areas, but statistically non-significant. This may be explained by their exposure to the sun more than those in the urban areas, the sun is considered the main source of vitamin D3.[35] Regarding the correlation between salivary vitamin D3 and dental caries experience in urban pregnant women, there was a statistically significant negative correlation between DMFS and salivary vitamin D3, and this agreed with Botelho et al. (36). This could be explained by that when the vitamin D3 level decreases, it leads to an increase in dental caries because it is essential for bone and tooth mineralization, and when levels aren't controlled, it can result in hypomineralized teeth and decay.[37,38]

Conclusion

The findings of the present study concluded that there were negative correlation of dental caries with salivary vitamin D3 levels among pregnant women in urban and rural areas. Pregnant women need more education and encouragement for oral health care and visiting the dentist during pregnancy.

Conflict of interest: None.

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العنوان: فيتامين د 3 اللعابي وعلاقته بتسوس الاسنان لدى النساء الحوامل في مدينة بغداد

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المستخلص:

الخلفية:نقص فيتامين د مشكلة للمرأة الحامل ، ويؤثر على الصحة العامة وصحة الفم. تزداد هذه المشكلة مع زيادة متطلبات فيتامين د أثناء الحمل. أجريت هذه الدراسة بين النساء الحوامل في المناطق الحضرية والريفية من أجل تقييم العلاقة بين فيتامين د 3 اللعابي وتسوس الأسنان.

المواد وطرق العمل:في هذه الدراسة المقطعية المقارنة ، كانت جميع النساء المشاركات يترددن على مراكز الرعاية الصحية الأولية في مدينة بغداد في قطاع الكرخ ، وتراوحت أعمارهن بين (15-44) سنة. بلغ العدد الإجمالي 90 سيدة حامل في الفصل الثاني فقط والتي تشمل: - المجموعة الأولى تتكون من (45) امرأة حامل تبحث عن علاج الأسنان في المناطق الحضرية ، وتتكون المجموعة الثانية من (45) امرأة حامل تبحث عن علاج أسنان في المناطق الريفية. تم جمع اللعاب غير المحفز وفقًا لـ **Tenovuo** عام (1996). بعد ذلك تم إجراء الفحص السريري لتسوس الأسنان **DMFT / S** وفقًا لمنظمة الصحة العالمية عام**.(2013)**

النتائج: كشفت نتائج هذه الدراسة أن نسبة النساء الحوامل في الفئة العمرية 15-29 سنة كانت أعلى في المناطق الريفية منها في المناطق الحضرية. بينما كانت الفئة العمرية 30-44 سنة أعلى في المناطق الحضرية. فيما يتعلق بالعمر ، فإن النسبة المئوية لتجربة تسوس الأسنان تزداد مع تقدم العمر. فيما يتعلق بالمنطقة ، كانت نسبة تسوس الأسنان أعلى في المناطق الحضرية منها في المناطق الريفية. تم العثور على أعلى متوسط قيمة **DMFT** في المنطقة الحضرية ، مع عدم وجود فروق ذات دلالة إحصائية. في حين تم العثور على أعلى قيمة متوسط **DMFS** في المناطق الريفية مع عدم وجود فرق معتد به إحصائياً ، باستثناء **FS** ، حيث كانت ذات دلالة إحصائية وأعلى في المناطق الحضرية. تم العثور على القيمة المتوسطة لفيتامين د3اللعابية لتكون أعلى في المناطق الريفية منها في المناطق الحضرية ، على الرغم من أنها ذات دلالة غيرإحصائية. كانت العلاقة بين تجربة تسوس الأسنان **(DMFT / S)** ومستوى فيتامين د3اللعابي ذات دلالة غيرإحصائية بين النساء الحوامل في المناطق الحضرية والريفية ، باستثناء المناطق الحضرية حيث وجد أن **DMFS** معنوي بفيتامين د3اللعابي.

الاستنتاجات:وفقا لنتائج هذه الدراسة ، كان هناك علاقة سلبية غير معنوية بين تسوس الأسنان وفيتامين د3 اللعابي بين النساء الحوامل في المناطق الحضرية والريفية. فيما عدا ، كانت العلاقة بين تجربة تسوس الأسنان عن طريق الأسطح وفيتامين د3اللعابي سالبة ومعنوية بين النساء الحوامل في المناطق الحضرية.