Alqalam Journal of Medical and Applied Sciences. 2025;8(3):1938-1945
https://doi.org/10.54361/ajmas.258396

Original article

Metabolic Influences of Vitamin D and Calcium Deficiency on Oral Health among Libyan Pregnant and Non-Pregnant Women

Emni Elshaali*[1], Samira Abdulrahman[2], Mahadia Abdalrahman[3]

[1]*Department of Preventive and Community Dentistry, Faculty of Dentistry, Sirte University, Libya*
[2]*Department of Obstetrics and Gynecology, Faculty of Medicine, Sirte University, Libya*
[3]*Department of Orthodontics, Faculty of Dentistry, Sirte University, Libya*
Corresponding email. *mi.alsh849@gmail.com*

Abstract
There have been physiological changes, fluctuations in hormones, and higher nutrient demands, all recognized as risk factors for periodontal disease and dental caries. There is a wealth of literature linking well-established roles of vitamin D and calcium in oral health. These nutrients frequently show a deficiency among women during pregnancy. This investigation aimed to assess the oral health condition along with the levels of calcium and vitamin D in both expectant and non-expectant women. A total of four hundred thirty women participated in the study, but 80 females dropped out of further analysis. Of the remaining 350 women, 175 were pregnant women and 175 were non-pregnant women who agreed to participate using a comparative, cross-sectional study design. Data collection included oral health clinical evaluations using the DMFT index, along with the use of questionnaires regarding nutrition, oral hygiene practices, and vitamin supplement use. This researcher revealed that the rate of dental caries was higher in pregnant women at 60.0 %, compared to 42.9 % ($p < 0.001$) in non-pregnant women. In addition, they found a substantial difference in the proportion of pregnant women taking supplements who achieved sufficient vitamin D status, with 80.0 % compared to 57.1 % ($p < 0.001$). Additionally, pregnant women had lower average vitamin D and calcium levels when compared to the non-pregnant group respectively (vitamin D 19. 8 ± 5. 0 ng/mL compared to 28. 2 ± 5. 8 ng/mL, $p < 0. 001$; calcium 7. 8 ± 0. 5 mg/dL, verse 9. 2 ± 0. 4 mg/dL, $p < 0.001$). There was an inverse relationship between DMFT and blood status of vitamin D ($r = -0.52$, *p* = 0.001) and calcium ($r = -0.68$, $p = 0.001$) in pregnant women. This research study illustrated an association between pregnancy, bad oral health, and low vitamin D and calcium status, although they used considerable numbers of supplements. Data suggested that improved dietary advice offered to women during pregnancy is likely to improve the oral health status of pregnant women and their infants.
Keywords: Pregnancy, Vitamin D, Calcium, Dental Caries, Oral Health.

Introduction

It is worth noting that oral health during pregnancy, and the health of the expectant mother in general, is a commonly under-emphasized and under-researched area. Research has shown that pregnancy can have an impact on oral health and systemic health because of physiological changes. Hormonal changes that occur in pregnancy have been reported to increase the likelihood of dental disease in expectant women. Considerable scientific literature has shown that pregnancy is an important time for the efficacy of calcium and vitamin D metabolism. This highlights the biological demands placed upon the mother and the developing fetus [1]. Vitamin D plays a fundamental part in mineralization, where it plays a crucial role in the maintenance of mineral homeostasis. Low vitamin D levels have been linked to mineralization disorders [2]. The aim for expectant mothers being tested is to reach more than 30 ng/mL or 74. 9 nmol/L of 25-hydroxyvitamin D (25OHD), as stated by global health authorities. These organizations are concerned with the fact that many of the expectant mothers may be in a vitamin D-deficient state despite the guidelines on how much vitamin D is required [3]. In extreme vitamin D deficiency, deficiency is also associated with frequent health problems - for example, rickets in children. Nevertheless, there is usually insufficient information on how slight to moderate shortages influence pregnancy. Like bone and teeth, the skin may demonstrate quite significant signs of vitamin D deficiency. In more advanced stages, dental flaws include defects in enamel mineralization, increased sizes of the pulp chamber with extended pulp horns, and periapical abscesses alone without cavities or physical trauma to the teeth [5,6]. Additionally, numerous studies have examined how vitamin D status is related to the incidence of enamel defects or any physical trauma of the teeth [7].

However, many studies have yielded mixed and sometimes conflicting results, leaving the relationship between vitamin D and early dental development still uncertain [8]. Morelli et al. discovered that hormonal fluctuations during pregnancy could affect the immune system's defense against infections in the dental and oral cavity. Previous research has linked hormones to a higher risk of periodontal disease during pregnancy [9,10]. The increase in hormone levels during pregnancy is a risk factor that can modify periodontal tissue conditions and affect biological changes in the total number of pro-inflammatory cytokines [11].

Pregnant women are also likely to experience disorders like pregnancy gingivitis because of the hormonal changes, especially the rise in estrogen and progesterone that cause the blood vessels to become more permeable and result in exaggerated inflammatory responses within the gingiva [12]. Cravings for food,

Received*: 04-08-2025 -* ***Accepted****: 02-09-2025 -* ***Published****: 10-09-2025*

tiredness, nausea, and vomiting tend to cause poor oral hygiene, hence putting one at risk for dental issues. These changes, coupled with nutrient deficiencies, exacerbate oral health issues [11].
No studies have looked into whether the optimal level of 25(OH) D during pregnancy should differ from the level considered adequate for non-pregnant persons. The low fetal 1, 25 (OH) 2D concentrations reflect low fetal PTH and high phosphorus levels, which restrict renal 1-hydroxylase activity [13,14].
The doubling of intestinal calcium absorption and the maternal adaptation's reliance on vitamin D sufficiency may be explained by the doubled 1, 25(OH) 2D concentrations, according to some researchers; however, this explanation may not be comprehensive. Even before free 1,25(OH)2D concentrations rise in the latter stages of pregnancy, intestinal calcium absorption in humans and rodents doubles in the early stages of pregnancy [15,16].
Research shows that vitamin D insufficiency is even higher in pregnancy and could have adverse health implications for both mothers and their babies, because of decreased serum concentrations of 25(OH)D3 [17]. Patients in Riyadh, Saudi Arabia, had been diagnosed with a 50% deficiency of vitamin D (25(OH)D) concentrations at < 50 nmol/L, and 43.8% were considered insufficient for vitamin D (25(OH)D) for being under 50-74 nmol/L. The mean concentration of 25(OH) D in this group was 49.9 nmol/L. Only about 8.1% of the pregnant women indicated they had sufficient vitamin D (equal to or more than 600 IU day). Age group, educational level, sun exposure frequency, and daytime and daily activities were all significantly associated with vitamin D levels. Overall, vitamin D deficiency was common among pregnant Saudi women in Riyadh (16). Due to a lack of evidence in clinical studies about its adverse effects on bone and dental health.
This study was created to examine how vitamin D and calcium levels relate to dental health in women who are pregnant women and those who are not pregnant. In addition, it also investigated the potential dental impacts associated with mild to moderate calcium and vitamin D deficiency during pregnancy.

Method

A comparative cross-sectional design study was conducted at a private medical and dental clinic in Sirte, Libya, over 12 months (July 2024 – June 2025) to comply with ethical standards for research. This study was used to look at the differences in the dental health clinical indicators and biochemical markers for dental health between pregnant and non-pregnant females, which provided a view into possible metabolic components that can affect oral health.

Study participants

At the beginning of this study, 430 subjects were included; however, 80 women withdrew voluntarily. The remaining subjects were comprised of 175 pregnant women and 175 non-pregnant women matched for age. Patients visiting the dental clinic for regular check-up examinations or treatments were approached to participate in this research using convenience sampling.

Inclusion and exclusion criteria

Only women aged 18 years or older who were not diagnosed with a systemic condition that affects bone or calcium metabolism, e.g., hyperparathyroidism or chronic kidney disease, were excluded. Pregnant women receiving medications that might alter calcium and vitamin D metabolism (corticosteroids and anticonvulsants) or who had pregnancy complications (like preeclampsia) were also excluded. These exclusions were necessary to accommodate healthy cases with no medical or dental confounding problems.

Data Collection Procedures

Clinical Oral Examination

Under ideal lighting and sterilization conditions, a qualified dentist conducted a standardized dental examination. Which undergoes dental treatment, including orthodontic procedures. Dental caries was evaluated using the DMFT Index (Decayed, Missing, and Filled Teeth), which recorded untreated decayed teeth (D), caries-related tooth loss (M), and filled or restored teeth (F). Each participant's total DMFT score was calculated, providing a quantitative measure of caries experience.

Questionnaire-Based Assessment

A pre-tested structured questionnaire was used in assessing socio-demographic data, dietary patterns, and oral hygiene habits. Contributors were asked about their brushing frequency (once or twice a day), whether they used fluoridated toothpaste (yes/ no), and whether they had regular or irregular dental checkups. Both the daily duration of sun exposure and vitamin D-rich foods (fatty fish, breakfast cereals that are fortified) were quantified. Dietary consumption of calcium-rich foods (dairy products, green vegetables) was recorded.

Received: *04-08-2025* - ***Accepted***: *02-09-2025* - ***Published***: *10-09-2025*

Biochemical Analysis

5 ml venous blood samples of participants were collected by a gynecologist, using aseptic procedures, and were placed in plain gel tubes for serum separation components of the studies. Trained hematology staff transport the samples to the clinical biochemistry laboratory under close-controlled conditions. Vitamin D level (serum 25 (OH) D) measured using chemiluminescence immunoassay (CLIA) was categorized as deficient (less than 20 ng/ml), insufficient (20 and 30 ng/ml), or sufficient (greater than 30 ng/ml). Calcium level is evaluated with a colorimetric assay; a normal level is between 8.5 and 10.2 mg/dL.

Statistical Analysis

SPSS (version 27) was used to analyze data. Description statistics were calculated as means, standard deviation for numerical data, and number and percentage of categorical data were presented. Categorical variables were compared by using Chi-square tests (for example, the vitamin D status versus the prevalence of dental caries), while differences in continuous variables were assessed by the independent t-test. A P-value greater than 0.05 reveals statistical significance.

Ethical Considerations

All participants provided formal informed consent under the Declaration of Helsinki. The participants were informed that they have the right to withdraw from participation at any stage of the study without penalty. Data was anonymized to ensure confidentiality, and restriction of access was granted to the research team alone.

Results

A total sample of 350, where 175 were pregnant and 175 were not pregnant women, all with comparable ages, economic backgrounds, living situations, and education levels, participated in the research. The demographic factors revealed no significant differences between the two sets of groups of women ($p > 0.05$), indicating that the groups were well matched regarding these features (Table 1).

Table 1. Participant Demographics among the studied participants

Characteristic	Categories	Pregnant (n=175)		Non-Pregnant (n=175)		p-value
		No.	%	No.	%	
Age (years)	18 – 25	60	34.3%	55	31.4%	0.420
	26 – 35	90	51.4%	85	48.6%	
	36 – 45	20	11.4%	30	17.1%	
	46 and above	5	2.9%	5	2.9%	
Economic Status	Low	25	14.3%	30	17.1%	0.48
	Middle	125	71.4%	120	68.6%	
	High	25	14.3%	25	14.3%	
Residence Type	Rural	50	28.6%	60	34.3%	0.180
	Urban	125	71.4%	115	65.7%	
Education Level	Primary	15	8.6%	20	11.4%	0.350
	Secondary	100	57.1%	95	54.3%	
	Higher	60	34.3%	60	34.3%	

(Table 2) illustrates that pregnant women have higher rates of dental caries (60%) than non-pregnant women, while the rates for non-pregnant women are 42.9% ($p < 0.001$). The DMFT index is notably higher for pregnant women, averaging 4.0 ± 1.4, compared to (3.1 ± 1.1; $p < 0.001$) for those who are not pregnant, yet this difference did not affect how often they brushed their teeth ($p = 0.320$) or used fluoridated toothpaste ($p = 0.550$). Additionally, pregnant women (34. 3%) visit the dentist less often than non-pregnant women (51. 4%, $p = 0.002$).

Table 2: Oral Health and Hygiene Practices among the studied participants

Characteristic	Categories	Pregnant		Non-Pregnant		p-value
		No.	%	No.	%	
Dental Caries	Yes	105	60.0%	75	42.9%	< 0.001***
	No	70	40.0%	100	57.1%	
DMFT Index	Mean ± SD	4.0 ± 1.4		3.1 ± 1.1		< 0.001***

Received*: 04-08-2025 -* ***Accepted****: 02-09-2025 -* ***Published****: 10-09-2025*

Brushing Frequency	Once	35	20.0%	25	14.3%	0.320
	Twice	100	57.1%	110	62.9%	
	Thrice+	40	22.9%	40	22.9%	
Fluoridated Toothpaste	Yes	150	85.7%	155	88.6%	0.550
	No	25	14.3%	20	11.4%	
Dental Visits (Regular)	Yes	60	34.3%	90	51.4%	0.002**
	No	115	65.7%	85	48.6%	

The expected mothers reported 80% who were more likely compared to non-expected mothers, 57.1% to consume vitamin D, with a statistically significant difference ($p < 0.001$). Daily milk-product consumption is slightly higher among pregnant women than non-pregnant women (57. 1% versus 51.4%). On the other hand, no significant changes were noticed in daily milk-product consumption, sunlight exposure, physical exercises, or daily sugar intake between both groups ($p > 0.05$ for all). It is also reported that a significantly larger percentage of non-pregnant women have more daily sunlight exposure than pregnant women (34.3% versus 28.6 %). Though in terms of weekly sun exposure, pregnant women are reported to have more exposure than non-pregnant women (51.4% compared to 48.6%). However, both pregnant and non-pregnant women have a similar proportion of uncommon sun exposure (20% in pregnant women and 17.1% in non-pregnant women) (Table 3).

Table 3: Dietary and Lifestyle Habits among the studied participants

Characteristic	**Categories**	**Pregnant**		**Non-Pregnant**		**p-value**
		No.	**%**	**No.**	**%**	
Dairy Consumption	Daily	100	57.1%	90	51.4%	0.220
	Weekly	60	34.3%	65	37.1%	
	Rarely	15	8.6%	20	11.4%	
Vitamin D Supplements	Yes	140	80.0%	100	57.1%	< 0.001***
	No	35	20.0%	75	42.9%	
Sunlight Exposure	Daily	50	28.6%	60	34.3%	0.670
	Weekly	90	51.4%	85	48.6%	
	Rarely	35	20.0%	30	17.1%	
Physical Activity	Sedentary	50	28.6%	40	22.9%	0.450
	Moderate	100	57.1%	105	60.0%	
	High	25	14.3%	30	17.1%	
Sugar Intake (Daily)	Yes	80	45.7%	70	40.0%	0.160
	No	95	54.3%	105	60.0%	

(Table 4) presents noteworthy variations in calcium metabolism and vitamin D level biomarkers between expectant mothers and those who are not expecting. The mean serum vitamin D level is significantly lower in pregnant women (19.8 ± 5.0 ng/mL) compared to non-pregnant women (28.2 ± 5.8 ng/mL), with a p-value < 0.001. The proportion of pregnant women with a vitamin D deficiency was also statistically different from the proportion of non-pregnant women with a deficiency (55.4% *vs* 32.5% $p < 0.001$). Moreover, serum calcium levels were substantially lower in pregnant women (7.8 ± 0.5 mg/dL) than in non-pregnant women (9.2 ± 0.4 mg/dL) with a p-value < 0.001.

Table 4: Biomarkers of Vitamin D and Calcium Metabolism among the studied participants

Biomarker	**Unit**	**Pregnant (Mean ± SD)**	**Non-Pregnant (Mean ± SD)**	**p-value**
Serum Vitamin D	ng/mL	19.8 ± 5.0	28.2 ± 5.8	< 0.001***
Vitamin D level	Deficient	97 (55.4%)	57 (32.5%)	< 0.001***
	insufficient	31 (17.7%)	39 (22.3%)	
	Sufficient	47 (26.8%)	79(45.1%)	
Serum Calcium	mg/dL	7.8 ± 0.5	9.2 ± 0.4	< 0.001***

Received*: 04-08-2025 -* ***Accepted****: 02-09-2025 -* ***Published****: 10-09-2025*

A greater percentage of expectant mothers indicated that they used calcium and vitamin D supplements (91. 4% compared to 65. 7%, p < 0. 001). The presence of prior health issues (such as high blood pressure and diabetes) was similar in both groups see (Table 5).

Table 5: Medical and Supplement Use among the studied participants

Characteristic	Categories	Pregnant		Non-Pregnant		p-value
		No.	%	No.	%	
Calcium/Vitamin D Use	Yes	160	91.4%	115	65.7%	< 0.001***
	No	15	8.6%	60	34.3%	
Pre-existing Conditions	Diabetes	12	6.9%	10	5.7%	0.720
	Hypertension	20	11.4%	15	8.6%	

Among women with insufficient vitamin D (<30 ng/mL), expectant mothers were significantly more likely to have tooth decay (77.3% compared to 57.1%, p = 0.003). However, among women who were vitamin D sufficient (≥30 ng/mL), there was no significant difference in tooth decay rates for both groups (Table 6).

Table 6: Relation between caries in vitamin D deficiency and pregnancy

Subgroup	Pregnant (n=175)	Non-Pregnant (n=175)	p-value
Caries in Deficient Vit D (<30 ng/mL)	85/110 (77.3%)	40/70 (57.1%)	0.003**
Caries in Sufficient Vit D (≥30 ng/mL)	20/65 (30.8%)	35/105 (33.3%)	0.720

The DMFT score had a clinically significant negative correlation with blood calcium in pregnant women (r = -0.68, p = 0.001) and with vitamin D (r = -0.52, p = 0.001). Among the non-pregnant women, the negative relationship with blood vitamin D (r = -0.28, p = 0.012) was very weak, and, as can be seen in (Table 7), there was no relationship with calcium.

Table 7: Correlation (r) Between DMFT Index and Biochemical Markers

Biomarker	Pregnant Women (n=175)		Non-Pregnant Women (n=175)	
	R	P	R	P
Serum Vitamin D	-0.52**	0.001	-0.28*	0.012
Serum Calcium	-0.68**	0.001	-0.18	0.085

Discussion

Dramatic alterations in the metabolism of calcium and vitamin D have profound implications for maternal and fetal health. Even if total serum 25(OH)D concentrations are in the normal or above normal range, estrogen enhances the liver's production of more vitamin D binding protein (DBP), which can ultimately reduce the circulating pool of free bioactive vitamin D [19]. It is also paradoxical that progesterone may inhibit parathyroid hormone (PTH), thereby 'masking' any deficiency due to stimulation of renal 1α-hydroxylase activity, leading to the conversion of vitamin D into its active form (1,25(OH)2D) [11]. These disparate changes in vitamin D metabolism related to pregnancy emphasize the clinical relevance of the dissociation of total and bioavailable vitamin D levels, and the need to ultimately consider revising the sufficiency thresholds for vitamin D insufficiency in pregnancy [14].

The current research indicated that women who are pregnant had lower average serum calcium (7. 8 ± 0. 5 mg/dL compared to 9. 2 ± 0. 4 mg/dL, P < 0. 001) and vitamin D (19. 8 ± 5. 0 ng/mL against 28. 2 ± 5. 8 ng/mL, P < 0.001) levels when matched with those who are not pregnant. Research conducted in Korea revealed that the rate of serious vitamin D deficiency (<10 ng/mL) among healthy expectant mothers was 28. 6%. In contrast, the proportion for women who were not pregnant was 7.2 % (p < 0.05). Moreover, the levels of vitamin D deficiency (<20 ng/mL) were noted to be 77.3% for pregnant women and 79.2% for non-pregnant women. The researchers noted that in Korea, pregnant women experienced more cases of vitamin D deficiency in winter (100%) compared to summer (45. 5%). The majority of subjects, by trimester, had a greater prevalence of vitamin D deficiency in the first trimester than in the third trimester. None of the pregnancy outcomes associated with this study were significantly correlated with vitamin D deficiency. More research is required to assess the lasting impacts of vitamin D deficiency on expectant women in Korea [20]. As a result, the World Health Organization (WHO) suggests a daily intake of 600-800 IU of vitamin D along with 1,000 mg of calcium to promote the health of both mothers and their babies and to lessen the influence of these hormones. Furthermore, safe sunlight exposure is still a natural method to improve endogenous vitamin D levels. These hormonal effects and associations must be understood to

Received: *04-08-2025* - ***Accepted***: *02-09-2025* - ***Published***: *10-09-2025*

appropriately navigate prenatal care and avoid the maternal and fetal consequences of vitamin D deficiency during pregnancy [20].

In this study, it has been reported that there is a significant difference in the consumption of vitamin D supplements between pregnant women (80.0%) and non-pregnant women (57.1%), which is numerically significant ($p < 0.001$). The results indicated that there were no significant differences in dairy consumption, sun exposure, physical activity, or sugar consumption between pregnant and non-pregnant women (all $p > 0.05$). Pregnant women were slightly more likely to experience a daily intake of dairy foods (57.1% compared with 51.4% for non-pregnant women). Pregnant women reported marginally greater frequencies of sun exposure each week (51.4% compared with 48.6% for non-pregnant women), but non-pregnant women experienced marginally greater frequencies of exposure to the sun daily (34.3% compared with 28.6%). Both reported the same level of no exposure (20.0% vs. 17.1% for non-pregnant participants). Our research findings suggest a strong correlation between the increase in tooth decay, lower levels of calcium, and lower levels of vitamin D in pregnant women versus women who are not pregnant. This supports the theory that inadequate nutritional intake during pregnancy may affect dental health. Therefore, this indicates a great need for more focused prenatal care [21].

It has been suggested that marked deficiency in vitamin D could lead to periapical abscess as well as large pulpal chambers with high pulpal horns and mineralization defects in dentine and enamel are not associated with dental trauma or dental caries [21]. The study outcomes illustrated high statistical differences in the prevalence rate of dental decay; it showed a significant difference between pregnant women (60. 0%) and non-pregnant women (42.9%, $p < 0.001$). Pregnant females also exhibited a significantly higher DMFT (4.0 ± 1.4) in comparison to those who were not pregnant (3.1 ± 1.1; $p < 0.001$). There was no statistical difference in the frequency of tooth brushing ($p = 0.320$) and the use of toothpaste containing fluoride ($p = 0.550$). Pregnant women visited the dentist less often (34.3%) compared to non-pregnant women (51.4%, $p=0.002$).

Although there were similar levels of oral hygiene behaviors, these results indicated that pregnancy was associated with poorer oral health outcomes and less utilization of dental services. It also highlighted the need for appropriate oral health interventions in pregnant women to tackle the oral health issues. These results are similar to earlier studies, which indicated that the hormonal changes, dietary changes, and immune response changes during pregnancy made women more vulnerable to oral health problems [21]. Pregnant women were also less likely to obtain dental care regularly (34.3% versus 51.4%), and that may have been due to access to care or a lack of understanding of dental procedures in pregnancy. Overall, these findings emphasize the need for improvements in prenatal dental care and oral health education programs.

Moreover, the research outcomes revealed significant differences in occurrence, so the risk for periodontal disease was staringly higher in pregnant women (56.0%) versus non-pregnant women (33.8%, $p < 0.001$). Multiple studies have found an association with infections and vitamin D deficiency, which is an important nutrient for immune health and its inflammatory response [21,22]. Vitamin D may impact the way humans respond to bacterial infection [23] by activating Toll-like receptors and inducing production of a specific antimicrobial peptide, cathelicidin. When Toll-like receptors are engaged on human macrophages, the vitamin D receptor is expressed, and vitamin D 1α-hydroxylase gene expression is upregulated several-fold. This leads to the destruction of intracellular Mycobacterium tuberculosis and cathelicidin induction. Toll-like receptor−2 responses are very important in the pathophysiology of periodontal disease, which has an infection that results in inflammatory and immunological responses by the host, and vitamin D might alter many of these host responses [25].

Our findings are supported by research by Boggess et al. that showed pregnant women with moderate to severe periodontal disease had lower serum 25(OH)D levels and were more likely than women with periodontal health to have a 25(OH)D level <75 nmol/L. After adjusting for several potential confounders, including race, this connection remained, indicating that low maternal vitamin D level is a risk factor for moderate to severe periodontal disease during pregnancy. According to the research, maintaining periodontal health and minimizing the effects of periodontal disease requires adequate vitamin D [24].

Potential consequences of milder forms of vitamin D deficiency or insufficiency are significant for continuing debates about the value of vitamin D supplementation during pregnancy and in the fetus, and they offer some more evidence in favor of supplementation, especially pointing to additional data supporting a potentially significantly lower risk of dental cavities. They also stress the significance of dental health as a potential predictor of overall bone and mineral health during the early years of life [26].

Overall, pregnant females who had much lower levels of serum vitamin D ($19. 8 \pm 5. 0$ ng/mL) compared to those who are not pregnant ($28. 2 \pm 5. 8$ ng/mL, $p < 0.001$) and were much more likely to have tooth decay (60. 0% vs 42.9%, $p < 0. 001$). Expectant mothers lacking vitamin D (below 30 ng/mL) had a greater occurrence of dental caries compared to those with sufficient vitamin D levels (77. 3% versus 57. 1%, $p = 0.003$), while there were no significant differences among those whose vitamin D was equal to 30 ng/mL or more. This corroborates earlier research indicating that vitamin D improves calcium absorption, aids in the mineralization of enamel, and modifies the immune reaction against decay-causing bacteria [24]. This

Received: *04-08-2025* - ***Accepted***: *02-09-2025* - ***Published***: *10-09-2025*

protective influence is also supported by the high degree of inverse correlation (r = -0.52, p = 0.001) between pregnancy serum vitamin D and the DMFT index.
Additionally, vitamin D levels below 15 ng/mL during pregnancy were linked to a 14% increased risk of deciduous dentition, according to a randomized clinical trial (RCT) [27]. Moreover, a 50% lower risk of enamel mineralization defects was found with high-dose vitamin D intake at high dose [26]. High-dose vitamin D supplementation in pregnant women had a 50% lower risk of enamel defects in the fetus, as evidenced in another randomized controlled trial, suggesting that enamel defects are preventable by vitamin D [28].
Using 25OHD levels of a Dutch cohort study (n = 5257), Navarro et al. [29] estimated maternal serum concentrations using a second-trimester blood sample and birth and age 6 maternal serum. Participants with severe prenatal and early childhood serum 25OHD deficiencies (<25 nmol) had more dental caries compared to participants with mild or no deficiency, but this association was weak.
The results highlighted the need for focused interventions to enhance pregnant women's oral health and had significant clinical and public health ramifications. Optimizing vitamin D and calcium supplementation through modified dosages or improved formulations is one example of a prenatal nutritional intervention that may help address deficiencies and lessen negative oral health outcomes [30]. Furthermore, early detection and treatment of caries and periodontal disease risks would be made possible by incorporating routine dental screenings into prenatal care visits. In order to debunk myths regarding the safety of dental procedures during pregnancy and to emphasize the significance of regular dental checkups and consistent oral hygiene habits, patient education was also essential [31]. When combined, these tactics may help close the gap between pregnant and non-pregnant women's oral health, ultimately leading to improvements for both the mother's and the fetus's health outcomes [32].

Limitations
The study's cross-sectional design limited the potential conclusions on causality. Self-reported behaviors, such as brushing frequency, are subject to recall bias. Future longitudinal studies could more effectively determine how oral health and nutrient status change during pregnancy.

Conclusion
Compared with women who are not pregnant, pregnant women presented with decreased vitamin D and calcium levels, a higher incidence of dental caries, and lower use of dental care. Increased micronutrient status can improve oral health during pregnancy, as indicated by the highly significant inverse correlation between serum biomarkers and DMFT scores. Improving prenatal dental care and maximizing nutritional support for this high-risk group should be the main targets of public health interventions.

Conflict of interest. Nil

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Received: *04-08-2025* - ***Accepted***: *02-09-2025* - ***Published***: *10-09-2025*

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Received*: 04-08-2025 -* ***Accepted****: 02-09-2025 -* ***Published****: 10-09-2025*