

## The relationship between serum vitamin D level & chronic periodontitis in patients attending Khanzad center in Erbil city

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### Abstract

**Background and objectives:** Chronic periodontitis is multifactorial infectious disease with high prevalence among different population with many risk factors. Vitamin D seems to have a protective anti-inflammatory role in periodontal disease. The aim of this study was to evaluate the effect of serum vitamin D3 level on periodontal health in Erbil city. **Methods:** Eighty-two patients were recruited in the Khanzad center; in Erbil city- Kurdistan region- Iraq. They were divided into 48 patients with chronic periodontitis patient (26 males & 22 females) & 34 subjects with non – periodontitis (8 males & 26 females). Periodontal examination including plaque index, gingival index, pocket depth & clinical attachment loss were measured for all patients. At the day of periodontal examination, patients sent to central laboratory where blood draws for serum vitamin D3 estimation. **Results:** The mean serum vitamin D3 value (mean  $\pm$  Std) was  $13.5 \pm 9.2$  &  $12.8 \pm 7.2$  in chronic periodontitis group & non-periodontitis group respectively which was statistically not significant, 34 subjects (41.4%) of the participant had sever deficiency while only 2 patients in a study group (2.4%) had sufficient level of serum vitamin D3. The mean plaque index & gingival index in chronic periodontitis group were  $1.96 \pm 6$  &  $2.16 \pm 54$  respectively, while in non-periodontitis group, they were  $1.24 \pm 42$  &  $1.32 \pm 28$  respectively, there were statistically significant differences regarding both periodontal parameters between both groups. **Conclusions:** The relationship between vitamin D deficiency & chronic periodontitis was not determined in a sample in Erbil City. **Key words:** Hypovitaminosis D, Lack of sun exposure, Periodontal disease

### Introduction

Chronic periodontitis is multifactorial inflammatory disease, affecting deeper structure of periodontium, produce by host immunity- bacterial plaque interaction, resulting in gingival bleeding, suppuration, associated with the formation of either periodontal pocket, gingival recession or both. If not properly treated cause tooth mobility & finally tooth loss<sup>1,2</sup>.

Several factors have been documented as a risk factor of chronic periodontitis, though the precise mechanism that initiating progression of reversible quite innocent gingivitis to irreversible vicious periodontitis is unidentified<sup>1</sup>.

Vitamin D is secosteroid hormone, which is vital for bone mineralization, calcium homeostasis and immunity<sup>3-5</sup>. Vitamin D probably influencing risk of periodontal disease through three key means: by improving host immune reaction to infection, preserving oral bone strength and

inhibiting alveolar bone loss<sup>5,6</sup>. Vitamin D has anti-inflammatory and anti-microbial action & it has wide range activity against Gram negative and Gram positive microbes, containing those linked to periodontal inflammation such as *A. actinomycetemcomitans*<sup>4,6,7</sup>.

It is potential that long-lasting vitamin D deficiency may cause an adverse calcium balance, consequently resulting in a secondary increase in calcium loss from bone, including the alveolar bone, such mechanism may participate to damaging the periodontal tissue during inflammation<sup>5,6,8</sup>. Many systemic disease & condition associated with both vitamin D deficiency & susceptibility to periodontal disease including diabetic mellitus, cardiovascular disease, osteoporosis & obesity<sup>1,3,4,6,9</sup>.

Although the synthesis of vitamin D in body is affected by numerous causes like environmental (pollution, location), local factors (duration and time of exposure in sunlight,

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diet, job) and genetic factors<sup>4,7,10-12</sup>. Vitamin D deficiency is a global health issue, affecting almost one billion people all over the world<sup>7,10-12</sup>. Nevertheless, a majority of middle east population<sup>12,13</sup> including Kurdistan, living in places receiving plenty sunshine throughout the year, vitamin D deficiency is quite common<sup>14</sup>.

Some studies show the influence of serum vitamin D level on periodontal health & determine that patients with chronic periodontitis have more fluency to word serum vitamin D deficiency<sup>15,16</sup>, however other studies of the relationship between chronic periodontitis & vitamin D deficiency do not definitely demonstrate a positive influence of vitamin D on a health state of periodontium<sup>8,17</sup>. The aim of this study was to determine the relationship between serum Vitamin D level & chronic periodontitis in a sample of population from Erbil City ,Kurdistan Region,Iraq.

## Patients and methods

The study proposal was approved by institutional ethics committee at Kurdistan Board for Medical Specialties (21/2018/1/10). A verbal & written informed consent was obtained from all participants.

This cross- sectional, convenient sampling study was conducted in the periodontic department, Khanzad center in Erbil city from November 2017 to March 2018. The patients whose age were  $\geq 35$  and  $\leq 60$  years & had at least 20 natural teeth were recruited for the study, while patients with the history of periodontal therapy, has history of antibiotic intake within the past 6 months, had systemic diseases, smokers, or taking nutrient supplement, were excluded from the study<sup>8, 17-21</sup>. Overall; Eighty-two patient were collected for the study, according to their periodontal condition; they were allocated into two groups; 48 patients with severe/ moderate chronic periodontitis (26 males & 22 females) & 34 non-periodontitis subjects (8 male & 26 females). Age, gender, educational status, smoking habits, history of any systemic disease & history of drug & nutritional supplement intake were assessed by an interview at the day of periodontal examination.

A single periodontist, performed all the periodontal examinations<sup>19,20,22</sup>. Standard dental equipment was used<sup>22,23</sup>. Full-mouth except third molars were assessed for plaque index & Gingival index using Silness and Loe indices<sup>1</sup>,

periodontal pocket depths (the distance from marginal gingivea & the base of pocket), clinical attachment loss ( the distance from cementoenamel junction to the base of pocket) & gingival recession (the distance from the cement-enamel junction to the marginal gingivae) were measured with a manual periodontal probe & recorded into nearest millimeters at four sites per tooth for all teeth present<sup>24</sup>.

The diagnostic principles for periodontitis was depend on the disease definitions & diagnosis determined by American Academy of Periodontology Criteria 1999 22-24.

Patient had at least 2 interproximal site with CAL more than 4 mm or  $\geq 2$  interproximal sites with PD  $\geq 5$  mm, not on the same teeth were considered had chronic periodontitis<sup>1,2,24</sup>.

Severe periodontitis was characterized by presence of 2 or more interproximal sites with clinical attachment loss of 6 mm or more and presence of 2 or more interproximal sites with 5 mm probing depth or more; not on the same tooth. Moderate periodontitis was defined as presence of 2 interproximal sites or more with 4 mm clinical attachment loss occurring at two or more different teeth or 2 interproximal sites or more with 5 mm probing depth not on the same tooth<sup>1,2,20,24</sup>.

At the same day of periodontal examination, the participants were sent to central laboratory, where three ml of blood was drawn<sup>19,22</sup> and analyzed for serum 25 hydroxyvitamin D level (via COBAS e 114, using Electro-chemiluminescence immunoassay<sup>19,21,23, 25</sup> & Roche Diagnostics, Mannheim, Germany) kit were done immediately.

Serum 25(OH) D level is considered as a suitable biomarker of Vitamin D status, which is biologically inactive form with the levels almost 1000 time more than the circulating active<sup>1</sup>, 25(OH) D form. Vitamin D mainly stored as 25(OH) D in the human body with the half-life of 2–3 weeks<sup>4,7</sup>.

The suitable concentration of 25(OH) D for overall health is  $\geq 30$  ng/ml and 20–30 ng/ml is considered to be vitamin D insufficiency. Level  $< 20$  ng/ml is commonly measured as vitamin D deficiency<sup>4,7,20</sup>. Level  $\leq 10$  ng/mL is considered as severe deficiency<sup>19</sup>, though the level of 40–60 ng/mL is considered as the desired range<sup>4</sup>.

All data were analyzed by IBM SPSS Statistics version<sup>20</sup>. Descriptive statistics included mean and standard devi-

ation for continuous variables and frequencies and percentages for categorical variables were calculated. Post hoc modification of one way ANOVA test was used to compare the means among the groups. Independent t- test was used to compare between chronic periodontitis & non-chronic periodontitis group. The p value  $\leq 0.05$  was regarded as statistically significant.

## Results

Eighty-two subjects were recruited in the study, 48 patients (26 male & 22 female) were grouped as chronic periodontitis & 34 patients (8 male & 26 female) were grouped as non-periodontitis. Most of the study subjects were self-reported as can read & write or finished primary school; 31.72% for each group. Detailed socio- demographic characteristics of study subjects were shown in, Table 1.

**Table (1):** Socio-demographic characteristics of study subject:

Variable	Categories	Periodontitis	Non-periodontitis	Total
		No. (%)	No. (%)	No. (%)
Sex	Male	26 (54.2%)	8 (23.5%)	34 (41.5%)
	Female	22 (45.8%)	26 (67.5%)	48 (58.5%)
Education level	Illiterate	6 (23.1%)	8 (14.3%)	14 (17.1%)
	Can read & write	4 (14.4%)	22 (39.3%)	26 (31.72%)
	Finished primary school	12 (46.2%)	14 (25.0%)	26 (31.72%)
	Finished secondary school or more	4 (14.4%)	12 (21.4%)	16 (19.55%)
<b>Total</b>		<b>48 (100%)</b>	<b>34 (100%)</b>	<b>82 (100%)</b>

Mean age of the periodontitis & non-periodontitis were  $45.00 \pm 5.83460$  &  $44.2353 \pm 6.29121$  respectively, while mean of formal education in the periodontitis & non-periodontitis group were  $6.1250 \pm 5.15143$  &  $7.5882 \pm 5.8263$ , respectively. There was statistically non-significant difference in mean age & years of formal education between the groups, Table 2.

**Table (2):** The mean age & educational level of subject:

Variable	Periodontitis	Non-periodontitis	p-value
	Mean $\pm$ Std-deviation	Mean $\pm$ Std-deviation	
Age (years)	$45.00 \pm 5.83460$	$44.2353 \pm 6.29121$	0.327
Educational level (years)	$6.1250 \pm 5.15143$	$7.5882 \pm 5.8263$	0.392

The periodontal condition including plaque index & gingival index were shown in the, Table 3, the mean plaque index & gingival index in periodontitis group were  $1.9631 \pm .60159$  &  $2.1612 \pm 0.54212$  respectively, while those of non- periodontitis group were  $1.2400 \pm .42489$  &  $1.3200 \pm 0.28665$ . There was statistically significant difference between both groups regarding plaque index & gingival index at the level,  $p=0.030$  &  $p<0.001$  respectively.

**Table (3):** Periodontal characteristic of study subjects:

Variable	Periodontitis	Non-periodontitis	p-value
	Mean $\pm$ Std. Deviation	Mean $\pm$ Std. Deviation	
Gingival index	$2.1612 \pm 0.54212$	$1.3200 \pm 0.28665$	$\leq 0.001$
Plaque index	$1.9631 \pm 0.60159$	$1.2400 \pm 0.42489$	0.030

Most of the study samples had serum vitamin D3 below sufficient level, only 2 patients in periodontitis group had sufficient serum vitamin D3 level (30–50 ng/ml) which were considered as 2.4% of the study subjects, while almost half of the study subject (41.4%) had severe serum vitamin D3 (<10 ng/ml), which in periodontitis group comprised 17.5% & non- periodontitis group comprise 21.9%. The detailed serum vitamin D3 status of the study group were presented in the Table 4, however the mean serum vitamin D3 level was slightly higher in periodontitis group

**Table (4)** Frequency of serum Vitamin D level among subjects:

Serum Vitamin D status	Periodontitis		Non- periodontitis		Total
	No. (%)		No. (%)		
	Male	Female	Male	Female	
Severe deficiency (<10)	6 (7.3)	10 (12.2)	2 (2.4)	16 (19.5)	34 (41.4)
Deficient (<20 -10 >)	14 (17.1)	12 (14.6)	2 (2.4)	8 (9.8/)	36 (43.9)
Insufficient (<30 -20 >)	4 (4.9)	0 (0)	4 (4.9)	2 (2.5)	10 (12.2)
Sufficient (<50 -30 >)	2 (2.4)	0 (0)	0 (0)	0 (0)	2 (2.4)
<b>Total</b>	<b>26 (31.7)</b>	<b>22 (26.8)</b>	<b>8 (9.8)</b>	<b>26 (31.7)</b>	<b>82 (100)</b>

(13.5375 ± 9.25075) than that in non-periodontitis group (12.8982 ± 7.22567), there was not a statistically significant difference between both group regarding serum vitamin D3 level, Table 5.

**Table (5)** on-periodontitis

Variable	Periodontitis	Non-periodontitis	p-value
	No. (mean ± Std-deviation)	No. (mean ± Std-deviation)	
Serum vitamin D <sub>3</sub> ng/ml	48 (13.5375 ± 9.25075)	34 (12.8982 ± 7.22567)	0.739

The Post hoc test was used to analyzed serum vitamin D3 level among periodontitis male, periodontitis female, non-periodontitis male & non-periodontitis female patients, there was statistically not significant differences between periodontitis male & non-periodontitis male, neither between periodontitis female & non-periodontitis female, Table 6. Although when comparing mean serum vitamin D3 level between male (16.2412 ± 9.98603) & female (11.1696 ± 6.11437) samples, the result was statistically significant, Table 7.

**Table (6)** ontitis & Non-periodontitis separated by sex.

Variable	Serum Vitamin D3	p-value
	No. (mean ± Std-deviation)	
Chronic periodontitis (Male)	26 (15.3154 ± 10.61805)	0.226
Non-Periodontitis (Male)	8 (19.25 ± 7.34361)	
Chronic periodontitis (Female)	22 (11.4364 ± 6.07742)	0.832
Non-Periodontitis (Female)	26 (10.9438 ± 6.07742)	

**Table (7)** male & female subjects:

Variable	Male	Female	p-value
	No. (mean ± Std-deviation)	No. (mean ± Std-deviation)	
Serum vitamin D <sub>3</sub> ng/ml	34 (16.2412 ± 9.98603)	48 (11.1696 ± 6.11437)	0.006

## Discussion

The result of the present study showed that the serum vitamin D3 value (mean  $\pm$  Std) was  $13.5 \pm 9.2$  &  $12.8 \pm 7.2$  in chronic periodontitis group & non-periodontitis group respectively, it was statistically not significant, even when female subjects & male subjects were analyzed separately; still they were statistically not significant. While there were statistically significant differences regarding oral hygiene measure represented by plaque index & gingival bleeding index between chronic periodontitis cases & non periodontitis subjects.

This result is in line with the study done by Millen et al, who studied the association between clinical attachment loss & serum vitamin D3 concentration in 920 postmenopausal women; the association was not significant, however they found inverse association between gingival bleeding index & serum vitamin D3 concentration<sup>22</sup>.

Using the National Health 2000 Survey, Antonoglou et al evaluated serum vitamin D3 concentration in 1262 healthy subjects in Finnish population, they found no significant association between serum vitamin D3 deficiency & chronic periodontitis<sup>17</sup>.

Also Khan et al studied the effect of vitamin D hypovitaminosis on periodontal health in a group of Pakistani female living in a rural district, they found no relationship between vitamin D deficiency & periodontal health<sup>19</sup>.

However; contrasting results were reported by other authors, Dietrich et al, used data from the National Health and Nutrition Examination Survey III & a negative association between serum vitamin D3 and periodontal attachment level was reported<sup>16</sup>. Joseph et al in examined 98 subject, chronic periodontitis patient had meaningfully lesser serum vitamin D3 concentration than healthy control<sup>20</sup>.

Abreu et al evaluated the relationship between serum Vitamin D3 level and periodontal disease in a 48 Hispanic subjects, they found that the periodontitis cases had significantly lower levels of serum vitamin D3 compared to controls<sup>25</sup>.

Negative association in the present study as many studies with the same result<sup>17,19,22</sup>, could be due to the fact that serum Vitamin D3 level was very low in all study group compared with other studies with different result<sup>16,20,25</sup>. It was dramatically shocking that only 2.4% of study group

in the present study had sufficient serum vitamin D3 concentration, while 41.4% of them had severe deficiency (vitamin D3  $\leq$  10 ng/ml), 54.1 % of female subject & 23.5 % of male participant had severe deficiency. While in Abreu et al study<sup>25</sup> none of the study participant had severe deficiency. Low serum vitamin D3 level among the participant could be attributed by reduced outdoor activity in the community & clothing habit (most of people tend to wear clothes that cover most parts of the body) which is not only affect periodontal health but also general health as vitamin D3 has anti-cancerous effect & boosting immunity<sup>4,6</sup>.

Many authors suggesting level of 50-60 ng/dl to get non-osteoid, immune benefit of vitamin D<sup>4,7</sup>. In the absence of anti-bacterial & anti-inflammatory effect of vitamin D3, oral hygiene measure remains the main cause of periodontal diseases.

## Conclusions

Although high prevalence of serum vitamin D deficiency need to be corrected, no association between serum Vitamin D3 level & chronic periodontitis was found.

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