

Relationship of Vitamin D Levels with Simultaneous Occurrence of Periodontal and Cardiac Diseases

Vitamin D Levels with Simultaneous Occurrence of Periodontal and Cardiac Diseases

Romana Mehwish, Amna Riaz, Shahid Hameed, Hammad Raziq, Bakhtawar Asghar and Tooba Abid

ABSTRACT

Objective: To observe relationship of vitamin D levels with the severity of periodontal disease and also with the occurrence of cardiac diseases.

Study Design: A cross-sectional study.

Place and Duration of Study: This study was conducted at the Physiology department of Bakhtawar Amin Medical & Dental College, Multan from April, 2022 to March 2023.

Materials and Methods: Total 150 subjects were enrolled in the study, of which half were suffering from cardiac and periodontal diseases and one third were only affected by periodontitis. Twenty five subjects were normal. Vitamin D and calcium levels were recorded from the blood samples. Mean and standard deviation were calculated between the groups with 2 sample t- test using SPSS v.23.0. The significance of difference was taken at $p \leq 0.05$.

Results: Vitamin D levels were 24.98 ± 4.53 ng/ml and 41.95 ± 1.42 ng/ml in patients with high and low intensity of periodontal disease, respectively ($p=0.22$). Calcium levels were 8.43 ± 0.14 nmol/L and 8.69 ± 0.28 nmol/L in patients with high and low intensity of periodontal disease, respectively ($p=0.437$). Among the male cardiac patients, vitamin D levels were 20.96 ± 2.39 ng/ml and 41.67 ± 4.78 ng/ml in high and low severity of periodontal disease cases ($p=0.002$), whereas calcium levels were 8.03 ± 0.30 nmol/L and 8.95 ± 0.77 nmol/L in high and low severity of periodontal disease cases ($p=0.075$). Among the female cardiac patients, vitamin D levels were 17.5 ± 4.93 ng/ml and 21.55 ± 18.12 ng/ml ($p=0.83$), while calcium levels were 8.4 ± 0.33 nmol/L and 8.57 ± 0.24 nmol/L in high and low severity of periodontal disease cases, respectively ($p=0.677$).

Conclusion: Low level of vitamin D has the relationship with the severity of periodontal disease and also with the occurrence of cardiac diseases.

Key Words: Calcium, Cardiac disease, Periodontal disease, Severity, Vitamin D.

Citation of article: Mehwish R, Riaz A, Hameed S, Raziq H, Asghar B, Abid T. Relationship of Vitamin D Levels with Simultaneous Occurrence of Periodontal and Cardiac Diseases. Med Forum 2023;34(7):55-58. doi:10.60110/medforum.340713.

INTRODUCTION

The link of dental health and vitamin D had attained considerable attention in relation to periodontal disease. Vitamin D may affect the risk of developing periodontal disease via an effect on bone mineral density or via immunomodulatory effects¹. This points out on the disorder of another system developing indirectly due to effect of a deficiency to its relevant system. The association between periodontitis and cardiovascular is also well realized and various researches have highlighted the mechanisms of association between these.

Department of Physiology, Bakhtawar Amin Medical & Dental College, Multan.

Correspondence: Dr. Romana Mehwish, Demonstrator, Department of Physiology, Bakhtawar Amin Medical & Dental College, Multan.

Contact No: 0335 7506824

Email: romanashabbir0909@gmail.com

Received: April, 2023

Accepted: May, 2023

Printed: July, 2023

The interrelationship between periodontitis, vitamin D deficiency and cardiovascular diseases has been gaining interest. Their relationship has been observed in different populations with different characteristic associated with these interrelated disorders. In the subjects with values <10 ug/mL, which is clearly a deficient state, showed significant association with prevalence and extent of coronary artery disease. In these subjects the status of coronary artery disease when was assessed with angiography and also the vitamin D was estimated it was found that hypovitaminosis had evident and significant correlation with coronary artery disease. In cases where the supplementation of vitamin D had been done the incidence of coronary artery disease was observed to be considerably low².

Globally there are now apprehensions that hypovitaminosis D is contributing in several diseases like periodontitis, inflammatory bowel disease, obesity, cardiovascular diseases these all are considered as inflammatory bowel disease and vitamin D play an important role in these diseases³. Management of these risk factors are key for contemporary care of periodontal patients though these risk factors are

modifiable as well⁴. Dietary supplements and regular intake may enhance periodontal health periodontal like vitamin C, vitamin D, calcium and multivitamins⁵.

Many studies have shown core relationship of periodontitis and vitamin D insufficiency and diabetes⁶. It is verified that 25-hydroxy vitamin D play important role in human gingival fibroblasts and periodontal ligaments. It has been revealed that there is strong correlation between generalized or aggressive periodontitis and with plasma vitamin D binding protein^{7,8}. It is evident that 25 OH vitamin D play important role in periodontal health and its deficiency causes periodontal and gingival inflammation. The investigations in relation to vitamin D and cardiovascular function had been for some time. It is mainly understood in relationships of cardiovascular diseases and vitamin D deficiency. Ischemic stroke has been documented to be associated with deficiency of serum 25-hydroxy vitamin D and it was found that ischemic stroke has an independent association with 25-hydroxy vitamin D deficiency. The overall physiological adaptation leads to increase risk of cardiovascular disease like hypertension and all other diseases like dyslipidemia, peripheral vascular disease, diabetes, cancer etc., in fact all had association with low level of vitamin D. The pathogenesis and risk of diabetes mellitus and cardiovascular disease had especially in focus in the studies with respect to vitamin D deficiency and its critical role and prevalence⁹.

Vitamin D deficiency is reported an independent risk factor of mortality causing disease cardiovascular disease and diabetes. Many metabolic changes actively started with in body like cardiac inflammation, fibrosis, oxidative stress, cardiac hypertrophy, apoptosis, left chamber alteration, systolic dysfunction and these all changes are associated with deficiency of vitamin D. Studies proved that vitamin D has potential protective effect on cardiovascular system¹⁰. Thus present study was undertaken to investigate relationship between vitamin D in periodontitis and cardiovascular diseases in the local population.

MATERIALS AND METHODS

This cross sectional study was conducted at Physiology department of Bakhtawar Amin Medical & Dental College, Multan from April, 2022 to March 2023. Ethical approval for the commencement of the study was taken from the hospital review committee. Total 150 subjects were selected by randomized sampling technique and informed consent form was signed by each of the included subject before the start of study. The patients of the hospitals ranging between 30 to 70 years were categorized in different groups in relation to the disorders for screening of vitamin D and calcium. The subjects of both the genders were assessed that a group is affected only by periodontitis with further realization of low and high degree of the disorder; this group had no clinical indications of heart diseases. In another group the subjects were not only affected by varying degree of periodontitis but also were inflicted

with cardiac diseases. A third group was of control nature and none of the subject had periodontitis in any degree and did not have clinical history of cardiac diseases. The admitted subjects in the hospitals were provided at 6:00 AM and the sampling was done at 8:00 AM. Total 150 subjects were enrolled in the study, of which 110 were males and remaining 40 were females. Out of 150 almost half were suffering from the cardiac and periodontal diseases. About one third was only affected by periodontitis and did not have any history of cardiac ailment. Twenty five subjects were with no periodontitis and also were without any indications of cardiac disease.

The blood sample of an amount of 5-6 ml was obtained with disposable sterile syringes and the blood was kept in syringe to clot. It was left at the laboratory temperature until the serum was separated. The serum from blood was placed in vaccinator serum separator tube and centrifuged at 3000rpm for 5-7 minutes. The clear serum was then pipetted out and poured into two separate 1.5 ml vials. The sera stored at -20 degree centigrade until used for hormonal and biochemical assays. Vitamin-D levels were expressed in ng/mol. It was noted in the kit manual that values that are less than 8.3 ng/mol must be reported as <8.3 ng/ml and values that are greater than 143.6 ng/ml is reported as > 143ng/ml. serum calcium levels were expressed as nmol/L. In the comparisons of various groups mean and standard deviation were calculated and the significance of the difference between the groups was determined with 2 sample t- test. The data was analyzed by SPSS v.23.0. The significance of difference was taken at $p \leq 0.05$.

RESULTS

All the patients included in the study were from 30 to 70 years of age. Mean calcium levels were 8.7 ± 0.319 nmol/L in normal males and 9.23 ± 0.24 nmol/L in normal females ($p=0.231$). Mean levels of vitamin D were 20.25 ± 3.61 ng/ml and 7.47 ± 4.35 ng/ml in normal males and females, respectively ($p=0.109$). Table-1

Vitamin D levels were 24.98 ± 4.53 ng/ml and 41.95 ± 1.42 ng/ml in patients with high and low intensity of periodontal disease, respectively ($p=0.22$). Calcium levels were 8.43 ± 0.14 nmol/L and 8.69 ± 0.28 nmol/L in patients with high and low intensity of periodontal disease, respectively ($p=0.437$). Table-2

Among the males who were cardiac patients, vitamin D levels were 20.96 ± 2.39 ng/ml and 41.67 ± 4.78 ng/ml in high and low severity of periodontal disease cases ($p=0.002$). Among the males who were cardiac patients, calcium levels were 8.03 ± 0.30 nmol/L and 8.95 ± 0.77 nmol/L in high and low severity of periodontal disease cases ($p=0.075$). Table-3

Among the females who were cardiac patients, vitamin D levels were 17.5 ± 4.93 ng/ml and 21.55 ± 18.12 ng/ml in high and low severity of periodontal disease cases ($p=0.83$). Among the females who were cardiac patients, calcium levels were 8.4 ± 0.33 nmol/L and

8.57±0.24 nmol/L in high and low severity of periodontal disease cases (p=0.677). Table-4

Table No. 1: Calcium and vitamin D levels in normal individuals

Gender	Calcium, nmol/L	Vitamin D, ng/ml
Normal males	8.7 ± 0.319	20.25 ± 3.61
Normal females	9.23 ± 0.24	7.47 ± 4.35
p-value	0.231	0.109

Data is entered as mean ± standard deviation.

Table No. 2: Comparison of vitamin D and calcium levels in two groups of patients according to severity of disease

Intensity of Periodontal Disease	Vitamin D, ng/ml	Calcium, nmol/L
High	24.98 ± 4.53	8.43 ± 0.142
Low	41.95 ± 1.42	8.69 ± 0.28
p-value	0.22	0.437

Data is entered as mean ± standard deviation.

Table No.3: Vitamin D and calcium concentration in low and high periodontal disease males with cardiac disease also.

Intensity of Periodontal Disease	Vitamin D	Calcium
High	20.96 ± 2.39	8.03 ± 0.30
Low	41.67 ± 4.78	8.95 ± 0.77
p-value	0.002	0.075

Data is entered as mean ± standard deviation.

Table No. 4: Vitamin D and calcium concentration in low and high periodontal disease females with cardiac disease also.

Intensity of Periodontal Disease	Vitamin D	Calcium
High	17.5 ± 4.93	8.4 ± 0.33
Low	21.55 ± 18.12	8.57 ± 0.24
p-value	0.83	0.677

Data is entered as mean ± standard deviation.

DISCUSSION

The roles of vitamin D is massive in human health and that is well projected from a report on a meeting held at Queen Mary University of London in last week of April 2014 on the theme "Vitamin D and Human Health: from the Gamete to the Grave". Vitamin D < 10 ug/ml is considered to be deficient, between 10 -29 ug/ml is insufficient and > 30 ug/mL is sufficient and > 100 ug/mL is vitamin toxicity. Therefore it is now considered that around 40 ug/mL is the ideal level for the normal functioning and least risk of various degenerative diseases from vitamin D requirements.

In the present study it has been very concerning to observe that except a minor proportion of the screened

population the remaining has been found to be vitamin D deficient. Very few subjects were found to be in the range of sufficient level. In this situation the strategy was undertaken to put aside the results of vitamin D in relation to the normal requirements and analyze the data according to the objectives of the present study. It has been striking to observe that the population that was assessed as control without periodontitis and cardiovascular disease showed very concerning low level of vitamin D. In the control group when the subjects were assessed gender wise it was striking to find that females had almost one third of the vitamin level in the males when in the males the vitamin level was almost half of the adequately required normal level. Thus females have extremely low level of vitamin D. The female belong to the category which mostly remained indoor and may also have the lower opportunity on the availability of the vitamin in foods. The males had better level probably of their outdoor opportunity and synthesis of the vitamin. Various observations were found to suggest that the major role of 1, 25(OH) ₂D₃ in bone is to provide the proper microenvironment for bone mineralization through stimulation of the intestinal absorption of calcium and phosphate¹¹. The calcium is utilized thus the probability of higher calcium in the blood demonstrates the possibility of low utilization of calcium. In females the comparative higher calcium level probably reflects low utilization of calcium due to low vitamin D. The calcium level in all these comparisons did not show obvious difference and statistically highly non-significant.

The link of dental health and vitamin D had attained considerable attention in relation to periodontal disease. Vitamin D may affect the risk of developing periodontal disease via an effect on bone mineral density or via immunomodulatory effects¹. Therefore the many investigations have shown on the relation of vitamin deficiency and incidence of periodontitis. Globally there are now apprehensions that hypovitaminosis D is contributing in several diseases like periodontitis, inflammatory bowel disease, obesity, cardiovascular diseases these all are considered as inflammatory bowel disease and vitamin D play an important role in these diseases³.

The pathogenesis and risk of diabetes mellitus and cardiovascular disease had especially in focus in the studies with respect to vitamin D deficiency and its critical role and prevalence⁹. The relationship between vitamin D deficiency and cardiovascular disease has been supported by growing body of evidences however underlying mechanism is yet to be understood. The present study from the specific population has also observed and contributed in the understanding that vitamin D deficiency adverse effect in expression of several diseases including periodontitis and cardiovascular diseases is proving. It has clearly indicated that certain comparisons that low level of vitamin D looked to be contributory in cardiac disease. If people get continuous supplementation of vitamin D

and calcium on daily basis <1,000 IU/day, periodontal health may preserved and most important is good dental care which is best solution of every periodontal problem¹².

There is no doubt that the importance of vitamin D had been overlooked and recently it is being revealed several degenerative diseases incidences are on rise due to vitamin D deficiency. Vitamin D association is also reflected as supplementation reduces this problem resulting in less tooth loss¹³⁻¹⁶. Effect of supplementation was seen just within 24 weeks as periodontal attachment was well maintained and tooth loss also reduced¹⁷. In population of Germany oral disease like caries, tooth loss, periodontitis are highly prevalent side by side they are also high prevalence in vitamin D deficiency, so vitamin D deficiency might be as risk factor for periodontitis as well as act as protective factor against periodontitis, caries and tooth loss¹⁸.

CONCLUSION

Low level of vitamin D has the relationship with the severity of periodontal disease and also with the occurrence of cardiac diseases.

Author's Contribution:

Concept & Design of Study: Romana Mehwish
 Drafting: Amna Riaz, Shahid Hameed
 Data Analysis: Hammad Raziq, Bakhtawar Asghar, Tooba Abid
 Revisiting Critically: Romana Mehwish, Amna Riaz
 Final Approval of version: Romana Mehwish

Conflict of Interest: The study has no conflict of interest to declare by any author.

REFERENCES

1. Martelli FS, Martelli M, Rosati C, Fanti E. Vitamin D: relevance in dental practice. *Clin Cases Miner Bone Metab* 2014;11(1):15.
2. Verdoia M, Schaffer A, Sartori C, Barbieri L, Cassetti E, Marino P, et al. Vitamin D deficiency is independently associated with the extent of coronary artery disease. *Eur J Clin Invest* 2014;44(7):634-42.
3. Jahani R, Fielding KA, Chen J, Villa CR, Castelli LM, Ward WE, et al. Low vitamin D status throughout life results in an inflammatory prone status but does not alter bone mineral or strength in healthy 3-month-old CD-1 male mice. *Mol Nutr Food Res* 2014;58(7):1491-501.
4. Genco RJ, Borgnakke WS. Risk factors for periodontal disease. *Periodontol* 2013;62(1):59-94.

5. Johnston B, Fritz P, Ward W. Use of dietary supplements in patients seeking treatment at a periodontal clinic. *Nutrients* 2013;5(4):1110-21.
6. Wang Q, Li H, Xie H, Fu M, Guo B, Ding Y, et al. 25-Hydroxyvitamin D3 attenuates experimental periodontitis through downregulation of TLR4 and JAK1/STAT3 signaling in diabetic mice. *J Steroid Biochem Mol Biol* 2013;135:43-50.
7. Zhang X, Meng H, Sun X, Xu L, Zhang L, Shi D, et al. Elevation of vitamin D-binding protein levels in the plasma of patients with generalized aggressive periodontitis. *J Periodont Res* 2013;48(1):74-9.
8. Bashutski JD, Eber RM, Kinney JS, Benavides E, Maitra S, Braun TM, et al. The impact of vitamin D status on periodontal surgery outcomes. *J Dent Res* 2011;90(8):1007-12.
9. Griz LH, Bandeira F, Gabbay MA, Dib SA, Carvalho EF. (2014) Vitamin D and diabetes mellitus, 1:1-8.
10. Beveridge LA, Witham MD. Vitamin D and the cardiovascular system. *Osteoporosis Int* 2013;24(8):2167-80.
11. Kronenberg HM, Melmed S, Polonsky K, Larsen P. Hormones and disorders of mineral metabolism. *Williams Textbook of Endocrinology*, 11th ed. Philadelphia Editorial Saunders Elsevier; 2008.p.1224-69.
12. Garcia MN, Hildebolt CF, Miley DD, Dixon DA, Couture RA, Spearie CL, Langenwalter EM, Shannon WD, Deych E, Mueller C, Civitelli R. One-year effects of vitamin D and calcium supplementation on chronic periodontitis. *J Periodontol* 2011;82(1):25-32.
13. Grant WB, Boucher BJ. Are Hill's criteria for causality satisfied for vitamin D and periodontal disease?. *Dermato Endocrinol* 2010;2(1):30-36.
14. Grant WB, Giovannucci E. The possible roles of solar ultraviolet-B radiation and vitamin D in reducing case-fatality rates from the 1918–1919 influenza pandemic in the United States. *Dermato-Endocrinol* 2009;1(4):215-19.
15. Bashutski JD, Eber RM, Kinney JS, Benavides E, Maitra S, Braun TM, et al. The impact of vitamin D status on periodontal surgery outcomes. *J Dent Res* 2011;90(8):1007-12.
16. Miley DD, Garcia MN, Hildebolt CF, Shannon WD, Couture RA, Anderson Spearie CL, et al. Cross-sectional study of vitamin D and calcium supplementation effects on chronic periodontitis. *J Periodontol* 2009;80(9):1433-39.
17. Intini G, Katsuragi Y, Kirkwood KL, Yang S. Alveolar bone loss: mechanisms, potential therapeutic targets, and interventions. *Advance Dent Res* 2014;26(1):38-46.
18. Zhan Y, Samietz S, Holtfreter B, Hannemann A, Meisel P, Nauck M, et al. Prospective study of serum 25-hydroxy vitamin D and tooth loss. *J Dental Res* 2014;93(7):639-44.