Association of Vitamin D with Cardiovascular Disease

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Article Link: https://www.brainetwork.org/index.php/jcihs/article/view/2

DOI: https://doi.org/10.69591/jcihs.v1i1.2

Volume 1, Issue 1, 2023

Funding
No

Citation:
Faisal, R., & Saad, A. B. A. (2023). Association of Vitamin D with Cardiovascular Disease, *Journal of Contemporary Insights in Health Sciences, 1*(1), 1-8.

Conflict of Interest: Authors declared no Conflict of Interest

Acknowledgment: No administrative and technical support was taken for this research

Article History

Submitted: March 01, 2023
Last Revised: Apr 11, 2023
Accepted: May 30, 2023

An official Publication of
Beyond Research Advancement & Innovation Network, Islamabad, Pakistan

Original Research Article

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ABSTRACT

Objective: To investigate the relationship between vitamin D level in serum and cardiovascular diseases.

Study Design: Prospective study.

Place and duration: Study was conducted in Choudhary Parvez Ellahi Institute of Cardiology in one year duration from 1st February 2020 to 1st February 2021.

Methodology: One hundred and fifty patients presented with cardiac illness at emergency department were enrolled in study. The serum levels of vitamin D were divided into three categories: deficiency, insufficiency, and sufficiency. SPSS version 23 was used for data analysis. P value ≤0.5 was taken as significant.

Results: Serum 25(OH) D levels in both the groups were shown in table 3. In the non-CVD Group, 48% of patients were 25(OH)D deficient. 56% of patients had insufficient and (40%) patients had sufficient serum 25(OH)D levels. While, in CVD Group, n=44 (58.6%) patients were 25(OH)D deficient. 37.3% of patients had insufficient, and 61.3% patients had sufficient serum 25(OH)D levels. The results were statistically significant.

Conclusion: Lower levels of serum 25-hydroxy vitamin D were associated with higher rates of cardiovascular diseases. Further studies are needed to recommend vitamin D supplements to reduce the risk of cardiovascular diseases.

Keywords: 25(OH) D, Cardiovascular Diseases, Deficiency, Blood, Vitamin D

1. INTRODUCTION

Cardiovascular diseases are the leading cause of mortality in the world. In 2015 about 17.7 million people died from cardiovascular diseases (CVD) which constitute 31% of global deaths (1). It has been recorded that coronary artery disease makes up approximately 7.4 million cases, while stroke accounts for 6.7 million cases worldwide (2). A significant portion of these fatalities happens in economically disadvantaged and developing nations.

In men CVD death rate is 5.00% and in women it is 3.65% per annum. This growth rate of CVD is higher in rural population as compared to urban population (3).

A survey conducted in 2016 indicates that 44.8% of deaths due to cardiovascular disease happen in rural areas (4), while a slightly lower proportion of 42.9% occur in urban regions with higher literacy rates (5). Main heart diseases are coronary heart disease, hypertension, heart failure and stroke. Vitamin D is a fat-soluble vitamin, which takes part in signaling from in human genome. About 3-5% of human genome regulates through vitamin D receptors (6). Skeletal health and calcium metabolism are usually not considered to be operated by vitamin D signals, but cell function totally depends on vitamin D signals either metabolism or cell differentiation (7).

It was proven that vitamin D deficiency is responsible for high mortality rate due to deficiency associated cardiac diseases (8). This mortality and cardiac issues can be reduced by using vitamin D supplements (9). Vitamin D deficiency can be investigated by serum 25- hydroxyvitamin-D level which is a common marker of vitamin D. Now a days, deficiency of vitamin D is a main problem affecting 50% of population (10). In this study we evaluate the association of vitamin D and cardiac diseases.

2. METHODOLOGY

This study was conducted in Choudhary Pervaiz Ellahi Institute of Cardiology in one year duration from 1st February 2019 to 1st February 2020. Study was started after approval from Hospital ethical committee. Informed written contents were obtained from patients after detailed information of study. Non-probability consecutive sampling technique was used. Openepi online software was used for calculation of sample size. Patients visited at the emergency department of hospital were included in this study. Patients with history of acute cardiac illness, using vitamin D supplements were exuded from the study.

A self-made questionnaire was given to patients, and they were interviewed for medical history, lifestyle, demographics, and use of medicine. Blood pressure measurement was done using sphygmomanometer, electronic body fat meter was used for measurement of body weight, echocardiogram was taken, waist and height was measured with fixed measuring tape, BMI calculated with formula BMI= weight (kg) / height (meter square). Venous blood sample was taken after an overnight fast and stored in vacuum blood container. A sample was sent to the laboratory for calculation of 25 hydroxyvitamin-D levels through enzyme linked immunosorbent assay. Routine investigations were also done. Total cholesterol, glucose level, high density and low-density protein were also taken. Data was recorded in performa (11).

SPSS version 23 was used for data analysis. Serum 25-hydroxyvitamin D (25(OH)D) levels were divided into three categories: deficiency, defined as greater than 20 mg/ml; insufficiency, falling between 20 mg/ml and 30 mg/ml; and sufficiency, indicating levels exceeding 30 mg/ml. The mean and standard deviation were computed for numerical data, while frequency and percentages were calculated for categorical data. P value ≤ 0.5 was taken as significant.

3. RESULTS

One hundred and fifty patients were included in this study, both genders. The patients were randomly divided into two groups as n=75 (50%) non-CVD and n=75 (50%) CVD. In non-CVD Group, there were n=55 (73.3%) males and n=20 (26.7%) females. The mean age, BMI, SBP, DBP and 25(OH)D, of the non-CVD Group was 55.96±6.32 years, 23.26±2.25 kg/m^2, 115.03±3.35 mm Hg, 73.33±3.36 mm Hg and 25.05±4.42 ng/ml, respectively. While, in CVD Group, there were n=44 (58.7%) males and n=31 (41.3%) females. The mean age, BMI, SBP, DBP and 25(OH)D, of CVD Group was 55.72±6.57 years, 27.46±2.82 kg/m^2, 144.91±4.24 mm Hg, 87.17±5.63 mm Hg and 23.11±1.20 ng/ml, respectively. The distribution of the patients according to marital status, literacy status, smoking status, high-fat diet, and physical activities were shown in table 1. Higher BMI, SBP and DBP were found in CVD Group, (p=0.000), (p=0.000) and (p=0.000), respectively. While the serum level in non-CVD Group was higher, (p=0.000). (Table 1)

Table 1: Demographic and Baseline Characteristics of the Patients

Variable	Non-CVD n=75 (50%)	CVD n=75 (50%)	P-value
Gender			
Male	n=55 (73.3%)	n=44(58.7%)	0.058
Female	n=20 (26.7%)	n=31(41.3%)	
Marital Status			
Married	n=67 (89.3%)	n=72 (96%)	0.247
Single/divorcement	n=8 (10.7%)	n=3 (4.0%)	
Education			
Literate	n=41 (54.7%)	n=48 (64%)	0.245
Illiterate	n=34 (45.3%)	n=27 (36%)	
Age (years)	55.96±6.32	55.72±6.57	0.820
BMI (kg/m^2)	23.26±2.25	27.46±2.82	0.000
SBP (mm Hg)	115.03±3.35	144.91±4.24	0.000
DBP (mm Hg)	73.33±3.36	87.17±5.63	0.000
25(OH)D (ng/ml)	25.05±4.42	23.11±1.20	0.000
Smoking			
Yes	n=26 (34.7%)	n=30 (40%)	0.500
No	n=49 (65.3%)	n=45 (60%)	
High-fat diet			
<25g/d	n=63 (84%)	n=54 (72%)	0.076
≥25g/d	n=12 (16%)	n=21 (28%)	
Physical activity			
Mild	n=42 (56%)	n=41 (54.7%)	0.974
Moderate	n=21 (28%)	n=21 (28%)	
Severe	n=12 (16%)	n=13 (17.3%)	

The mean WHR, WHtR, GLU, TG, TC, HDL-C and LDL-C of non-CVD Group was 0.84±0.05, 0.57±0.029, 6.53±2.13 mmol/l, 4.18±1.31 mmol/l, 1.74±0.64 mmol/l, 1.29±0.78 mmol/l and 2.79±0.75 mmol/l, respectively. Abnormal WHR and Abnormal WHtR of was noted in n=45 (60%) and n=60 (80%), respectively. T2DM was in n=23 (30.7%) patients. While, in CVD Group, the mean WHR, WHtR, GLU, TG, TC, HDL-C and LDL-C was 0.94±0.03, 0.60±0.027, 6.25±2.13 mmol/l, 4.01±1.37 mmol/l, 1.79±0.62 mmol/l, 1.29±0.74 mmol/l and 2.71±0.75 mmol/l, respectively. Abnormal WHR and Abnormal WHtR of was noted in n=23 (30.7%) and n=13 (17.3%), respectively. T2DM was in n=32 (42.6%) patients. The difference was statistically significant in WHR (p=0.000), WHtR (p=0.000) and GLU (p=0.000). (Table 2)

Table 2: Baseline Characteristics among the Groups

Variable	Non-CVD n=75 (50%)	CVD n=75 (50%)	P-value
WHR	0.84±0.05	0.94±0.03	0.000
Abnormal WHR	n=45 (60%)	n=23 (30.7%)	0.232
WHtR	0.57±0.029	0.60±0.027	0.000
Abnormal WHtR	n=60 (80%)	n=13 (17.3%)	0.675
T2DM	n=23 (30.7%)	n=32 (42.6%)	0.068
GLU (mmol/l)	6.53±2.13	6.25±2.13	0.000
TG (mmol/l)	4.18±1.31	4.01±1.37	0.411
TC (mmol/l)	1.74±0.64	1.79±0.62	0.574
HDL-C (mmol/l)	1.29±0.78	1.29±0.74	0.950
LDL-C (mmol/l)	2.79±0.75	2.71±0.75	0.483

Serum 25(OH)D levels in both the groups were shown in table 3. In non-CVD Group, n=36 (48%) patients were deficient. n=42 (56%) patients were insufficient and n=30 (40%) patients were sufficient serum level. While, in CVD Group, n=44 (58.6%) patients were deficient. n=28 (37.3%) patients were insufficient and n=46 (61.3%) patients were sufficient serum level. The differences were statistically significant. (Table 3)

Table 3: Distribution of Serum Levels among the Groups

Levels	Non-CVD n=75 (50%)	CVD n=75 (50%)	P-value
Deficiency (c>20)	n=36 (48%)	n=44 (58.6%)	0.000
Insufficient (20≤c<30)	n=42 (56%)	n=28 (37.3%)	0.000
Sufficient (c≥30)	n=30 (40%)	n=46 (61.3%)	0.000

4. DISCUSSION

Vitamin D deficiency poses a significant and widespread health issue in rural areas, often contributing to numerous cardiovascular diseases. According to a study by Hannesdottir et al., vitamin D deficiency was identified as a risk factor for hypertension, obesity, type 2 diabetes mellitus, and various other cardiovascular diseases. Numerous cardiac arrests and deaths are attributed to vitamin D insufficiency. While various studies have explored this topic, many have focused on specific age groups or genders.

A study was conducted by Wang T et al. (12) reported 25.85% Vitamin D deficiency in his study and 16.70% of presented patients have enough vitamin D. All these patients belong to a rural population. Our study also conducted similar

findings that a rising association between vitamin D and Cardiovascular diseases. In 2014 another study was conducted by Chen YH et al. (13) on pregnant women and reported that vitamin D deficiency is responsible for maternal disease as well as fetal slow growth

Reis JP et al. (14) conducted a study on role of serum vitamin D and CVD. He reported that vitamin D signal mediated receptors play an important role in protection of cardiovascular system and reduce the risk of cardiac problems. In another study Kleinreich et al. (15) reported similar finding that cardiac events can be reduced by taking vitamin D supplements and avoiding vitamin D deficiency. Both of these studies were in favor of our study that vitamin D is a strong predictor of CVD in deficient form.

Kunutsor et al. (16) conducted a study and observed an increase in serum vitamin D level 10mg/ml associated with 10% increase in hypertension. This study found in contrast with previous studies and in our study. In another study Raed et al. (17) concluded that effect of vitamin D is dose dependent on cardiovascular system. Arterial stiffness may increase with an increase in 25 (OH) D level. CVD may increase in increase of slowly 25 (OH) D levels.

Similar study was conducted by Lu L et al. (18) in 2009 on elderly patients and reported that insufficient vitamin D level may increase the CVD, hypertension, diabetes and reported associated in decrease level of 25 (OH) D. Kelkshadi et al. (19) reported in 2014 that vitamin D signals play a protective role against DVD. Vitamin D receptors are found to be important and protective against cardiovascular diseases like coronary artery disease, hypertension, arrhythmias, and immortality.

5. CONCLUSION

The results of our study indicate a correlation between lower levels of serum 25-hydroxy vitamin D and an elevated risk of cardiovascular diseases. Additional research is required to determine whether vitamin D supplements could be recommended to mitigate this risk.

REFERENCES

1. Raja Chakraverty and Pranabesh Chakraborty. “Recent Insights into the Role of Vitamin B12 and Vitamin D upon Cardiovascular Mortality: A Systematic Review”. Acta Scientific Pharmaceutical Sciences 2018;2(12):61-65.

2. Wimalawansa SJ. Vitamin D and cardiovascular diseases: Causality. J Steroid Biochem Mol Biol. 2018;175:29-43. doi: 10.1016/j.jsbmb.2016.12.016.
3. Rai V, Agrawal DK. Role of Vitamin D in Cardiovascular Diseases. *Endocrinol Metab Clin North Am*. 2017;46(4):1039–1059. doi:10.1016/j.ecl.2017.07.009
4. Chen S, Swier VJ, Boosani CS, Radwan MM, Agrawal DK. Vitamin D Deficiency Accelerates Coronary Artery Disease Progression in Swine. Arterioscler Thromb Vasc Biol. 2016;36(8):1651–9.
5. Li DM, Zhang Y, Li Q, Xu XH, Ding B, Ma JH. Low 25-Hydroxyvitamin D Level Is Associated with Peripheral Arterial Disease in Type 2 Diabetes Patients. Arch Med Res. 2016;47(1):49–54.
6. Oh SH, Kweon SS, Choi JS, Rhee JA, Lee YH, Nam HS, et al. Association between Vitamin D Status and Risk of Peripheral Arterial Disease: The Dong-gu Study. Chonnam Med J. 2016;52(3):212–6.
7. Lupton JR, Faridi KF, Martin SS, Sharma S, Kulkarni K, Jones SR, et al. Deficient serum 25-hydroxyvitamin D is associated with an atherogenic lipid profile: The Very Large Database of Lipids (VLDL-3) study. Journal of clinical lipidology. 2016;10(1):72–81.
8. Aleksova A, Beltrami AP, Belfiore R, Barbati G, Di Nucci M, Scapol S, et al. U-shaped relationship between vitamin D levels and long-term outcome in large cohort of survivors of acute myocardial infarction. Int J Cardiol. 2016;223:962–6.
9. Batra CM, Agarwal R. Hypocalcemic Cardiomyopathy and Pseudohypoparathyroidism Due to Severe Vitamin D Deficiency. J Assoc Physicians India. 2016;64(6):74–6.
10. Hannesdottir T, Hrafnkelsson H, Johannsson E, Sigurdsson EL. [The relationship between serum vitamin D levels and cardiovascular risk factors among Icelandic children]. Laeknabladid. 2017; 103 (9):367–71. https://doi.org//10.17992/lbl.2017.09.149
11. Wang TJ, Pencina MJ, Booth SL, Jacques PF, Ingelsson E, Lanier K, et al. Vitamin D deficiency and risk of cardiovascular disease. Circulation. 2008; 117(4):503–11. https://doi.org/10.1161/ CIRCULATIONAHA.107.706127
12. Chen YH, Fu L, Hao JH, Yu Z, Zhu P, Wang H, et al. Maternal vitamin D deficiency during pregnancy elevates the risks of small for gestational age and low birth weight infants in Chinese population. The Journal of clinical endocrinology and metabolism. 2015; 100(5):1912–9. https://doi.org/10.1210/jc. 2014-4407
13. Reis JP, von Muhlen D, Miller ERr, Michos ED, Appel. Vitamin D status and cardiometabolic risk factors in the United States adolescent

population. Pediatrics. 2009; 124(3):e371–9. https://doi.org/10.1542/peds.2009-0213

14. Kienreich K, Tomaschitz A, Verheyen N, Pieber T, Gaksch M, Grubler MR, et al. Vitamin D and cardiovascular disease. Nutrients. 2013; 5(8):3005–21. https://doi.org/10.3390/nu5083005
15. Ministry of Health of the People's Republic of China (2011) China's health statistics yearbook, 2011. Beijing: Peking Union Medical College Press (ISBN 978-7-81136-536-8) Page 290, 329. 2011
16. Kunutsor SK, Apekey TA, Steur M. Vitamin D and risk of future hypertension: meta-analysis of 283,537 participants. Eur J Epidemiol. 2013; 28(3):205–21. https://doi.org/10.1007/s10654-013-9790-2
17. Raed A, Bhagatwala J, Zhu H, Pollock NK, Parikh SJ, Huang Y, et al. Dose responses of vitamin D3 supplementation on arterial stiffness in overweight African Americans with vitamin D deficiency: A placebo controlled randomized trial. PLoS One. 2017; 12(12):e0188424. https://doi.org/10.1371/journal. pone.0188424
18. Lu L, Yu Z, Pan A, Hu FB, Franco OH, Li H, et al. Plasma 25-hydroxyvitamin D concentration and metabolic syndrome among middle-aged and elderly Chinese individuals. Diabetes Care. 2009; 32(7):1278– 83. https://doi.org/10.2337/dc09-0209
19. Kelishadi R, Salek S, Salek M, Hashemipour M, Movahedian M. Effects of vitamin D supplementation on insulin resistance and cardiometabolic risk factors in children with metabolic syndrome: a triplemasked controlled trial. J Pediatr (Rio J). 2014; 90(1):28–34. https://doi.org/10.1016/j.jped.2013.06.006