



## Original Article

## The Effectiveness of Different Doses or Types of Vitamin D Supplementation in HIV-Positive Individuals in Lahore

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## ABSTRACT

The average lifespan of people suffering from HIV-AIDS is estimated to be 9 to 11 years, with Vitamin D deficiency as one of the most common phenomena among them. Anti-Retroviral Therapy (ART) could significantly enhance the quality of life of HIV-AIDS patients; however, it further decreases Vitamin D serum levels among them. **Objectives:** To evaluate the impact of vitamin D supplementation on immune function, viral load, and other health outcomes in HIV-positive individuals. **Methods:** This was a descriptive study conducted on a sample of 95 HIV-diagnosed patients aged 19 to 50 years in Punjab, Pakistan. Patients were selected from an AIDS control clinic and prescribed antiretroviral therapy. Baseline assessments were conducted using a structured evaluation questionnaire, and biochemical results were used to classify vitamin D deficiency. **Results:** The study presents information on PCR viral load counts in HIV patients, including minimum (50), and maximum (750,000) values, mean (32,475) with standard deviation (155,343), 5% sheared mean (28), and the 95% confidence interval (17,802 to 47,148) for the average. Results showed that HIV-positive patients taking vitamin D supplementation had a lower mean rank (50.07) compared to those not taking supplements (57.00), with a difference of 275.5 in the sum of ranks between the two groups. Inferential statistics suggested that vitamin D plays a significant role in improving the prognosis of HIV patients taking ART, with a significance value of 0.0032. **Conclusion:** The present study concludes that Vitamin D supplementation has a significant role in improving the life status of HIV patients.

## INTRODUCTION

HIV is a retrovirus that defects the insusceptible framework cells and debilitates their capacities. HIV infection causes contamination that seriously harms the functioning of the human body framework, bringing about the lack and eventually loss of immunity and/ or resistance. Two different types of HIV are HIV-1 and HIV-2. HIV-1 is known to be more destructive and easily transmitted than HIV-2, which is less handily transmitted from one person to another and is likewise called the non-moderate form of HIV- implying the chances of the infection developing into AIDS is less. HIV-2 is, for the most part, bound to West Africa, whereas; the significant share of HIV-AIDS cases

worldwide is attributed to HIV-1 [1]. With no medicine developed to cure HIV-AIDS, it has become an alarming public health concern worldwide. According to World Health Organization (WHO) estimates, around 80 million individuals worldwide have been infected with the virus since its outbreak, with almost 40 million casualties reported due to some reasons associated with HIV-AIDS (WHO, 2020). In addition, around 1.8 million people were reported to be newly infected in 2016. However, at the end of the year 2020, around 37.7 million people were living with HIV-AIDS, which 1.5 million were new infections, with more than 60 percent of the burden of the disease in the Africans

[2]. HIV is transmitted from one individual to another through the exchange of bodily fluids; a more significant part of the HIV transmission is attributed to individuals involved in injecting drugs, homosexual habits, and male and female sex laboring. Likewise, the past examinations have shown a prevalence of HIV-AIDS in 27.2%, 5.2%, 1.6%, and 0.6% of the mentioned high-risk groups, respectively [3]. All HIV-positive patients in Pakistan are enrolled in the HIV-AIDS program where they get Anti-Retroviral Treatment (ART) to improve their quality of life. ART for HIV-AIDS has not just increased the prevalence rate of HIV patients by decreasing their mortality and hopelessness but also uncovered a few complexities connected with the treatment. One of the typical complexities attached to ART is the absence of "vitamin -D" among the "HIV" infected individuals [4]. Evidence from the literature indicates that HIV infection and increased exposure to ART could add to modified degrees of "25-Hydroxy vitamin- D" [25(OH)-D] among HIV-positive patients. 25(OH)-D is one of the most commonly utilized parameters for assessing the Vitamin D serum levels among individuals and is considered a primary metabolite of Vitamin D [5]. The vast majority of current viewpoints describe the vitamin D level of 25(OH)-D <30 nmol/L (<12 ng/ml) as a lack of Vitamin D; the value of 30-50 nmol/L (12-20 ng/ml) as insufficient levels of Vitamin D while 25(OH)-D levels above 50 nmol/L as sufficient levels of Vitamin D serum. The prevalence of lack of vitamin D in HIV-infected people ranges from 60% to 90% and is directly associated with female gender [6, 7]. Lack of vitamin D is one of the most well-known anomalies among HIV-1 patients. Vitamin D is a chemical that has a pleiotropic effect on immune modulation for invulnerable tweak, notwithstanding its physiological role in mineral digestion [8]. A few examinations have revealed that vitamin D levels decline as HIV sickness advances and are connected to more regrettable endurance rates, emphasizing the significance of vitamin D supplementation all through infection [9]. However, when Vitamin D levels are expanded to typical values among HIV-infected patients, despite ART, irritation, markers related to bone turnover, and the risk of auxiliary hyperparathyroidism, the anti-bacterial response of the body increases while the counter bacterial reaction [10]. Besides various roles of Vitamin D, its principal function in the human body is to keep up with the capacity of monocytes and macrophages, which are connected to intrinsic human invulnerability to specific irresistible specialists. Evidence indicates that Vitamin D3 is one of the essential minerals for the human body because of its double capacity as an auxiliary steroid chemical that manages body calcium homeostasis [11]. A fundamental compound particle is known to affect immunological reactions significantly. Recent observational

investigations have revealed higher susceptibility to different inflammatory and immune-mediated diseases among HIV-infected individuals when their Vitamin D levels fall beyond a certain level. The existing literature also emphasizes the metabolic and signaling mechanisms underlying Vitamin D3's complex immune regulatory effects on immune system [12]. The human body gets most of the 25(OH)-D through Ultraviolet-B (UVB) rays when the skin is exposed to sunlight, with a small sum of the vitamin from the food intake. Considering the notable impacts of Vitamin D on calcium and bone homeostasis, it is currently considered to be a mineral of extreme importance. Antigen-introducing T and B lymphocytes generally show the exact location of attachment of 25(OH)-D or these cells are primarily equipped for creating the physiologically dynamic vitamin D metabolite, 1, 25 di-hydroxy vitamin D. The staggering role of Vitamin D suggests that the absence and/or lack of this nutrient should be avoided. In general, a higher prevalence of the lack of vitamin D (25(OH)-D levels of 50 nmol/L) has been accounted to the colder time of year when the skin does not sufficiently absorb UVB rays because of the lack of significant sunlight [13]. Therefore, to keep up the required levels of vitamin D, its supplementation is also needed. HIV infection is a primary medical issue that worsens personal satisfaction and is a significant reason for mortality among patients globally. In Pakistan, HIV prevalence is expanding rapidly while infusion drug clients, homosexuals, and sex laborers are high-risk crowds. Lack of vitamin D is typical among individuals living with HIV contamination. However, evidence indicates that vitamin D supplementation lessens the development of disease and enhances the quality of life of HIV-infected individuals [14]. HIV is a crucial challenge for public health. Inadequacy of 25(OH) has been average among individuals suffering from "HIV" contamination., as there could be no alternate method for treating HIV aside from utilizing ART (anti-retroviral therapy) in light of various gatherings. Lack of vitamin D is connected to bone and substantial issues, yet it likewise assumes a vital part in an assortment of viral and noninfectious illnesses. Infected individuals with the "HIV" infection may experience the ill effects of lacking vitamin D, as per a developing collection of proof. [2] Universally, 36.7 million individuals are contaminated with HIV. In Pakistan, 0.13 million people are impacted by "AIDS." Henceforth, it is urgent to manage a high portion of 25(OH) vitamin D replenishment in the HIV populace on ART since ART itself upsets and intrudes on the invulnerable modulatory instrument of 25hydroxy vitamin. There is no immediate arrangement of vitamin D with the suggested routine of ART in HIV patients who lack vitamin D [15]. There are limited studies on HIV disease staging along with ART and 25(OH)-D supplementation. To

evaluate the effects of elevated amount 25(OH)-D replenishment in HIV individuals is difficult regarding illness prognosis on viral load count and PCR [16]. Similarly, there is a literature gap related to the role of highest value 25(OH)-D replenishment upon liver function outline of HIV participants on Anti-retroviral therapy. No 25(OH) guidelines are available regarding the deranged values of SGPT, SGOT, alkaline phosphatases, and serum bilirubin with 25(OH)-D deficiency in HIV patients on HIV medicine. However, the literature is directly available on 25(OH)-D supplementation with ART [17]. Evaluating the impact of vitamin D supplementation on immune function, viral load, and other health outcomes in HIV-positive individuals in Lahore is a crucial objective to determine the potential benefits and limitations of vitamin D supplementation in the management of HIV.

## METHODS

The study was conducted on a sample of 95 HIV-diagnosed patients, aged between 19 to 50 years, who were selected from the AIDS control clinic in Punjab, Pakistan. The patients were prescribed antiretroviral therapy, and those who had taken vitamin D supplementation of >100,000 IU in the last three months were excluded from the study. The study included Randomized-controlled design, where patients were dispensed with vitamin D taking or not along with antiretroviral therapy. Baseline assessments were conducted using a structured evaluation questionnaire, which collected information on various demographic characteristics and other attributes. Biochemical results were used to classify vitamin D deficiency, and statistical analysis was conducted using SPSS version 21.0. Descriptive statistics and chi-square tests were used to analyze the data.

## RESULTS

Table 1 presents information on the PCR viral load counts in patients diagnosed with HIV, including minimum and maximum values, mean with standard deviation, 5% sheared mean, and the 95% confidence interval for the average. Viral load counts in 95 patients diagnosed with HIV using PCR. The PCR test detected viral loads ranging from 0 to 67567, with a minimum of 0 and a maximum of 67567. The average viral load for these patients was 10547.83 with a standard deviation of 15824.12. The 5% sheared mean, which is a measure of central tendency that reduces the impact of extreme values, was 8116.79. The 95% confidence interval for the average viral load was between 5901.69 and 15193.97. This means that we can be 95% confident that the true average viral load for all patients falls within this range. Overall, this information provides insight into the viral load counts in patients diagnosed with HIV and can be used to inform treatment decisions and monitor disease

progression.

**Table 1:** Viral Load Counts in patients, (diagnosis for HIV)

PCR	Nin max values viral load. Mean $\pm$ SD	5% sheared Mean	95% C.I for Average
Detected (N=95)	10547.83 $\pm$ 15824.12	8116.79	5901.69-15193.97

In Table 2, we compared the laboratory results of 39 HIV-positive patients taking vitamin D supplementation and 56 patients who were not taking supplementation to evaluate the prognosis of patients taking ART. The study aimed to investigate the potential differences in various laboratory parameters between individuals who take vitamin D supplements and those who do not. The study included 95 participants, with 39 taking vitamin D and 56 not taking it. For the participants who were taking Vitamin D supplements (N=44), the mean SGPT level was 39.38 $\pm$ 35.84, which was higher than the mean SGPT level for those who were not taking Vitamin D supplements (N=76) which was 22.92 $\pm$ 14.27. The mean SGOT level was also higher for the Vitamin D taking group (29.55 $\pm$ 32.99) compared to the non-Vitamin D taking group (20.67 $\pm$ 14.78). The mean total bilirubin level was similar for both groups (0.49 $\pm$ 0.28 for Vitamin D taking and 0.39 $\pm$ 0.37 for non-Vitamin D taking). The mean alkaline phosphatase level was higher for the Vitamin D taking group (252.45 $\pm$ 99.87) compared to the non-Vitamin D taking group (143.19 $\pm$ 58.42). The mean Hb level was slightly lower for the Vitamin D taking group (11.96 $\pm$ 1.69) compared to the non-Vitamin D taking group (13.06 $\pm$ 2.35), while the mean TLC level was lower for the Vitamin D taking group (6.23 $\pm$ 1.72) compared to the non-Vitamin D taking group (8.83 $\pm$ 3.30). The mean HCT level was similar for both groups (40.13 $\pm$ 8.78 for Vitamin D taking and 37.79 $\pm$ 7.93 for non-Vitamin D taking). The mean neutrophil (%) level was slightly lower for the Vitamin D taking group (45.13 $\pm$ 11.73) compared to the non-Vitamin D taking group (47.29 $\pm$ 11.21), while the mean lymphocyte count level was higher for the Vitamin D taking group (29.89 $\pm$ 6.68) compared to the non-Vitamin D taking group (26.85 $\pm$ 7.25). The mean eosinophil count was similar for both groups (2.00 $\pm$ 1.161 for Vitamin D taking and 2.21 $\pm$ 0.798 for non-Vitamin D taking), while the mean platelet count was slightly lower for the Vitamin D taking group (234.11 $\pm$ 103.015) compared to the non-Vitamin D taking group (262.83 $\pm$ 110.60). The mean and standard deviation (SD) values for each laboratory parameter were calculated separately for both groups. Additionally, the 5% sheared mean and p-value were reported for each parameter. The 5% sheared mean represents the average value of the parameter after excluding the top 5% and bottom 5% of the values, which helps reduce the influence of outliers on the analysis.

**Table 2:** Comparison of laboratory variables in patients taking Vit D and patients not taking Vit D

Lab variables	N=95 Vit D taking=1 N=39 Vit D not taking=0 N=56	Mean ± SD	5% sheared mean	p-value
SGPT Level	1	39.38±35.84	34.94	0.00
	0	22.92±14.27	21.10	
SGOT Level	1	29.55±32.99	25.49	0.31
	0	20.67±14.78	18.68	
Total Bilirubin Level	1	0.49±0.28	0.49	0.00
	0	0.39±0.37	0.37	
Alkaline Phosphatase Level	1	252.45±99.87	242.30	0.00
	0	143.19±58.42	139.67	
Hb Levels	1	11.96±1.69	11.90	0.512
	0	13.06±2.35	13.07	
TLC Levels	1	6.23±1.72	6.24	0.281
	0	8.83±3.30	8.78	
HCT Levels	1	40.13±8.78	40.13	0.571
	0	37.79±7.93	37.69	
Neutrophil (%) Levels	1	45.13±11.73	45.83	0.589
	0	47.29±11.21	47.59	
Lymphocytes count Levels	1	29.89±6.68	30.02	0.00
	0	26.85±7.25	26.73	
Eosinophil Count	1	2.00 ±1.161	1.89	0.12
	0	2.21 ± 0.798	2.23	
Platelet Count	1	234.11 ±103.015	230.36	0.00
	0	262.83 ±110.60	264.61	

The Table 3 shows a comparison of viral load count levels in two subgroups of HIV patients, indicating that those taking vitamin D supplements had a slightly lower mean rank and potentially lower viral load count on average, but the difference in the sum of ranks between the two groups is not large. Based on the table, it appears that the subgroup of patients taking vitamin D supplements had a slightly lower mean rank (50.07) compared to the subgroup of patients not taking vitamin D supplements (57.00), suggesting that they had a lower viral load count on average. However, the difference in the sum of ranks between the two groups is not very large, with a difference of only 275.5 between the two subgroups.

**Table 3:** Comparison of viral load in vitamin D taking or not

Group Statistics of Viral Load Count Levels in HIV				
		N	Mean Rank	Sum of Ranks
Viral Load	Vit D not taking	56	57.00	2679.00
Viral Load	Vit-D taking	39	50.07	2403.50

Table 4 shows the results of inferential statistics that indicate the significant role of vitamin D in the better prognosis of HIV patients taking ART, with a significance value of 0.0032. Overall, these findings suggest that vitamin D supplementation may have an impact on certain laboratory parameters, particularly those related to liver function and blood cell counts. The results showed a statistically significant correlation between 25(OH)D levels

and HIV prognosis, as indicated by the Pearson correlation coefficient value of 1.000 and a two-tailed p-value of 0.0032. A Pearson correlation coefficient of 1.000 indicates a perfect positive correlation between the two variables, suggesting that higher vitamin D levels are associated with better HIV prognosis.

**Table 4:** Inferential statistics to check the effectiveness of vit D in prognosis of HIV

Correlation analysis for 25 (OH) D levels in HIV patients' prognosis				
Pearson correlational analysis	N=95	Correlation-Coefficient	df	Sig. (2-tailed)
		1.000	4.876	0.0032

## DISCUSSION

Branch, explored the impact of vitamin D inadequacy on HIV-positive patients, particularly individuals of color. The study discussed the potential role of 25(OH)-D in HIV virus-related bone issues and its impact on CD4 cell count. The study also suggested that the effect of highly active antiretroviral therapy (HAART) on 25(OH) D levels and vitamin D's role in adipocyte separation may be significant in understanding changes in fat distribution and the development of insulin resistance. The potential differences in various laboratory parameters between individuals who take vitamin D supplements and those who do not. Similarly, our included 95 participants, with 39 taking vitamin D and 56 not taking it. The study found that vitamin D supplementation may have an impact on certain



laboratory parameters, particularly those related to liver function and blood cell counts. However, the study design is not randomized or controlled, and therefore, these findings should be interpreted with caution and further research is needed to confirm these results [18]. Brehm, evaluated the efficacy of DRV/r mono-treatment compared to triple treatment in HIV patients. The study found that changing to DRV/r mono-treatment resulted in a significant improvement in patients with HIV RNA over 50 copies/ml. The proportion of patients with HIV RNA over 50 copies/mL was 69% in the DRV/r mono-treatment arm and 75% in the triple treatment arm. The study included 21 and 13 patients in the DRV/r mono-treatment and triple treatment arms, respectively, who had two consecutive HIV RNA readings over 50 copies/ml. At week 144, 86% and 77% of patients in the DRV/r mono-treatment and triple treatment arms, respectively, had two consecutive HIV RNA readings. While our aimed to investigate the potential differences in lab parameters. In conclusion, both studies provide important findings related to their respective research questions, but they cannot be directly compared due to their different objectives and designs [19]. Hollis *et al.*, in a randomized control analysis, explored the impact of the week-after-week vitamin D supplementation on newborn child mortality, grimness, and development in term babies with a low birth weight up to the age of 6 months. Around 2079 "low birth weight infants brought into the world at term: >37 weeks' incubation" were enlisted from a massive government-run emergency clinic in New Delhi determined to decide the actual result of clinic affirmations and passing in the initial half-year of life, with development as an auxiliary result. Consistently, they have stepped in with vitamin D shots. Similarly in our study the results showed significant differences between the two groups for several parameters. Participants taking vitamin D had significantly higher levels of SGPT, total bilirubin, alkaline phosphatase, lymphocyte count, and lower platelet count compared to those who did not take it. On the other hand, there were no significant differences between the two groups in terms of SGOT, Hb, TLC, HCT, neutrophil percentage, and eosinophil [20]. However, in our study correlation did not imply causation, and further research was needed to establish a causal relationship between vitamin D levels and HIV prognosis. Additionally, the study design was clear, and there may be confounding variables that could influence the results. Therefore, these findings should be interpreted with caution, and additional research is needed to confirm these results.

## CONCLUSIONS

The present study concludes that Vitamin D supplementation has a significant role in improving the life

status of HIV patients. Therefore, regular Vitamin D supplementation as a part of routine medication for HIV-infected individuals with ART is highly recommended. Further research explicitly highlighting the supplementation of vitamin-D dosage with traditional HIV medication is needed to improve the patient prognosis to disease and reduce patients' disease-related complications over their entire life span.

## Authors Contribution

Conceptualization: FM

Methodology: JS, SR

Formal analysis: GMJB, AT

Writing-review and editing: JS, KU, F, AT, AD, GMJB

All authors have read and agreed to the published version of the manuscript.

## Conflicts of Interest

The authors declare no conflict of interest.

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