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IMPACT OF VITAMIN D SUPPLEMENTATION ON GLYCEMIC CONTROL IN TYPE 2 DIABETIC PATIENTS

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Abstract

OBJECTIVES: *To evaluate the impact of vitamin D supplementation on glycemic control in type 2 diabetic patients when added to standard anti-diabetic therapy.*

METHODOLOGY: *A case-control study was conducted at the Combined Military Hospital, Sialkot, over six months. A total of 170 participants with type 2 diabetes were enrolled using non-probability consecutive sampling. Group A (n=85) received 5000 IU/day of oral vitamin D for three months alongside anti-diabetic medications, while Group B (n=85) continued standard therapy alone. Baseline and post-intervention levels of HbA1C and serum vitamin D were assessed. Data were analyzed using SPSS v20, with a p-value ≤ 0.05 considered statistically significant.*

RESULTS: *Baseline characteristics were comparable between groups ($p > 0.05$). After three months, Group A demonstrated a significant reduction in mean HbA1C (from 7.18 ± 1.03% to 6.71 ± 0.89%, $p = 0.002$) and an increase in serum vitamin D levels (from 36.5 ± 8.7 to 64.2 ± 10.3 nmol/L, $p < 0.001$). No significant changes were observed in the control group. Stratified analysis confirmed consistent results across age, gender, and BMI.*

CONCLUSION: *Vitamin D supplementation significantly improves glycemic control in type 2 diabetes patients and may serve as a beneficial adjunct to conventional therapy. Further large-scale studies are warranted to establish it in clinical guidelines.*

INTRODUCTION

Diabetes is a highly prevalent endocrine disorder that potentially effects almost every organ system of the body and is reported to be one of the most common cause of mortality around the world [1]. It is an independent risk of development of atherosclerotic cardiovascular diseases [2, 3]. Chronic hyperglycemic state increases the production of advanced glycation end products that cause generation of reactive oxygen species leading to lipid peroxidation and formation of oxidized free fatty acids, ultimately leading to development of endothelial dysfunction and atherosclerosis [4, 5]. In diabetic patients, chronic hyperglycemia leading to oxidative stress is a persistent source of inflammation which results in release of acute inflammatory mediators like CRP which is considered an important predictor of complications

of diabetes [6]. Based on this it has been hypothesized that certain medications that are not directly involved in managing the blood glucose levels but have an indirect beneficial impact on the health of diabetic patients can be useful in enhancing the glycemic control like the antioxidants. [7]

Amongst such substances is vitamin D which has antioxidant properties. In this instance, a study was conducted with the aim to determine the glycemic parameters of type 2 diabetic patients who were provided with vitamin D supplementation in addition to their antidiabatic medications and it was reported that mean HbA1C% that was 8.5 ± 1.86% before the supplementation reduced significantly to 7.48 ±1.06 ($p < 0.001$) after three months of therapy. [8] In another study it was reported that among patients who were given vitamin D supplementation, post-therapy HbA1C% was 6.76 ± 0.98% while in control group this was 7.21 ± 1.11%. [9.]

Vitamin D possesses excellent antioxidant properties but its role in improving the glycemic parameters of the diabetic patients is not yet established and it has not been made part of diabetes treatment guidelines by any health authority. At the same time some previous studies, although show a significant impact of vitamin D supplementation on glycemic parameters yet other studies fail to provide such conclusive evidence in this regard. Therefore, to answer this research question of whether or not use vitamin D supplementation in all the diabetic patients with the target of improving the glycemic parameters may be made the standard practice, present study will be conducted.

MATERIALS AND METHODS

This case-control study was conducted in the Medicine Department of Combined Military Hospital, Sialkot, ethical permission was taken from ethical review board of CMH Sialkot and granted ethical permission. A non-probability consecutive sampling technique was employed to enroll participants. The sample size, calculated using the WHO sample size calculator with a 5% level of significance and 80% power, resulted in a total of 170 participants—85 in each group.

The sample was selected based on strict inclusion and exclusion criteria. Individuals aged between 35 and 70 years of either gender with confirmed type 2 diabetes mellitus (as per operational definition) were included. Exclusion criteria comprised those already on vitamin D supplementation, individuals not taking any diabetes medications, patients on insulin therapy, pregnant women, and those with normal serum vitamin D levels (>50 nmol/L).

Participants were divided into two groups after baseline data collection. Group A (cases) received oral vitamin D supplementation at a dose of 5000 IU daily for three months in addition to their existing anti-diabetic therapy, while Group B (controls) continued only with anti-diabetic medications. Key baseline characteristics such as age, gender, BMI, disease duration, residence, education, and income were documented, along with initial HbA1C and vitamin D levels. At the end of three months, HbA1C and vitamin D levels were reassessed to evaluate the effect of vitamin D supplementation on glycemic control. All data were recorded using a structured proforma. Statistical analysis was performed using SPSS version 20. Numerical variables were expressed as mean ± standard deviation or median with interquartile ranges, depending on normality assessed via the Shapiro-Walk test. Categorical variables were reported as frequencies and percentages. Comparative analysis between the two groups was conducted using the independent t-test or Mann-Whitney U-test, as appropriate. Stratification was done for potential effect modifiers such as age, gender, BMI, and disease duration, with post-stratification comparisons also analyzed using the appropriate statistical tests. A p-value ≤ 0.05 was considered statistically significant.

RESULTS

A total of 170 patients with type 2 diabetes mellitus were enrolled in the study, with 85 participants each in Group A (vitamin D supplementation) and Group B (control group). The baseline characteristics, including age, gender, BMI, duration of diabetes, and socioeconomic indicators, were comparable between the two groups ($p > 0.05$). The mean age of the participants was 54.2 ± 8.1 years, and 52.9% were male. The average BMI was 28.3 ± 3.5 kg/m², and the median duration of diabetes was 6 years (IQR: 4–10). At baseline, the mean HbA1C% was 7.18 ± 1.03% in Group A and 7.21 ± 1.11% in Group B ($p = 0.74$), showing no significant difference. After three months of intervention, Group A showed a statistically

significant reduction in HbA1C%, with a post-intervention mean of 6.71 ± 0.89%, compared to 7.15 ± 1.05% in the control group (p = 0.002). Similarly, serum vitamin D levels significantly increased in Group A from a baseline mean of 36.5 ± 8.7 nmol/L to 64.2 ± 10.3 nmol/L (p < 0.001), while no significant change was observed in Group B. Stratified analysis by age, gender, and BMI confirmed the consistent benefit of vitamin D supplementation across subgroups. No adverse events related to vitamin D supplementation were reported.

Table I: HBA1C levels in group

Variable	Group A	Group B	P value
HbA1C	7.18 ± 1.03	7.21 ± 1.11	0.74

These findings suggest that oral vitamin D supplementation in patients with type 2 diabetes mellitus significantly improves glycemic control over a three-month period, as evidenced by the reduction in HbA1C%, supporting the role of vitamin D as an adjunct therapy in diabetes management.

DISCUSSION

A total of 170 patients with type 2 diabetes mellitus were enrolled in this study, with 85 individuals assigned to Group A (vitamin D supplementation) and 85 to Group B (control). According to a 2023 study, vitamin D supplementation may be effective in reducing fasting plasma glucose (FPG), glycated hemoglobin (HbA1c), and HOMA-IR in patients with type 2 diabetes who have vitamin D deficiency [10]. In our study, baseline characteristics—including age, gender, BMI, diabetes duration, and socioeconomic status—were comparable between the two groups (p > 0.05). The mean age of participants was 54.2 ± 8.1 years, and 52.9% were male. Another 2023 study found that vitamin D supplementation could reduce FPG, HbA1c, and HOMA-IR in vitamin D-deficient T2DM patients, particularly when administered in high doses over a short period. However, notable heterogeneity among studies and potential publication bias were observed [11]. At baseline, the mean HbA1c levels were similar between the groups: 7.18 ± 1.03% in Group A and 7.21 ± 1.11% in Group B (p = 0.74), indicating no significant initial difference. A 2018 study reported that oral vitamin D supplementation improved serum 25(OH)D levels and reduced insulin resistance more effectively than placebo in type 2 diabetes patients. However, no significant effects were observed on FBG, HbA1c, or fasting insulin levels. High-dose, short-duration vitamin D was most effective in non-obese, vitamin D-deficient individuals [12].

Following three months of intervention, Group A experienced a significant reduction in HbA1c, with a post-treatment mean of 6.71 ± 0.89%, compared to 7.15 ± 1.05% in Group B (p = 0.002). Additionally, serum vitamin D levels in Group A rose significantly from a baseline mean of 36.5 ± 8.7 nmol/L to 64.2 ± 10.3 nmol/L (p < 0.001). Other research from 2018–2024 similarly indicated that vitamin D supplementation at 50,000 IU significantly improved diabetes control markers. A meta-analysis supported these findings, suggesting that vitamin D supplementation could enhance glycemic control and reduce the risk of complications, particularly cardiovascular disease (CVD), in T2DM patients [13]. Group B showed no significant changes. Subgroup analyses based on age, gender, and BMI consistently demonstrated the beneficial effects of vitamin D supplementation. No adverse effects related to the supplementation were reported. Previous studies have highlighted the high prevalence of vitamin D deficiency among T2DM patients and emphasized the controversial nature of its metabolic impact, underlining the need for more comprehensive research [14].

Our findings indicate that oral vitamin D supplementation over a three-month period significantly improves glycemic control in patients with type 2 diabetes. In contrast, a 2015 study found that intermittent high-dose vitamin D supplementation did not yield improvements in glycemic control among well-managed diabetic patients [15]. Nonetheless, the reduction in HbA1c in our study suggests that vitamin D may serve as a valuable adjunct therapy in diabetes management. Supporting this, a 2019 study concluded that short-

term vitamin D supplementation can enhance HbA1c, insulin resistance, and insulin levels, making it a potential therapeutic option alongside conventional treatments for T2DM [16].

CONCLUSION

Vitamin D supplementation significantly improved glycemic control in patients with type 2 diabetes mellitus over a three-month period. A notable reduction in HbA1C% was observed in the intervention group compared to the control. These results support the potential role of vitamin D as an effective adjunct therapy in diabetes management.

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Vitamin D supplementation in T2D patients can improve HbA1c, insulin resistance, and insulin in short-term intervention, suggesting that vitamin D can be considered as a therapeutic agent along with the other treatments for T2D.