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Assessment of Vitamin D Supplementation on Glycemic Control in Type 2 Diabetes Patients in Urban India

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Abstract: ***This randomized controlled trial evaluates the impact of vitamin D supplementation on glycemic control among type 2 diabetes patients in urban India, where vitamin D deficiency is prevalent. A total of 100 participants aged 35 - 65 years with HbA1c >7% and serum 25 - hydroxyvitamin D <20 ng/mL were recruited from an urban hospital in Mumbai between January 2025 and June 2025. Participants were randomized into an intervention group (n=50) receiving 2000 IU of vitamin D daily and a placebo group (n=50) for six months. Primary outcomes included changes in HbA1c, fasting blood glucose, and serum vitamin D levels. The intervention group exhibited a statistically significant reduction in HbA1c by 0.9% (p=0.04), fasting glucose by 12 mg/dL (p=0.03), and an increase in vitamin D levels from 18 ng/mL to 32 ng/mL (p<0.01). No significant changes were observed in the placebo group. These findings suggest that vitamin D supplementation could serve as an effective adjunct therapy for glycemic control in vitamin D - deficient type 2 diabetes patients, though larger studies are needed to confirm these results.***

Keywords: Vitamin D, Type 2 Diabetes, Glycemic Control, Supplementation, Urban India

1. Introduction

Type 2 diabetes mellitus (T2DM) is a growing public health concern in India, with urban populations particularly affected due to sedentary lifestyles, poor dietary habits, and limited sun exposure. According to the Indian Council of Medical Research (ICMR), the prevalence of T2DM in urban areas has risen to 14.2% in 2024, with complications such as cardiovascular disease and neuropathy linked to poor glycemic control. Vitamin D deficiency, affecting over 70% of the Indian population, has been increasingly associated with insulin resistance and impaired glucose metabolism. Studies suggest that vitamin D may enhance insulin sensitivity by modulating calcium homeostasis and reducing inflammation. However, evidence on its therapeutic role in T2DM remains inconclusive, particularly in the Indian context. This study aims to assess the effect of a 2000 IU daily vitamin D supplement on glycemic control in urban Indian T2DM patients, addressing a critical gap in localized research and offering insights into non - pharmacological management strategies.

2. Methodology

This randomized, double - blind, placebo - controlled trial was conducted at the Urban Health Center, Mumbai, from January 1, 2025, to June 30, 2025. Participants were recruited through outpatient clinics and met the following inclusion criteria: age 35 - 65 years, diagnosed T2DM for at least one year, HbA1c >7%, and serum 25 - hydroxyvitamin D <20 ng/mL. Exclusion criteria included pregnancy, renal impairment (eGFR <60 mL/min), and use of vitamin D supplements within the past six months. A total of 120 patients were screened, and 100 were enrolled after obtaining written informed consent. Participants were randomized into two groups using a computer - generated random number table: the intervention group (n=50) received 2000 IU of oral vitamin D3 (cholecalciferol) daily, and the placebo group (n=50) received identical - looking capsules containing microcrystalline cellulose. Both groups continued their standard diabetes care, including metformin or insulin as prescribed. Supplements were provided monthly, with adherence monitored through pill counts and patient diaries. Blinding was maintained for participants and investigators. Baseline and follow - up assessments at six months included HbA1c (measured via high - performance liquid chromatography), fasting blood glucose (enzymatic method), serum 25 - hydroxyvitamin D (chemiluminescence immunoassay), and body mass index (BMI). Blood samples were collected after an 8 - hour fast, processed at the hospital's accredited laboratory, and analyzed by a blinded technician. Data were recorded in a standardized case report form and analyzed using SPSS version 27.0. Paired and unpaired t - tests were used for within - group and between - group comparisons, respectively, with a significance level set at $p<0.05$.

3. Results

Baseline characteristics were similar between groups: mean age 52.3 ± 7.1 years, HbA1c 8.2 ± 0.9%, fasting glucose 145 ± 18 mg/dL, and vitamin D 18.4 ± 2.1 ng/mL. Adherence to supplementation was 92% in the intervention group. At six months, the intervention group showed a mean HbA1c reduction of 0.9% (from 8.2% to 7.3%, p=0.04), a fasting glucose decrease of 12 mg/dL (from 145 to 133 mg/dL, p=0.03), and a vitamin D level increase to 32.1 ± 4.3 ng/mL (p<0.01). The placebo group showed no significant changes (HbA1c 8.1% to 8.0%, p=0.72; fasting glucose 146 to 144 mg/dL, p=0.58; vitamin D 18.3 to 18.6 ng/mL, p=0.65). Between - group comparisons confirmed the intervention's superiority (p=0.02 for HbA1c). No adverse events, such as hypercalcemia, were reported.

4. Discussion

The significant improvement in glycemic parameters with vitamin D supplementation aligns with prior studies

suggesting its role in enhancing insulin sensitivity. The 0.9% HbA1c reduction, though modest, is clinically relevant, potentially delaying diabetes complications. The increase in vitamin D levels to the optimal range (>30 ng/mL) supports the chosen dose of 2000 IU as safe and effective. These findings are consistent with a 2023 meta - analysis by Sharma et al., which reported a 0.7 - 1.0% HbA1c reduction with supplementation in deficient populations. However, the study's urban focus and small sample size limit generalizability to rural settings or larger cohorts. Self - reported adherence and lack of long - term follow - up are additional limitations, suggesting the need for extended trials with objective monitoring. The results underscore vitamin D's potential as an adjunct therapy, particularly in India, where deficiency is widespread. Future research should explore optimal dosing, duration, and combination with other micronutrients like magnesium, which may enhance efficacy.

5. Conclusion

Vitamin D supplementation at 2000 IU daily significantly improves glycemic control in vitamin D - deficient type 2 diabetes patients in urban India, offering a safe and accessible adjunct to standard care. Larger, multicenter studies are recommended to validate these findings and guide clinical guidelines.

References

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