The Correlation between the Effect of Vitamin D3 and both glycated hemoglobin and fasting glucose levels in Iraqi females in the province of Maysan who have uncontrolled type 2 diabetes

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Abstract

A total of 130 overweight Iraqi women with uncontrolled type 2 diabetes, the ages of the women (28 to 60) years, were divided into groups, group 5000 IU (65 women) as group A and control (65 women) as group B. were participants from The Specialized Center for Diabetes in Maysan Province and its related areas in the countryside and the city for this double-blind, randomized control trial (Maysan Province, Iraq). A placebo and 5000 IU of D3 daily were given to the participants for four months. Laboratory tests were conducted at baseline and four months to analyze serum levels. After four months of treatment, positive changes in Glycated hemoglobin, and D3 levels, There was no statistically meaningful change in Fasting blood glucose. Age and place of residence were not considerably different. According to this study, vitamin D may help type 2 diabetics lower their Glycated hemoglobin.

Keywords: diabetes, vitamin D3, Glycated hemoglobin, Fasting blood glucose, obesity.

1. Introduction

Glycated hemoglobin serves as the primary indicator of glycemia. One study found that a one percent decrease in HbA1c was related to a 21% reduction in diabetes complications and a 37% reduction in microvascular illness [1]. Given that Asian populations develop type 2 diabetes at a younger age than their Caucasian counterparts, glycemic control through HbA1c monitoring is even more critical [1, 2]. It has been proven that the high prevalence of diabetes in the Middle East is strongly correlated with vitamin D deficiency [3]. Several cross-sectional studies have found a link between low vitamin D levels in the blood, high blood glucose levels when fasting, and insulin resistance [4].

. Recent interventional trials investigating the effect of vitamin D intake on glycemia indicators have produced inconclusive results. There is no conclusive link between vitamin D and glucose metabolism [5]. Vitamin D may affect glycemia by binding to the vitamin D receptor (VDR) on beta cells in the pancreas, which increases insulin gene transcription and glucose uptake in the periphery [6]. By modulating extracellular and intracellular calcium [6], vitamin D may also indirectly promote glucose transport across target cells. This study tests the idea that vitamin D therapy lowers the levels of glycated hemoglobin and fasting blood glucose.

2. Materials and Techniques

2.1. Materials

All of the research reagents came from Roche Diagnostics (Germany): Vitamin D immunoassay kit, Glucose HK GLUC3 enzymatic assay kit, Tina-quant Haemogblon A1c Gen.3 turbidimetric inhibition immunoassay kit, and Tina-quant Haemogblon A1c Gen.3 turbidimetric inhibition immunoassay kit (Cobas A1C-3, Roche Diagnostics, Germany).Use deionized water (Local store, Iraq), distilled water (Local store, Iraq), Sterile Gloves (Local store, Iraq), Microcrystalline cellulose placebo (German), and 5000 IU vitamin D3 (German).

2.2 Measurement of the concentration HBA1c

The Roche turbidimetric inhibition immunoassay was applied in this study. As part of this two-step assay, a sample is combined with an anti-HbA1c antibody, Formation of soluble antibody-antigen complexes from glycohaemoglobin (HbA1c). Through turbidimetry, the Cobas c 111 analyzer can measure the amount of insoluble antibody-polyhapten complex produced by the addition of polyhaptens. 180 µl of Hemolyzing Reagent was added to 2 µl of blood. According to the PreciControl HbA1c norm (typical), the control interval was established at a lower limit of 4.80-6.12 percent and a maximum of 9.3-11.7 percent (Pathogenic). When HbA1c levels are at or above 6.5%, diabetes is diagnosed based on WHO guidelines and American Diabetes Association guidelines for 2020. Study participants had poorly managed T2DM, defined as HbA1c values above 8% in previous studies [7-9].

2.3 Measuring fasting glucose level

Roche's enzymatic reference method assessed glucose levels during the fast by combining 2µl of serum with hexokinase. Photometric analysis with the Cobas c 111 analyzer reveals that the rate of NADPH production during the reaction is directly proportional to the glucose concentration. The control intervals for the lower limit were established as 92-112 mg/dL for PreciControl ClinChem Multi 1 and 212–260 mg/dL for PreciControl ClinChem Multi 2.

3. Results and Discussion

3.1 Fasting blood glucose (FBG)

Table 1 shows how the average fasting blood glucose levels of participants in groups A and B differ (tests after four months minus the first test).

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Table 1-Comparison of FBG **(mg/dl) concentrations before and after four months.**

Group S	Before four months (Tests)	After four months (Tests)	The change in the mean (The tests after four months minus baseline tests)	b-p-value
	Mean ±SD			
A	210.21 ±65.67	171.10 ±68.31	-39.11 ±62.47	0.001
B	186.70 ±63.42	185.77 ±71.01	-0.93 ±86.07	0.831

The difference in average fasting glucose levels between the two groups was insignificant (F (2, 123) = 1.289, p = 0.281). The association between time and both groups was statistically significant (F (2,124) = 12.99, p = 0.039; mixed testing). A one-way analysis (tests after four months minus baseline testing) found that the average FBG levels of the two groups did not differ significantly. After four months, only group A demonstrated a significant change in FBG levels (mean change =-39.11, p = 0.001). (tests after four months minus baseline testing). See Table 1. Figures 1 and 2 show the difference between the two groups' mean fasting glucose levels (tests at the beginning and after four months).

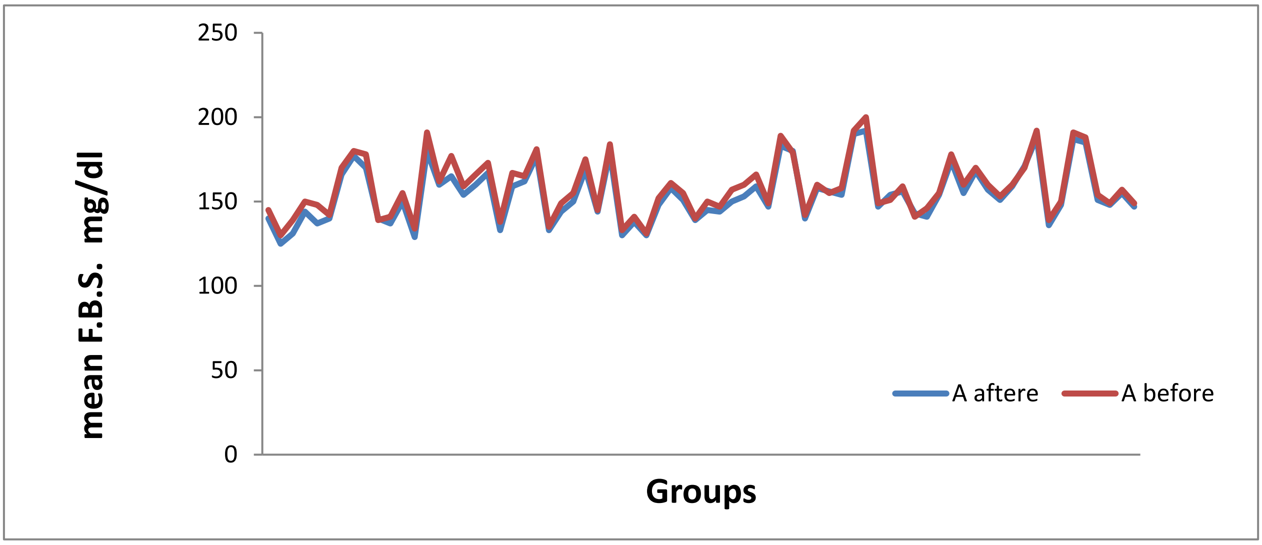

Fig. 1: Average FBG (mg/dl) to group A over time (tests after four months minus baseline tests).

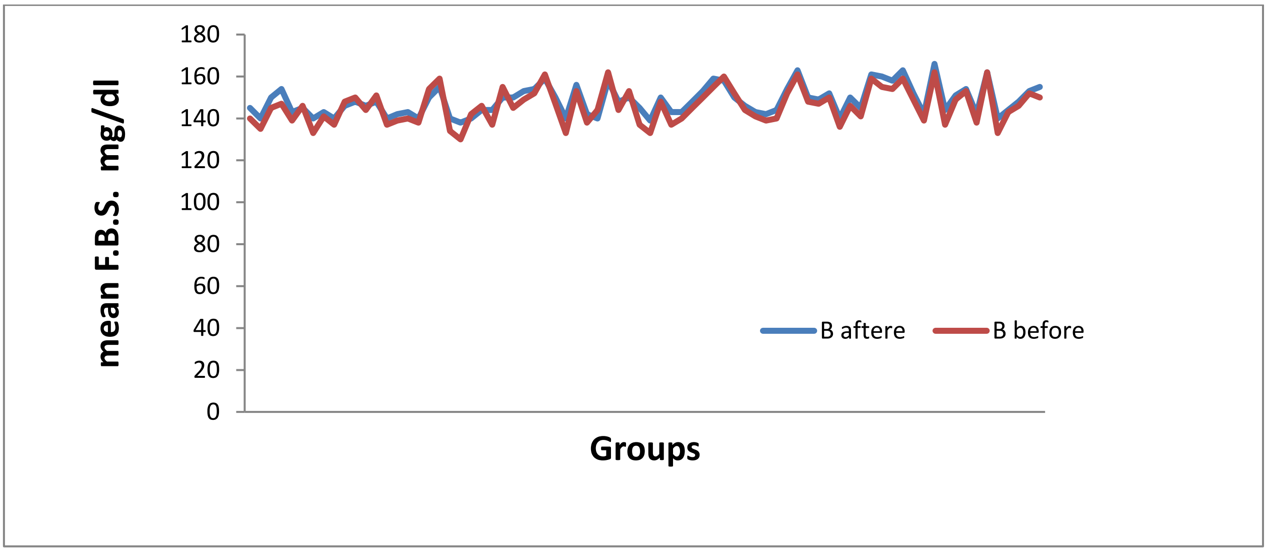

Fig. 2: Average FBG (mg/dl) to group B over time (tests after four months minus baseline tests).

In this study, adding either 5000 IU of D3 every day or a fake drug had no effect on FBG levels. These findings corroborate prior research that revealed no association between D3 administration and reduced fasting blood glucose [10-16]. Researchers (1994) included twenty type 2 diabetes participants in a placebo-controlled, double-blind study with daily D3 supplementation of 200 IU for four days. This investigation supported the conclusion that D3 administration no affects the FBG levels of type 2 diabetes. Researchers conducted randomized, placebo-controlled research, including 47 type 2 diabetics, taking 1000 IU of D3 daily over 48 weeks revealed no change in FBG levels [17]. Even at higher doses and serum concentrations, it was shown that D3 did not diminish FBG levels. Other researchers provided 40,000 IU of D3 weekly to 36 patients with type 2 diabetes in a randomized controlled experiment [18]. The fasting glucose levels did not alter considerably from the six-month initial readings. The difference between the FBG levels of the D3 and placebo groups was also not significant. This is in line with the results of a large 2012 trial where 100 people with type 2 diabetes were randomly assigned to receive 5000 IU of vitamin D per day for 12 weeks or a placebo [19]. Even at higher doses, D3 had no effect on fasting blood glucose levels, according to the study. This study demonstrates that taking D3 while fasting has no effect on blood glucose levels. A 2014 meta-analysis of 25 randomized controlled studies assessing the efficacy of D3 in adults without diabetes, pre-diabetes, and type 2 diabetes showed contradictory findings [20]. Following supplementation, there was no improvement in FBG levels among those with type 2 diabetes. Those with prediabetes, however, showed a significantly lower increase in FBG compared to those who were randomly assigned a placebo, Pittas and his colleagues gave D3 to 314 people with osteoporosis as part of a randomized, controlled experiment [21]. 92% of evaluated individuals had an abnormal FBG level. After 3 years, individuals who received D3 had a significantly lower rise in FBG than those who received a placebo (0.04 mg/dl versus 6.12 mg/dl). Similarly, other researchers showed that the treatment of D3 improved glucose tolerance in people with a deficiency and poor glucose tolerance [22].This study confirms prior findings that D3 treatment had no effect on the fasting glucose levels of people with type 2 diabetes. A review of the scientific literature shows that D3 may help stabilize FBG levels in people who are on the verge of getting diabetes.

3.2 Glycated haemoglobin (HbA1c)

Table 2 compares the variations in the individuals' average Glycated hemoglobin (tests after four months minus baseline tests) in groups A and B.

Table 2-Comparison of HbA1c (%) concentrations before and after four months.

Group S	Before four months (Tests)	After four months (Tests)	The change in the mean (The tests after four months minus baseline tests)	b-p-value
	Mean ±SD			
A	10.91±1.19	9.60±1.72	-0.41±1.08	0.025
B	9.80±1.29	10.29±1.39	0.49±1.18	0.01

The average HbA1c levels of the A group and B group were considerably different (F (2, 124) = 7.13, p = 0.001, eta squared = 0.103), even when the effect size was small. There was a statistically significant interaction between time and the two groups (F (2,125) = 122, p = 0.001). The results demonstrated that the pre-test averages of HbA1c did not differ significantly between the two groups. On the other hand, tests after 4 months of HbA1c readings for the two groups were significantly different (F (2, 125) = 4.158, p = 0.016). After four months, pairwise comparisons revealed that group A had significantly lower average HbA1c levels than group B (average change = -0.69 ng/ml, p = 0.009). (Table 3)

Table 3-Test comparison of HbA1 (%) between the two groups after four months.

Thet ime	The group	The group	The change in the mean	b-p-value
after four months -test	A	B	-0.69	0.009

Figures 3 and 4 depict the difference in average HbA1c between the four-month test and the four-month test for the two groups.

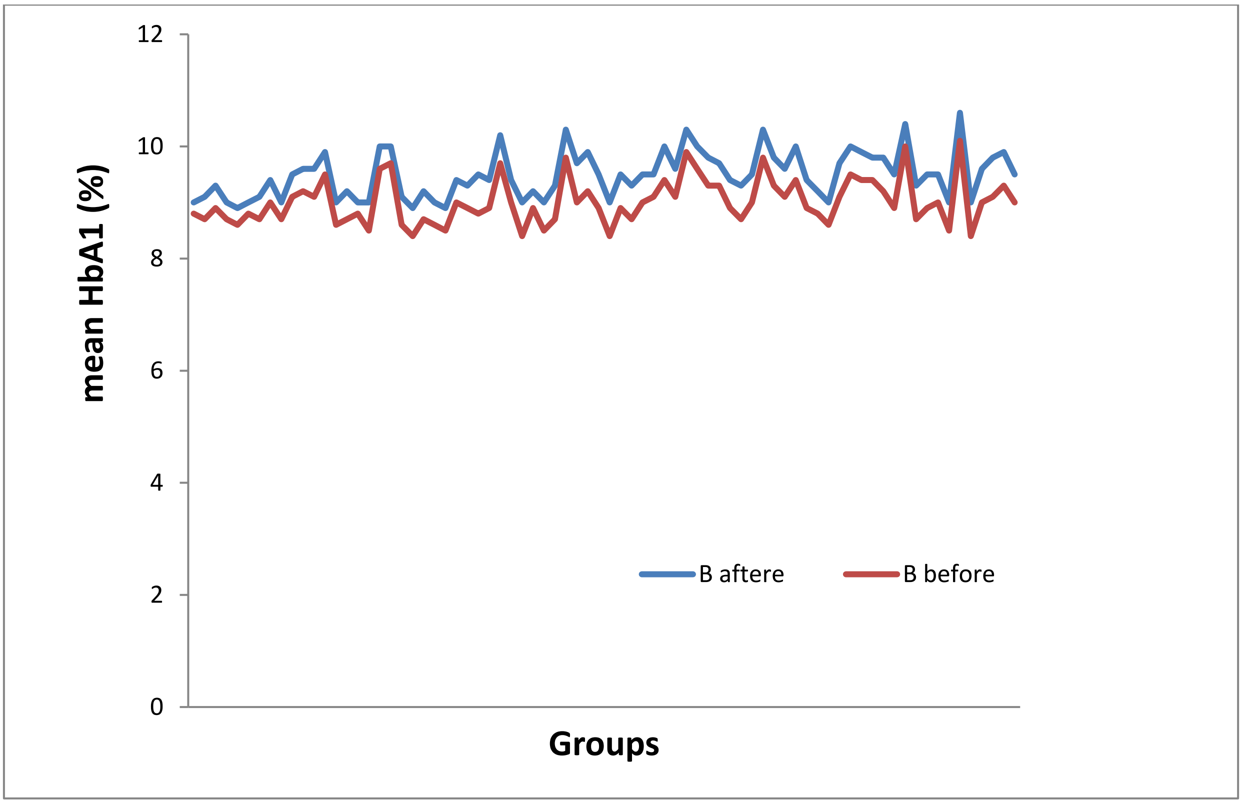

Fig. 3: Mean HbA1c (%) to group B over time (tests after four months minus baseline tests).

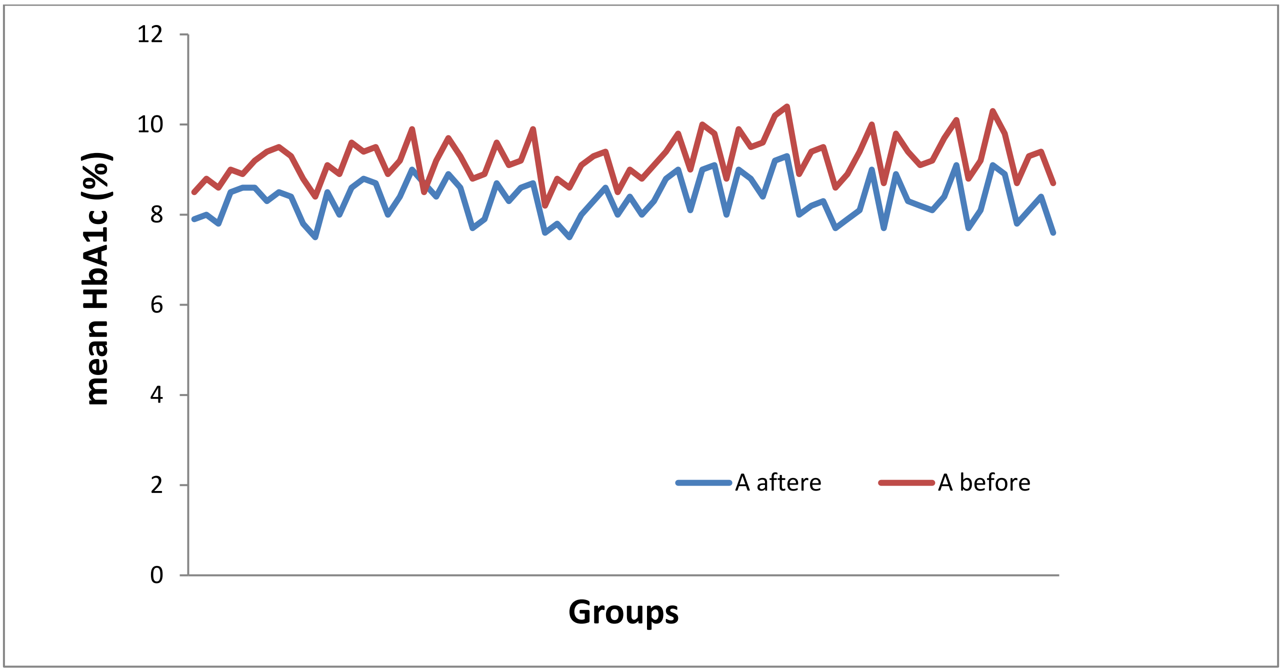

Fig. 4: Mean HbA1c (%) to group B over time (tests after four months minus baseline tests).

According to the findings of this study, vitamin D supplementation significantly reduced glycated hemoglobin levels; after 4 months of D3 treatment, 62 percent of patients had lower HbA1c levels than at the start. Among patients who received 5,000 IU of D3 daily, the proportion rose to 72%. On the other hand, after 16 weeks, HbA1c levels had gone up in 67% of patients who were given a placebo.T hese results align with those of others. cross-sectional studies that discovered an inverse association between vitamin D and HbA1c [23-28]. In 2012, a cross-sectional study of 158 people with type 2 diabetes and a lack of D3 showed that glycated hemoglobin went up when serum D3 levels went up [25]. Researchers in 2013 found that serum D3 level is negatively correlated with HbA1c in 715 individuals with diabetes type 2 and known serum D3 levels [26]. Sabherwal and colleagues studied 52 South Asians with type 2 diabetes and low D3 in a retrospective study. Researchers found that the drop in HbA1c paralleled the rise in D3 levels in the blood [24].

In the present literature, there are still disagreements over whether D3 supplementation improves HbA1c levels. There is a link between higher levels of D3 in the blood and lower levels of HbA1c in the Arab world and North Africa [13, 28-30]. In a controlled, randomized study done in 2014, the HbA1c levels of 722 Moroccan type 2 diabetics who took 2000 IU of D3 every day went down by 21% after three months [28]. Similarly, Nasri reported that treatment with 50,000 IU of D3 weekly for 3 months dramatically decreased HbA1c levels in sixty Iranian patients with type 2 diabetes [13]. According to a case study conducted in 2008 [23], after nine months, the HbA1c values of two type 2 diabetic women receiving 3000 IU daily and 2000 IU daily of vitamin D reduced dramatically by 13.5% and 9.0%, respectively. Contrarily, a number of large-scale interventional investigations [6, 11, 14, 31-35] have failed to identify a causal relationship between vitamin D and HbA1c. In a 2012 randomized controlled study, 42 type 2 diabetes patients in Iran who got a single intramuscular injection of 300,000 IU of D3 had unchanged HbA1c values [33]. The researcher concluded that the sample size was probably insufficient to find major improvements in this instance. Other researchers used sample sizes that were likely too small to suggest a significant effect of D3 therapy on glucose metabolism [10, 12, 18, 31, 35]. Additionally, in a 2010 pilot prospective randomized study, 24 type 2 diabetics with blood concentrations of D3 25 ng/ml were supplemented with 400 IU daily or 1200 IU daily of D3, which is significantly less than the 2,000 IU required for significant results [10]. Therefore, this discrepancy in the evidence may be attributable to the varied doses of supplements utilized, the sample size, and the racial composition of the study population. This study provides additional evidence that D3 supplementation has a significant impact on glycated hemoglobin levels in people with type 2 diabetes from the Arab world and North Africa. Benefits were observed when subjects with sample sizes ranging from 58 to 722 were given D3 supplements of at least 2,000 IU daily.

4. Conclusion

This research revealed no link between 5000 IU of vitamin D3 and glucose levels. However, a significant improvement in glycated hemoglobin was seen in the D3-supplemented group (p = 0.001). This suggests that D3 may play a helpful role in diabetes management and complication prevention, particularly in Arab World countries. More research with people using greater doses of D3 supplements to achieve blood concentrations between 40 and 60 ng/ml will assist in determining the role of D3 in the treatment of type 2 diabetes over the long run.

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