Electronic Journal of University of Aden for Basic and Applied Sciences
EJUA-BA Vol. 5 No. 4 (2024)
https://doi.org/10.47372/ejua-ba.2024.4.405
ISSN: 2708-0684

RESEARCH ARTICLE

SUPPLEMENTED VITAMIN D AND GLYCEMIC PARAMETERS IN DIABETIC PATIENTS

Dikrayat A. Ahmed[1,*], Samira A. Mahmood[1], Khaled Saeed Ali[2]

[1] *Dept. of Pharmacology and Toxicology, Faculty of Pharmacy, University of Aden, Yemen.*
[2] *Dept. of Pharmaceutical Chemistry, Faculty of Pharmacy, University of Aden, Yemen.*

***Corresponding author: Dikrayat A. Ahmed; E-mail: drphomodai2024@gmail.com**

Received: 28 November 2024 / Accepted: 04 December 2024 / Published online: 31 December 2024

Abstract

There is alarming increase in prevalence of type 2 diabetes mellitus worldwide. Although lifestyle modifications may delay the development of type 2 diabetes, maintaining long term behavioral changes is difficult. Therefore, new strategies to reduce the incidence of type 2 diabetes are needed for people with impaired glucose tolerance. This research aimed to study the effect of supplemented vitamin D on glycemic control in newly diagnosed patients with T2DM. An open-label, randomized, controlled clinical trial, was carried out in the period from May to November, 2023, on newly diagnosed T2DM patients who met the inclusion criteria treated with metformin and vitamin D (n=30) or metformin only as control group (n=20). attending Aden Diabetic Center at Al-Gamhouria General Modern Hospital, Aden. Data collected by using structured questionnaire including sex, age, family history of diabetes, height, weight, waist circumference, adherence to diet and exercise, smoking and khat chewing. glycemic parameters and serum vitamin D level were also measured. Descriptive statistics and Chi-square tests were used for data analysis with $P \leq 0.05$ considered significant. Vitamin D and control group showed almost the same mean age, 49.7±7.87 years and 49.6±8.94 years, respectively. Paired t-test was applied to compare the baseline mean of vitamin D level with the mean after three months of vitamin D supplementation within vitamin D group, there was a slight increase in vitamin D levels with statistically significance difference (P=0.000), while the control group showed statistically insignificance difference after 3 months from baseline (P= 0.104). After 3 months supplementation with vitamin D, there was statistically significant differences from the baseline for HBAIc , FBG and RBG within vitamin D group with P = 0.001, p=0.000 and p=0.000, respectively, where paired t-test was applied. There was a decrease in the percentage of patient with glycosylated hemoglobin category > 8.5% from (90% to 86%), after 3 months with no change in control group. In conclusion, glycemic parameters of newly diagnosed patients with type 2 diabetes mellitus were slightly improved after supplementation with vitamin D compared to the standard treatment. Further studies with larger samples are crucial to address the status of vitamin D among diabetes.

Keywords: Vitamin D, Type 2 Diabetes Mellitus, Glycated Hemoglobin, FBG.

1. Introduction

Type 2 diabetes mellitus is a serious and growing global public health problem with an important economic burden [1, 2]. It's a significant risk factor for cardiovascular disease and causes a variety of adverse complications. Globally, type 2 diabetes is enrolled as the ninth leading cause of mortality with more than 1 million deaths yearly and with an evaluated 462 million cases in 2017 [3].

Vitamin D deficiency is prevalent in several countries and has become a common public health problem worldwide due to sun protection measures, decreased of outdoor activities, increased obesity prevalence, and environmental pollution. Combined effects of vitamin D supplementation and exercise training on insulin resistance, a 3-month randomized controlled trial among 60 T2DM Chinese patients aged 40–65, newly diagnosed with T2DM, vitamin D intervention group received a dose of 1000 IU daily, demonstrated beneficial effects in

the prevention and treatment of T2DM by [4].The classical actions of vitamin D include regulation and promoting calcium and phosphorus absorption in the gut to ensure adequate serum concentrations and mineralization of bone. Among non-classical target tissues, the parathyroid glands, the neuromuscular and immune system, heart, vessels, cancer cells, and gastrointestinal tissues have been studied [5]. Several large studies have suggested a relationship between vitamin D deficiency and the prevalence of diabetes [6]. Hypovitaminosis D has been suggested to increase the risk of type 2 diabetes (T2DM) with an inverse relationship between vitamin D levels and the onset of diabetics [7]. Type 2 diabetic patients usually have vitamin deficiency but it is still unknown whether this is a coincidence or implicated in the development of diabetes.

Recent studies have suggested that a lack of vitamin D could play an important role in T2DM pathogenesis through altering several crucial processes in the development of diabetes and its complications namely: pancreatic insulin secretion, peripheral insulin resistance, down-regulation of the insulin receptor gene, systemic inflammation and immune activation [8]. T2DM and hypovitaminosis D risk factors in common are obesity, aging and low physical activity [9].

Administration of vitamin D restores glucose-stimulated insulin secretion and promotes β-cell survival by modulating the generation and effects of cytokines. Insulin secretion is also affected by calcium concentration and flux through the β-cells. Vitamin D regulates the function of calbindin, a systolic calcium-binding protein found in pancreatic β-cells, and acts as a modulator of depolarization stimulated insulin secretion by arrangement of intracellular calcium [10]. One of the potential mechanisms associated with vitamin D and diabetes include improving insulin action by stimulating expression of the insulin receptor, enhancing insulin responsiveness for glucose transport, having an indirect effect on insulin action potentially via a calcium effect on insulin secretion, and improving systemic inflammation by a direct effect on cytokines. Insufficient vitamin D appears to hinder glycemic control and its involvement may be necessary to optimize glucose metabolism [11]. Therefore, the aim of the study was to examine the effect of administration of vitamin D to newly diagnosed type 2 diabetic patients on glycemic parameters.

2. Methods

Study design and period

The present study was an open-label, randomized, controlled clinical trial, and carried out in the period from May to November, 2023.

Drugs

Cholecalciferol (Vitamin D3) 1000 IU (25ug), (ultra Vitamin D ®, VITABIOTICS Company-BRITISH PHARMACOPOEIA QUALITY) was used. The treating endocrinologists prescribed the anti-diabetic agent metformin as initial treatment to the participants.

Study area

The study carried out in Aden Diabetic Center at Al-Gamhouria General Modern Hospital, Aden.

Study population

The target population were newly diagnosed T2DM patients who met the inclusion criteria.

Inclusion criteria

Newly diagnosed T2DM patients aged 30 – 65 years (as by Ahmed et al.2020) and accepted to participate in this study

Exclusion criteria

Patients with type 1 diabetes mellitus, patients requiring insulin for acute diabetic control, patients taking drugs that alter vitamin D level such as antipsychotics (carbamazepine, sodium valproate, gabapentin), anticonvulsants (barbiturates, phenytoin) isoniazid, corticosteroids, and calcitonin, pregnant or lactating women, patients with autoimmune disease, hepatic disease, kidney disease, convulsive disorders, cardiovascular disease were excluded.

Sample size and sampling

A sample-size of 61 was decided based on data which reveals that at least 24 newly diagnosed of Type II diabetics were presented every month in the year 2022. Hence, there would be 72 subjects during the three-month study period. The study sample was selected using simple random sampling method and calculated using the equation developed by Steven K. Thompson method [12]:

$$\text{n} = \frac{N \times p(1-p)}{[(N-1 \times (d^2 \div z^2)] + p(1-p)}$$

N: population study =72

Z: score corresponding to the level indication (0.95) and equal (1.96)

d: Standard Error equal (0.05)

P: Property availability and neutral and equal (0.50)

$$\text{n} = \frac{72 \times 0.5(1-0.5)}{[(72-1 \times (0.05^2 \div 1.96^2)] + 0.5(1-0.5)}$$

$$\text{n} = \frac{18}{[(71 \times (0.0025 \div 3.8416)] + 0.25} = 60.768$$

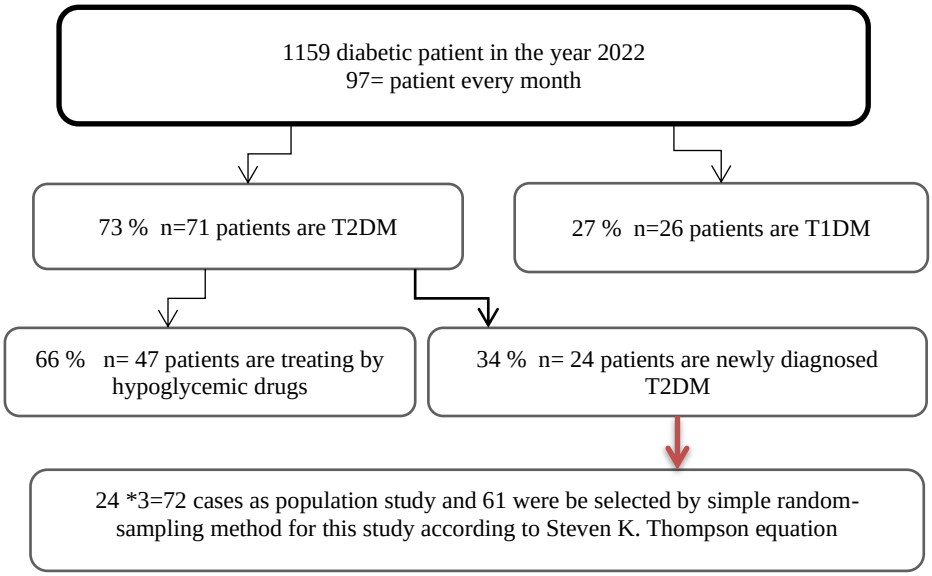

Fig. 1: Sample size determination

Procedure

All patients interviewed by the researcher after obtained the written informed consent. Data collected by using structured questionnaire including sex, age, family history of diabetes, height, weight, waist circumference, adherence to diet and exercise, smoking and khat chewing. The source of the information was the patient him/herself. Venous blood was drawn with a sterile 10 ml needle and immediately transfer into a plain tube for the measurements at baseline and after three-months, the same measurements were done. The participants were divided into two groups. The first group (31 patients) was the interventional group that received vitamin D supplement 1000 IU of vitamin D3 daily [4] to the standard treatment (metformin 500mg once a day) and the second group was the control group (30 patients) that received the standard treatment only. Patients were instructed to take the medication on time daily and to contact the researcher if he/she planned to add medications for any reason. The researcher followed the patients through telephone calling up every two weeks.

Investigation

The drawn blood were divided into two parts. 2ml of collected blood was put in a tube containing EDTA for glucose measurement at room temperature (25°C). Serum separation was achieved by centrifugation at 3000 rpm for 5 minutes using a Centrifuge 800 device (China). The remaining serum aliquots were transferred to clear, dry Plain tubes and immediately stored at -20°C for subsequent analysis of serum vitamin D levels, measured on Cobas e 411. [13]

Statistical analysis

Data were entered the Statistical Package for Social Sciences (SPSS) software version 25 (IBM Corp, Armonk, NY, USA) for processing and analysis. Descriptive statistics was calculated by using mean and standard deviation for quantitative variables such as age, HbA1c, FBG, RBG, and vitamin D, while frequencies and percentages were used for qualitative variables, including sex, smoking, FH of diabetes, adherence to diet and exercise and vitamin D categories. Independent t-test was used to compare between two groups and paired T-test for within group. Association between two groups was made using the Chi-square. P value ≤ 0.05 was considered statistically significant. p value ≤ 0.05 was taken as significant.

Ethical consideration

Ethical approval was granted by the Research Ethics Committee of the Faculty of Medicine and Health Sciences University of Aden, REC-159 -2023.The interview with participants and drawing of blood conducted only after obtaining the written informed consent from each participant. For ethical purposes, every participant in the study was given sufficient information about the study objectives, the content of the questionnaire as well as the confidentiality of the information and the data used for research purpose only.

3. Results

The total number of the participants in this study was 61divided into 31 for vitamin D group and 30 for control group but during the study period there were 11 patients (7 females and 4 males) of both groups were declined to participate, some for medical problems. Therefore, the current study was carried out on 50 patients with T2DM at Aden Diabetic Center at Al-Gamhoria Modern General Hospital, Aden. They were newly diagnosed and randomized to be treated with metformin and vitamin D (n=30) or metformin only as control group (n=20). The

vitamin D group constituted of 40% male patients and 60% females, while the control group constituted of 45% males and 55% females.

Both groups showed almost the same mean age, 49.7±7.87 years and 49.6±8.94 years for vitamin D and the control, respectively. Related to the age group, the study shows 46.7% of the patients in vitamin D group and 45% in the control group were in the age group 50-60 years, table 1.

Table 1: Distribution of the study sample by Sex, Age, and Age group.

Social demographical variables	Vitamin D group n=30 No. (%)	Control group n=20 No.(%)	p
Sex			
male	12 (40.0)	9 (45.0)	0.726
female	18 (60.0)	11(55.0)	
Age Mean ± SD	49.7±7.879	49.6±8.941	0.000
Age (year)			
30-40	6 (20.0)	4 (20.0)	0.993
>40-50	9 (30.0)	6 (30.0)	
>50-60	14 (46.7)	9 (45.0)	
>60	1 (3.3)	1 (5.0)	

Note: Percentage according to the column. Statistical test is Chi-square test.

Table 2 shows the social habits and family history of the studied type 2 diabetic patients. The study found that 83.3% and 85% were nonsmokers in vitamin D and control group, respectively. Also, 63.3% and 65.0% of T2DM patients of vitamin D and control group were non-khat chewers, respectively. Concerning family history 66.7% of patients within vitamin D group and 60.0% of control group had family history of T2DM. There was no adherence to exercise and diet in both groups.

Table 2: Distribution of the study sample by social habits and family history of type 2 diabetes.

Social habit	Vitamin D group n=30 No.(%)	Control group n=20 No.(%)	p
Smoking			
Yes	5(16.7)	3(15.0)	0.875
No	25(83.3)	17(85.0)	
khat chewing			
Yes	11(36.7)	7(35.0)	0.904
No	19(63.3)	13(65.0)	
Family history			
Yes	20(66.7)	12(60.0)	0.630
No	10 (33.3)	8(40.0)	
Adherence to exercise			
Yes	1(3.3)	1(5.0)	0.768
No	29(96.7)	19(95.0)	
Adherence to diet			
Yes	2(6.7)	0(0.00)	0.239
No	28(93.3)	20(100.0)	

Note: Percentage was calculated from the column. Statistical test is Chi-square test.

Most of the patients (63.3%) in vitamin D group were in the overweight category (high BMI), while patients in the control group showed obesity (high BMI), by 50%. The study finding revealed that male waist circumference in vitamin D group and control group were <120 cm by 36.7% and 35% respectively, while female waist circumference in vitamin D and control group was ≥ 88 cm by 50%, 40% respectively, Table 3. The differences were statistically insignificant.

Table 3: Anthropometric measurement of the studied type 2 diabetic patients in vitamin D group and control group.

Anthropometric measurement	Vitamin D group n=30 No. (%)	Control group n=20 No. (%)	p
Body mass index			
Normal weight 18.5-24.9 kg/m2	3(10.0)	3(15.0)	0.141
Overweight 25-29.9 kg/m2	19(63.3)	7(35.0)	
Obese ≥ 30 kg/m2	8(26.7)	10(50.0)	
Waist male circumference			
< 120 cm	11(36.7)	7(35.0)	0.622
≥ 120 cm	1(3.3)	2(10.0)	
waist female circumference			
< 88 cm	3(10.0)	3(15.0)	0.747
≥ 88 cm	15(50.0)	8(40.0)	

Note: Percentage was calculated from the column. Statistical test is Chi-square test.; P

Table 4: Distribution of study sample by vitamin D mean ± SD and groups.

Vitamin D category	Vitamin D group n=30			Control group n=20		p	P*
	Baseline NO %	after 3 months NO %	P	Baseline NO %	after 3 months NO %		
Vitamin D (mean ± SD)	13.82±3.518	14.93±3.919	0.000	14.25±3.522	14.05±3.486	0.104	0.422
Deficiency (< 20ng/ml)	29(96.7%)	27(90.0%)	0.000	18 (90.0)	18 (90.0)	0.000	1.000
Insufficient (20 –29ng/ml)	1(3.3%)	3(10.0%)		2 (10.0)	2 (10.0)		
Sufficient (≥ 30ng/ml)	0 (0.00)	0 (0.00)		0 (0.00)	0 (0.0)		

Note: Percentage according to the column.
*P**=*p* value after 3 months between both groups.
P=*p* value between baseline and after 3 months within groups.

Table 5: Distribution of the glycemic categories within groups.

Glycemic category	Vitamin D group n=30			Control group n=20		
	Baseline n %	after 3 months n %	P	Baseline n %	after 3 months n %	P
HBA1c category > 8.5 % 7 - 8.5 %	 27 (90.0) 3 (10.0)	 26 (86.7) 4 (13.3)	1.000	 18 (90.0) 2 (10.0)	 18(90.0) 2 (10.0)	0.722
RBG category ≥ 200 < 200	 24 (80.0) 6 (20.0)	 18 (60.0) 12 (40.0)	1.000	 16 (80.0) 4 (20.0)	 16 (80.0) 4 (20.0)	0.137
FBG category ≥ 126 < 126	 29 (96.7) 1 (3.3)	 23 (76.7) 7 (23.3)	0.331	 18 (90.0) 2 (10.0)	 17 (85.0) 3 (15.0)	0.470

Note: Percentage according to the column. Statistical test is Chi-square test.

We applied paired t-test to compare the baseline mean of vitamin D level with the mean after three months of supplementation with vitamin D within vitamin D group, there was a slight increase in vitamin D levels statistically with significance difference (*P*=0.000), while the control group showed statistically insignificance difference after 3 months from baseline (*P*= 0.104). Also there was statistically insignificance difference when we compare the mean after 3 months of both groups (*P*= 0.422) by using independent t-test. We applied Chi-square test for within groups, and showed that baseline vitamin D deficiency was present in vitamin D group (96.6%) and in the control group (90%) that slightly significant changed after three months supplementation within vitamin D group, *P*= 0.000, while there was no change in control group, *P* > 0.05. Two patients within deficiency category of vitamin D group were improved into insufficient category. On the other hand, there was no change within the control group. The difference between the test and control after three months was insignificant, *P*=1.000.

After 3 months of supplementation, there was a decrease in the percentage of patient with glycosylated hemoglobin category > 8.5% from (90% to 86%). While there is was no change in control group. There was no statistically difference between them. Likewise, there was clear improvement in the number of patients with RBG category < 200 mg/dl from 20% at baseline to 40% after three months supplementation compared to control group in the same category. There was a clear raise in FBG category < 126 md/dl after three month supplementation from 3.3% to 23.3% as compared to the control group. There were no statistically difference between all of them., Table5.

Table 6 compares the values of glycemic parameters before and after vitamin D application. After 3 months supplementation with vitamin D, there was statistically significant differences from the baseline for HBAIc, FBG and RBG within vitamin D group with *P* = 0.001, p=0.000 and p=0.000, respectively, where paired t-test was applied. Surprisingly we found also statistically difference within control group for the same parameters *p* < (0.05), but there was a difference in the significant levels. Comparing between both groups after three months, where we applied independent t-test, the result showed statistically significant differences between vitamin D and control group in terms of HBAIc, FBG, and PPBS with *p*=0.000.

Table 6: Comparison of mean and standard deviations of glycemic parameters at baseline and after 3 months within and between vitamin D group and control group.

Parameters	Vitamin d group N=30 (mean ± SD)	Control group N=20 (mean ± SD)	P value
HBA1c % Baseline After 3 months	10.37±1.608 10.07±1.552 P*= 0.001	10.65±1.348 10.25±1.482 P*= 0.002	0.000
FBG mg/dl Baseline After 3 months	186.40±46.223 169.33±44.721 P*= 0.000	182.75±46.187 176.95±45.926 p*= 0.001	0.000
RBG Baseline After 3 months	228.37±46.794 211.87±45.255 P*= 0.000	227.50±41.023 218.25±39.111 P*= 0.000	0.000

P*=p-value among the patient within the group (column); Paired t-test
P= p- value between the groups after three months (row); Independent t-test.

4. Discussion

In the present study, the effect of supplemented 1000 IU vitamin D (Cholecalceferol) in newly diagnosed patients with T2DM attending ADC at Al-Gamhoria Modern General Hospital was evaluated. The treating endocrinologist prescribed 1000 mg metformin for the newly diagnosed patients, then they were randomly divided into patients received vitamin D, assigned as vitamin D group, and those were only on the prescribed metformin as control group. The study result found a slight significant increase in serum vitamin D levels in the interventional group after three months compared to the control group. This result is in line with [14,15,16], that reported a significant increase in vitamin D levels after intervention in experimental group compared to that of control group, but disagrees with [17]. Vitamin D supplementation (200-600 IU/d) was insufficient to achieve optimal vitamin D levels (>90 nmol/l), but oral vitamin D intake have to be at least 800-1000 IU/d (20–25 µg) to achieve an adequate serum vitamin D level, and a reduction in FBG could be achieved when vitamin D intake was 4000 IU/d [15]. In this context, 1000 IU/d vitamin D used in this study was low but seemed to be sufficient because slight improvement in glycemic parameters had occurred. A case control study had used 2000 IU/d vitamin D and concluded an increase in insulin secretion that improved glucose metabolism [18]. Holick stated that blood levels of vitamin could be raised by 10 ng/ml if healthy persons received 1000 IU vitamin D /d [19].

The slightly increased vitamin D level shown in the current study was associated with significant changes in glycemic parameters (HbA1c, FBG, PPBG) after three months and as compared to the control group. This result is in line with [15,20,21,22].

The study enrolled diabetic patients newly diagnosed of both sexes with females were more than males in both groups. This finding agrees with Ahmed et al. from Qatar who noted that diabetic females were more than diabetic males and vitamin D was lower in diabetic female patients [7]. In the current study, the ratio of males to females was almost equivalent. In addition, the majority of participants in both groups (vitamin D and control) found to be in the same age group 50-60 years. Taken theses together, these equal ratios between women and men as well as age group indicate that the two groups might be free of contradictory factors, which may have an impact on the strength of the results.

It is worth to mention that the mean age of vitamin D group was (49.7±7.87years) and that for control group was (49.6±8.941years). This unexpected similarity in the mean ages supports the sex ratio, which may made this study as a match-designed study. This result is almost in line with the study of [6] who found likeness between the mean age of diabetic patients (47.6±9.5years) for interventional group and (48.5±11.8 years) for control group.

Regarding patients' habits, the study revealed that the majority of participants of both groups were non-smokers and non-khat chewers. This finding is in consistent with [8], but is not in line with [23] who found more diabetic smokers compared to the non-diabetics and demonstrated that smoking is a risk factor for diabetics. So, our result did not support this finding. Furthermore, there are association between khat chewing and diabetes development, but not with glycemic control; and the Khat chewers had more risk of developing T2DM than non-chewers [24]. A high proportion of study patients did not adhere to diet and did not exercise. Our finding is in line with other study observed that unhealthy diet represent a possible cause for diabetes, there is a highly significant difference between the diabetic and non-diabetic groups in the consumption of fortified food [23].

The study exposed two third of the patients in both groups had family history. This result is in agreement with other study that reported family history of diabetes represents a predictor of the disease and they supported the promotion of a family history tool for diabetes prevention and early detection strategies as a valuable measure of diabetes risk [25].

It is not surprising that the baseline serum vitamin D values of newly diagnosed T2DM patients were low in the category of deficiency in vitamin D group and control group. Several studies reported an inverse correlation between low levels of serum vitamin D and pathogenesis of T2DM exists. There was expected small effect of vitamin D and would be most noticeable among patients with early diabetes not requiring pharmacotherapy and daily administration of vitamin D3 did not improve

HbA1c [26]. Therefore, our finding is in consistence with the implication of vitamin D in diabetes progression.

Although the study showed increase in vitamin D level after three months intake, but it did not reach the optimal recommended level, which may be due to short intake period or low vitamin dose. Another reason might be the lower baseline level of the participants that may affect the outcome as has been discussed in meta-analysis [20]. Nevertheless, one participant in vitamin D group improved from the insufficient level to the optimal sufficient vitamin level; there was no change in the control group. It is worth to mention, that metformin treatment induced slight significant improvement in glycemic parameters for the control group, but with a less significant power than vitamin group.

It has been debated that the increase in vitamin D level did not show progress of glycemic control to optimal or prevent incident type 2 DM. Therefore, clinical trials with sufficient sample size, study periods, and optimal doses of vitamin D supplementation are still needed. Nakashima et al. suggested that the relation between vitamin D concentrations and type 2 DM is not causal [27]. The lack of benefit may be because of low numbers of participants and short duration (maximum 3 months) of intervention [22]. In almost similar scenario to that study, the present study contain small sample size but there was improvement from the category to another in terms of FBG, RBG and HbA1c levels after three months supplementation with vitamin D compared to no improvement in control group.

In conclusion, glycemic parameters of newly diagnosed patients with type 2 diabetes mellitus were slightly improved after supplementation with vitamin D compared to the standard treatment. Adherence to diet and exercise are crucial for obtaining proper glycemic control.

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مقالة بحثية

مكملات فيتامين د ومؤشرات نسبة السكر في الدم لدى مرضى السكري

ذكريات علي احمد[1،*]، سميرة عبدالله محمود[1]، و خالد سعيد علي[2]

[1] قسم علم الأدوية والسموم، كلية الصيدلة، جامعة عدن، اليمن.
[2] قسم الكيمياء الصيدلانية، كلية الصيدلة، جامعة عدن، اليمن.

* الباحث الممثّل: ذكريات علي احمد؛ البريد الالكتروني: drphomodai2024@gmail.com

استلم في: 28 نوفمبر 2024 / قبل في: 04 ديسمبر 2024 / نشر في 31 ديسمبر 2024

المُلخّص

هناك زيادة مثيرة للقلق في انتشار مرض السكري من النوع الثاني في جميع انحاء العالم. على الرغم من ان تعديلات نمط الحياة قد تؤخر تطور مرض السكري من النوع 2، إلا أن الحفاظ على التغييرات السلوكية على المدى الطويل أمر صعب، ولذلك هناك حاجة إلى استراتيجيات جديدة للحد من الإصابة بمرض السكري من النوع 2 للأشخاص الذين يعانون من ضعف تحمل الجلوكوز. يهدف هذا البحث إلى دراسة تأثير مكملات فيتامين د على التحكم في نسبة السكر في الدم لدى المرضى الذين تم تشخيصهم حديثاً بمرض السكري من النوع 2. تم إجراء تجربة سريرية مفتوحة، عشوائية، خاضعة للرقابة، في الفترة من مايو إلى نوفمبر 2023 على مرض السكري من النوع الثاني الذين تم تشخيصهم حديثاً والذين استوفوا معايير الاشتمال الذين تم علاجهم بالميتفورمين وفيتامين د (العدد = 30) أو الميتفورمين فقط كمجموعة تحكم (العدد= 20) الحضور لمركز عدن للسكري في مستشفى الجمهورية العام الحديث، عدن. تم جمع البيانات باستخدام استبانة منظمة تشمل الجنس والعمر والتاريخ العائلي لمرض السكري والطول والوزن ومحيط الخصر والالتزام بالنظام الغذائي وممارسة الرياضة والتدخين ومضغ القات. كما تم قياس مؤشرات نسبة السكر في الدم ومستوى فيتامين د في الدم. تم استخدام الاحصاء الوصفي واختبارات مربع كاي لتحليل البيانات مع اعتبار $P\leq0.05$ معنويا. أظهرت كلا المجموعتين نفس متوسط العمر تقريباً، 49.7±7.87 سنة و 49.6±8.94 سنة لمجموعة فيتامين د ومجموعة التحكم على التوالي. طبقنا اختبار t المقترن لمقارنة المتوسط الأساسي لمستوى فيتامين د مع المتوسط بعد ثلاثة أشهر من تناول مكملات فيتامين د ضمن مجموعة فيتامين د، كان هناك فرق ذو دلالة إحصائية (p=0.000)، في حين أظهرت المجموعة الضابطة فرقاً ذو دلالة إحصائية بعد 3 أشهر من خط الاساس (p=0.104). بعد 3 أشهر من التكميل بفيتامين د، كانت هناك فروق ذات دلالة إحصائية عن القيمة الأساسية ل HBAIc و FBG و RBG ضمن مجموعة فيتامين د مع P=0.001 و p=0.000 و p=0.000، على التوالي، حيث تم تطبيق اختبار t المزدوج. وبعد 3 أشهر من تناول المكملات لوحظ انخفاض نسبة المرضى من فئة السكر التراكمي <% 8.5 من (90% إلى 86%)، في حين لم يكن هناك أي تغيير في المجموعة الضابطة. ولم يكن هناك فرق احصائي بينهما. في الختام تم تحسين معايير نسبة السكر في الدم لدى المرضى الذين تم تشخيصهم حديثاً بمرض السكري من النوع 2 بشكل طفيف بعد إضافة فيتامين د إلى العلاج القياسي.

الكلمات المفتاحية: فيتامين د، داء السكري من النوع 2، الهيموجلوبين السكري، سكر الدم للصائم.

How to cite this article:

D. A. Ahmed, S. A. Mahmood, K. S. Ali, "SUPPLEMENTED VITAMIN D AND GLYCEMIC PARAMETERS IN DIABETIC PATIENTS", *Electron. J. Univ. Aden Basic Appl. Sci.*, vol. 5, no. 4, pp. 477-485, December. 2024. DOI: https://doi.org/10.47372/ejua-ba.2024.4.405