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Prevalence of Vitamin D Deficiency among Type II Diabetic Patients in Shahat, Libya

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Abstract: Vitamin D deficiency is one of the most increasingly diagnosed comorbidities in patients with type II diabetes mellitus (TIIDM), suggesting that it may play a role in TIIDM. The present study aims to determine and evaluate Libyan adults' vitamin D (Vit D) status with and without TIIDM. 100 Libyan adults with TIIDM from the Diabetic Clinics and 100 healthy without TIIDM were included in the study. The mean age for the TIIDM subjects was 25.8 ± 15.4 years versus 35.9 ± 4.2 years for the healthy controls. Serum 25 hydroxy cholceferiol (vitamin D), calcium, cholesterol, blood glucose, high-density lipoprotein (HDL), and triglycerides were measured and the outcomes were compared between the TIIDM and control groups. Both the TIIDM and healthy agencies had diet Vit D deficiency. The suggested ranges of Vit D had been appreciably decreased in the TIIDM adults compared to the controls (29.1±1.6 nmol/L versus 36.4±1.9 nmol/L). In the TIIDM adults, 66.7% had mild, 30.7% moderate, and 3.3% severe Vit D deficiency, in contrast with 43.7% (mild), 33.5% (moderate), and 6% (severe) in the control group. Overall, 100% of the TIIDM adults and 75% of the healthy adults were Vit D deficient. In this study, compared to the healthy groups with TIIDM, the prevalence of vitamin D deficiency among TIIDM adults used to be quite high. Therefore, screening for vitamin D deficiency and supplementation for this population is warranted.

Keywords: Vitamin D, Vitamin D Deficiency, Type II Diabetes Mellitus, Shahat, Libya.

INTRODUCTION

Type II Diabetes Mellitus (TIIDM) has become a significant world health-care issue related to serious multi-pathological factors (Roglic et al., 2005). There is evidence suggesting that vitamin D is regarded essential in calcium homoeostasis, skeletal health, and diabetes mellitus (DM) (Christakos et al., 1979; Riste et al., 2001). Several types of research show that low vitamin D popularity is linked with the development of insulin resistance in adults (Norman et al., 1980; Zipitis & Akobeng, 2008). A study found that supplementation of vitamin D for 16 weeks expands the pancreatic β-cell characteristic in adult diabetic patients (Roglic et al., 2005). Vitamin D is mainly produced in the skin under exposure to ultraviolet irradiation from the sun.

Moreover, ingestion of meals (e.g., fish, margarine, or milk) and vitamin D dietary supplements enhance vitamin D levels (Christakos et al., 1979). Adults who rely on sunlight for most of their vitamin D necessi-

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ties are susceptible to deficiency due to the variability of factors that reduce the cutaneous production of vitamin D, such as ageing (Giovannucci et al., 2006; Wang et al., 2008). Vitamin D can affect multiple organs (pleiotropic actions) and cause metabolic syndrome, cardiovascular diseases, diabetes, and weight problems (Boucher, 1998; Pittas et al., 2017). Obesity is a risk issue for many physiological disorders, including TIIDM, cardiovascular diseases, and osteoarthritis (Holick, 2006). Recently, obesity and weight problems are associated with low vitamin D status (Bandeira et al., 2006). There is evidence that vitamin D influences body fat mass by inhibiting adipogenic transcription elements and lipid accumulation through adipocyte differentiation. Therefore, vitamin D might also enhance the regular metabolic functioning of adipose tissue (Pittas et al., 2017).

Furthermore, previous reviews suggest that a low level of vitamin D may contribute to the deterioration of TIIDM (Mishal, 2001). Therefore, the present study was conducted to check the prevalence of vitamin D deficiency in non-diabetic and type II diabetic patients at Shahat Medical and Beauty Center. The relationship between glucose tolerance indicators and vitamin D was assessed (hemoglobin A1c and fasting blood glucose).

MATERIALS AND METHODS

The study sample included Libyan subjects who had been diagnosed with TIIDM. One hundred issues with TIIDM (more than five months' duration) and 100 healthy controls were randomly and cross-sectionally selected. Written informed consent was taken from each subject before inclusion. They were asked to complete a generalized questionnaire that included previous and present medical history and to visit for blood withdrawal after fasting for more than 7 to 8 hours. At the screening visit, blood samples were examined for levels of glucose and cholesterol. Subjects who had abnormal glucose and cholesterol levels (> 140 mg/dL and > 200 mg/dL respectively) at chemical laboratory tests were excluded.

Blood collection: Fasting blood samples were collected and transferred straight to a non-heparinized tube for centrifugation. The collected serum was then transferred to prelabelled plain tubes and was stored on ice.

Sample analyses: Fasting glucose, lipid profile, calcium, and phosphorous were measured using a BS3000M Semi-Auto Biochemistry Analyzer (Sinnowa, China). Serum Vit D was measured using ichroma™ II device, an automatic or semiautomatic in-vitro diagnostic device that measures the concentration of analytes for 25(OH)D.

Data analysis: The data were analyzed using the Statistical Package for the Social Sciences, version 16.0 (SPSS, Chicago, IL, USA). Normal continuous variables were introduced as mean ± standard deviation. The student's t-test of ($P < 0.05$) was considered significant.

RESULTS

We assessed clinical and laboratory findings in 100 Libyan adults with TIIDM. The mean age for the TIIDM subjects was 25.8 ± 15.4 years versus 35.9 ± 4.2 years for the healthy controls. The characteristics of the entire group by DM status and vitamin D levels are shown in Table (1). TIIDM adults had significantly higher fasting glucose concentrations and HDL cholesterol ($p = 0.002$) than healthy adults. Calcium levels confirmed statistically significant differences between TIIDM and non-diabetic subjects ($p = 0.01$), although all subjects had calcium levels within the normal range. Calcium levels were 2.9 ± 0.38 mmol/L in healthy controls and 2.5 ± 0.33 mmol/L in the TIIDM adults. The classification of level of 25(OH) D is above 49 nmol/L (19 ng/mL) as normal, 25–49 nmol/L (10–20 ng/mL) as a mild deficiency, 12.5–27 nmol/L

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(5–13 ng/mL) as moderate, and < 13.5 nmol/L (< 4 ng/mL) extreme deficiency (Mishal, 2001). According to this classification, each group had vitamin D deficiency and the vitamin D levels were considerably decreased among TIIDM cases, compared with healthy adults (p = 0.03). The mean of 25(OH)D levels had been 36.4 ± 1.9 nmol/L in the normal controls and 29.1 ± 1.6 nmol/L in the TIIDM group (p = 0.03). Overall, 100% of the TIIDM and 75% of the healthy adults were vitamin D deficient. Daily consumption of vitamin D-rich foods was focused on such as milk and fish. TIIDM patients consumed significantly fewer amounts of fish than healthy patients. At the same time, the typical daily consumption of 3–4 glasses/day of milk was much less in the TIIDM topics than the healthy adults.

Table (1): The characteristics of vitamin D levels in type II diabetic patients and healthy control subjects.

Variables	Controls N= 100	TIIDM N= 100	*P*. value
Gender (M/F)	65/35	45/55	0.71
Age	35.9 ± 4.2	25.8 ±15.4	<0.001
Glucose (mmol/L)	6.2 ±0.63	12.8 ± 7.7	<0.001
Cholesterol (mmol/L)	3.8 ± 1. 0	0 .40 ± 1.1	0.78
HDL (mmol/L)	0.80 ±0.34	1.2 ± 0.42	0.002
LDL (mmol/L)	3.5± 0.95	3.7 ± 0.91	0.81
Triglyceride (mmol/L)	1.5 ± 0.74	1.4 ± 0.86	0.97
Vitamin D (nmol/L)	36.4±1.9	29.1±1.6	0.03
Vitamin D deficiency (%)			
< 12.5 nmol/L	4 (6)	2 (3.3)	
25.0–12.5 nmol/L	20 (33.5)	18 (30.7)	
50–25 nmol/L	27 (43.7)	40 (66.7)	0.19
Calcium (mmol/L)	2.9 ± 0.38	2.5 ± 0.33	0.01
Fish (g/week)	724.9 ± 163.7	150 ± 52.9	< 0.001
Egg yolk	220.5 ± 139.2	300 ± 202.2	0.13
Milk (0 glasses/day)	25 (41.4)	31(52.3)	0.16
Milk (1–2 glasses/day)	22 (33.6)	27 (43.7)	
Milk (3–4 glasses/day)	10 (16.0)	5 (7.0)	

DISCUSSION

To the best of the researchers' knowledge, no studies are primarily based on populations examining the association between vitamin D and TIIDM in Libyan adults. All the participants in the present study with TIIDM had vitamin D deficiency, revealing that the deficiency was once significantly higher in TIIDM adults (100%) compared to the non-diabetic subjects (75%). A considerable difference in the mean value of vitamin D between the TIIDM and healthy adults was found (p = 0.03). Although vitamin D deficiency was common in each group, it was much greater among diabetic adults. Moreover, many clinical trials confirm an increasing loss of glycemic control over time as type II diabetes progresses, which manifests clinically through deterioration in A1C levels and requires more aggressive treatment. Further comparison and explanations of the study findings were limited due to the cross-sectional design of the survey (Cantorna et al., 2004). One of the findings indicated that vitamin D deficiency is more common in patients with diabetes, who are almost twice more likely to have the deficiency (57%), in contrast to the average population (32%) (Ogunkolade et al., 2006). This should have consequences beyond glycemic control because low vitamin D levels are related to many other health risks, including bone disease, cancer, cognitive impairment, and death from cardiovascular disorders (Boucher,

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1998; Pittas et al., 2017). These outcomes help other research, demonstrating that vitamin D deficiency will increase the risk of TIIDM (Wortsman et al., 2000). The incidence of vitamin D deficiency was more significant in our cohort (100%) than in previously published Western researches (Boucher, 1998; Ogunkolade et al., 2006) analyzing subjects with TIIDM. The prevalence of vitamin D deficiency was 60.5% in a Swiss study (Bandeira et al., 2006), 43% in an Australian study (Ogunkolade et al., 2006), about 25% in an Italian study (Deluca & Cantorna, 2001), and 15% in a North American study (Boucher, 1998). In Australian adults and teenagers with TIIDM, the mean 25(OH)D was 64.6 nmol/L (61.3–67.9) in normal adults and 54.7 nmol/L (50.3–58.9) in adults with TIIDM (Ogunkolade et al., 2006). The proportions of 25(OH)D deficiency were 18% for normal adults and 43% for those with TIIDM (Boucher, 2018). The results showed that vitamin D deficiency was once more prevalent among older adults and those with a longer duration of diabetes (Boucher, 1998). These variations would possibly be described with the useful resource of differences in dietary intake, sun avoidance, geographical environment, skin colour, or genetics. Not all research links reduce vitamin D ranges in humans with TIIDM in contrast with the control group.

Further, serum samples from 110 subjects with TIIDM and 153 control subjects were cross-sectionally analyzed. The 25(OH)D levels were found to be similar among the two groups, with the median 25(OH)D being 20.1 ng/mL (13–37.4) in the control group and 24 ng/mL (14.1–34.1) in the type II diabetes group. Understanding the nature of low vitamin D stages in adults with TIIDM is thus critical. It might also clarify mechanisms of susceptible ß-cells on pancreases, leading to insulin resistance. Patients with no history of drug use may be in the first stage of the ailment development with extra healthy ß-cells than patients on diabetic medicinal drugs. They ought to keep a nutritious diet, exercise, and introduce lifestyle changes. Several limitations were confronted in the current study, which consisted of a specific period and time of sun exposure, which might also impact the present study. The recommended 25(OH)D levels in diabetic adults were significantly lower than those in Western research (Bandeira et al., 2006; Boucher, 1998; Cantorna et al., 2004). This would possibly replicate the excessive incidence of 25(OH)D deficiency and insufficiency in the normal Libyan population. The immoderate incidence of vitamin D deficiency is possibly related to reduced sun exposure. Although there is enough sunlight throughout the year in the Middle East and other Arab countries, time spent outside is severely limited. Therefore, vitamin D deficiency is expected in the Libyan population. It has been documented in a few studies (Al-Daghri et al., 2014; Zhang et al., 2016) that vitamin D status is strongly linked with lifestyle and precisely the kind of clothing worn by a population. Vitamin D status was once much better in women with Western clothing than those with the commonly worn veils that cover the face and palms. Vitamin D deficiency was particularly prevalent among veiled females in Turkey, Lebanon, Jordan, Saudi Arabia, and Iran, among other Arab countries (Narchi et al., 2001). The Libyan population cover their body entirely, except for the face. Therefore, wearing traditional clothing and restricted outdoor movement has been a risk issue for vitamin D deficiency among Libyan adults.

CONCLUSION

In the present study, vitamin D deficiency was higher in adults with type II diabetes mellitus than in non-diabetic control group subjects. Moreover, vitamin D deficiency was found to be common in the Libyan population. Low vitamin D levels in the adult population have mainly been attributed to social customs, such as avoiding vitamin D supplements and exposure to sunlight.

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ETHICS

All participants provided written informed consent before collecting data to conduct this research study.

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انتشار نقص فيتامين د بين مرضى السكري من النوع الثاني في مدينة شحات، ليبيا

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المستخلص: يعد نقص فيتامين د أحد أكثر الأمراض المصاحبة التي يتم تشخيصها بشكل متزايد في مرضى السكري من النوع الثاني (TIIDM)، مما يشير إلى أنه قد يلعب دورًا في مرض السكري من النوع الثاني. تهدف هذه الدراسة إلى تحديد، وتقييم حالة فيتامين د للبالغين الليبيين مع مرض السكري من النوع الثاني وبدونه. تم تضمين 100 شخص م ن البـ البالغين الليبيـ ين المصابين بمرض السكري من النوع الثاني من عيادات السكري، و100 عنصر من الأصحاء في الدراسة. كان متوسط العمر لمن لديهم مرض السكري 15.4 ± 25.8سنة مقابل 4.2 ± 35.9سنة للأصحاء. تم قياس مصل 25 هيدروكسي كولسيفيريول (فيتامين د)، والكالسيوم، والكوليسترول، وجلوكوز الدم، والبروتين الدهني عالي الكثافة (HDL)، والدهون الثلاثية، ومقارنة النتائج بين المجموعتين. كان لدى كلا المجموعتين نقص في فيتامين د، وانخفضت النطاقات المقترحة من فيتـ امين د بشـ كل ملحوظ في البالغين المصابين بمرض السكري مقارنة بالأصحاء (1.6±29.1نانومول / لتر مقابـ ل 1.9±36.4 نـ انومول / لتر). بالنسبة لمجموعة المصابين بمرض السكري، 66.7٪ منهم كان لديهم عوز خفيف، و30.7٪ نقص معتدل و3.3٪ نقص حاد في فيتامين د، على عكس مجموعة الأصحاء، 43.7٪ (خفيف)، و33.5٪ (متوسط) و6٪ (شديد). بشكل عام، 100٪ من البالغين المصابين بمرض السكري و75٪ من البالغين الأصحاء كانوا يعانون من نقص فيتامين د. في هذه الدراسـ ة مقارنـ ة مجموعة بالبالغين الأصحاء غير مصابين بمرض السكري من النوع الثاني، كان انتشار نقص فيتامين د بين البالغين المصابين بمرض السكري مرتفعًا جدًا. لذلك هناك ما يبرر فحص نقص فيتامين د، والمكملات لهذه الفئة من الناس.

الكلمات المفتاحية: فيتامين د، نقص فيتامين د، مرض السكري من النوع الثاني، شحات، ليبيا.

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