EVALUATION OF THE RELATIONSHIP BETWEEN VITAMIN D DEFICIENCY AND OBESITY AMONG LIBYAN PATIENTS WITH DIABETES MELLITUS

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Abstract - Diabetes Mellitus has become an important global healthcare problem, associated with serious multi-pathological factors. Vitamin D deficiency as associated to obesity, promotes the development of Type 2 diabetes.There aremulti-factors linking to vitamin Deficiency, including cutaneous dysfunction and aging. This study was aimed to evaluate thevitamin D deficiency in association to obesity and aging among diabetic patients in Tripoli, Libya. The study was conducted on 100 healthy, volunteer subjects aged between 26-62years old as a control group and another 100 patients with age-range between 26-59 years old and with history of Type 2 diabetes mellitus.Initial blood samples were collected from both the control and diabetes subjects and measurement of the height and weight are taken and recorded. The second samples were collected from the diabetes subjects, three months after the vitamin D supplementation. Serum was used for determination of the levels of vitamin D and their accumulation level. The results have shown that BMI values were significantly higher in all age groups of the diabetic subjects, females having (27±2 kg/m^2) and males (26±2 kg/m^2) compared to BMIvalues of the control subjects, were females have (23±1 kg/m^2) and males (24±1 kg/m^2). The study further revealed deficiency in the vitamin D level in all age groups of females and males, before the vitamin D supplementation (10±3 & 10±3 ng/ml); (8±3 & 8±2 ng/ml) respectively. After three months of vitamin D supplementation, a normal vitamin D level were noted in all age groups (39±8 & 43±9 ng/ml); (41±7 & 39±8 ng/ml) respectively. The results have shown a significant variation in vitamin D level after supplementation by (P=< 0.05). In conclusion, patients with Diabetes Mellitus often tend to be overweight; however, it was negatively correlated with vitamin D levels in young and middle-age subjects. To avoid the harmful effects of vitamin D deficiency, obese diabetic patients should be monitored and supplemented with adequate doses of vitamin D.

Keywords - Vitamin D, Diabetes mellitus, Obesity, Body mass index, Deficiency.

I. INTRODUCTION

Type 2 Diabetes Mellitus has become a significant global healthcare problem, associated with serious multi-pathological factors [1]. There is evidence suggesting that vitamin D has been considered as an important factor in calcium homoeostasis, skeletal health and Diabetes Mellitus [2],[3]. Several studies have suggested that low vitamin D status is linked with the development of insulin resistance in adults [4],[5]. In a study it has been found that supplementation of vitamin D for 16 weeks improved the pancreatic β-cell function in adult diabetes [1]. Vitamin D is primarily produced in the skin under the exposure to ultraviolet irradiation from the sun. Moreover, ingestion of food (e.g., fish, margarine or milk), and vitamin D supplements enhances vitamin D level[3]. Adults who depend on sunlight for most of their vitamin D requirements are susceptible to developing vitamin D deficiency, due to the variability of factors that reduce the cutaneous production of vitamin D, including aging [6], [7].Vitamin D can affect multiple organs (pleiotropic actions) and metabolic syndrome, including cardiovascular disease, diabetes and obesity [8], [9].
Obesity is a risk factor for many psychological disorders, including Type 2 Diabetes Mellitus, Cardiovascular Disease and Osteoarthritis [10]. Recently, being overweight and obesity have been shown to be related to low vitamin D status [11]. There is evidence that vitamin D affects body fat mass by inhibiting adipogenic transcription factors and lipid accumulation during adipocyte differentiation. Therefore, vitamin D may enhance the normal metabolic functioning of adipose tissue [9]. Furthermore, previous reports suggest that a low level of Vitamin D contribute to the development of Type 2 Diabetes [12]. Therefore, the aim of this study was to evaluate the relationship of vitamin D deficiency as associated with obesity and aging among diabetic patients.

II. METHODS AND DESIGNS

Methods

A cross-sectional study was conducted at AL-wafi Medical Laboratory in Tripoli, Libya. A total of 100 healthy volunteer subjects which composed of (49) males and (51) females, with age-range between 26-62 years old were utilized as a control group. Another group of 100 patients of both sexes residing in Tripoli, Libya were employed in the study whose age ranges from26-59 years old and with a history of Type 2 Diabetes Mellitus. These patients were supplemented with 200000 ng/ml vitamin D monthly for three months before the initiation of the study.

Design

The study was conducted with the participation of all subjects involved between 24th of June and 22nd of August 2017. Before the study was initiated, the weight and height of each participant was measured, blood sample were taken after 8 hours of fasting and the serums we restored at -20 C for future analysis. The target would be the healthy subjects who have depended in significant cutaneous vitamin D synthesis from solar radiation and diet. The vitamin (200000 ng/ml) dose was supplemented monthly for diabetic patients by the Pharmacist (AL-wafi Medical Laboratory). This dose is within the monthly average range of total intake as C. J. Bacon et al. 2009 reported, (50,000 IU/month) is needed for vitamin D supplementation. At the end of the course of doses, blood was collected from the subjects by venipuncture and into a vacant tube with no additive, which was immediately stored at -80 ^{O}C until required for analysis. A 800 IU/daily dosage of vitamin D, increased serum from 25-(OH)D levels to greater than 20 ng/ml in women[13].

III. RESULTS

The concentration of the main circulating vitamin D metabolite is 25-hydroxyvitamin D (25(OH)D) was measured [14]. In this experimental study, the patients and the control group were categorized by age-range; namely, young-age groups (26- 39 years old) and middle-aged adult groups (40-62 years old) then by sex; female (51) and male (49). BMI was calculated from the measured height and weight with categories; underweight = <18.5, normal weight = 18.5–24.9, overweight = 25–29.9 and obese = BMI of 30 or greater in kg/m2 [15], [16], [14].The results have shown that BMI values were significantly higher in the all-age groups of subjects with diabetes, females having (27±2 kg/m^2) and males (26±2 kg/m^2) compared to BMI values of the control subjects, females (23±1 kg/m^2) and males (24±1 kg/m^2).The results also revealsBMI values of the females were found to be higher in the all aged group than in the male aged groups (Figure 1).

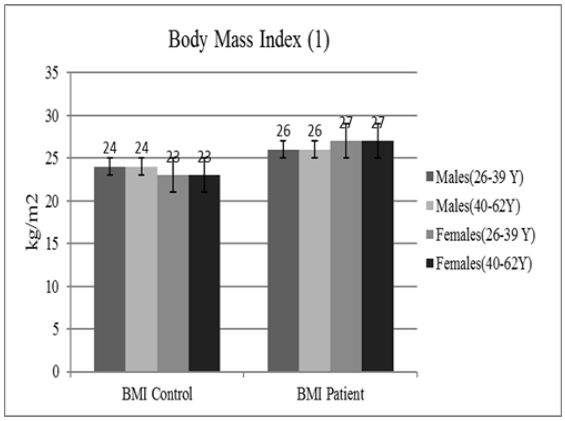


Figure (1): Shows the BMI of both female and male control subjects and diabetic patients with age-range between 26-62years old.

Serum concentration of vitamin D levels are categorized as; (sufficient: >30 ng/ml; insufficient: 20–30 ng/ml; deficient :<20ng/ml) [17]. This study have shown the deficiency of vitamin D in females and males in young and middle-age groups, before supplementation (10±3 &10±3 ng/ml); (8±3 & 8±2 ng/ml) respectively. The vitamin D concentration where found to be in normal levels after three months of supplementation in all age groups (39±8 &43±9ng/ml); (41±7 &39±8 ng/ml) respectively. The results have shown a significant variation in vitamin D concentration level after supplementation at (P=< 0.05). The mean serum concentration of vitamin D was significantly higher among the control subjects than in the diabetic subjects (female and male), before and after the administration of the vitamin supplement. In contrast, serum vitamin D accumulation concentrations did not differ significantly from each group and in the control subjects (Figure 2 & 3). Further, no significant changes were noted in females and males of each group after vitamin supplementation (Figure 4).

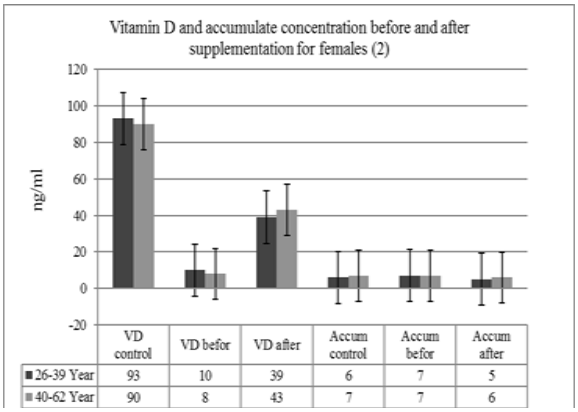


Figure (2): Shows the different levels of vitamin D and their accumulation in females control subjects and diabetic patients before and after supplementation.

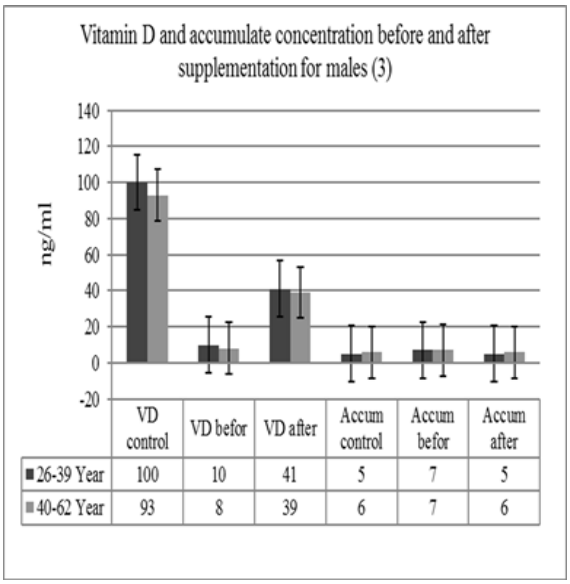


Figure (3): Shows the different levels of vitamin D and their accumulation in males control subjects and diabetic patients before and after supplementation.

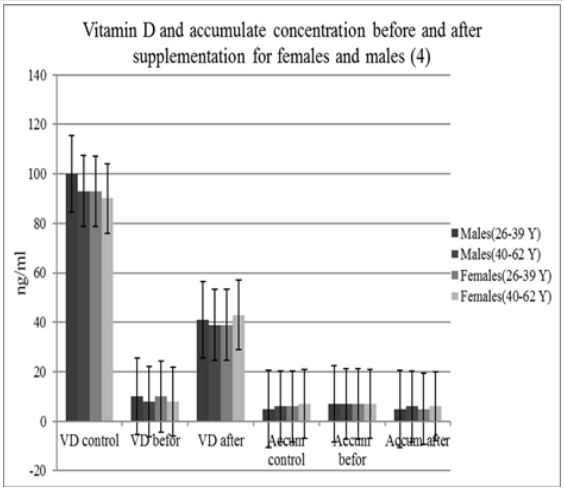


Figure (4): Shows the different levels of vitamin D and their accumulation in both female and male control subjects and diabetic patients before and after supplementation of Vitamin D.

IV. DISCUSSION

In this study, all diabetic subjects in all age groups were found to have less than 20 ng/ml of vitamin D in their blood. These findings are in agreement with previously published reports [4], [11],[19]. The result of the study further revealed that in both sexes of all age groups whose BMI's were calculated, all were found to be overweight. These age groups of diabetic subjects were also overweight and deficient in vitamin D. They were found to have a higher BMI with an increase of about four kg/m^2 for female and two kg/m^2 for male more than that of the control groups who had normal vitamin D levels. Several studies suggested that being overweight and vitamin D deficiency have been linked to Diabetes Mellitus [20], [21]. However, the study found no significant correlation between subjects in the young and middle-aged groups to the levels of vitamin D.

The results of the current study strongly suggest that vitamin D deficiency were common in diabetic patients with higher BMI's. This relationship might be also because of the link between vitamin D and the metabolic syndrome [9]. The metabolic syndrome is a precursor factor that occurs to the development of Diabetes Mellitus, including insulin resistance, high total cholesterol and triglyceride levels, and high blood pressure [11], [22]. Vitamin Dplays an essential role in insulin action and may influence several pathways, which are thought to be of significance in the development of Type 2 Diabetes [23], [24]. In contrast, several reports have shown a negative relationship between vitamin D state and insulin resistance and progress of T2DM [25], [26].

In this study, it was found that the vitamin D accumulation level did not differ significantly in all-age groups of diabetic subjects, compared to control groups.However,excess body fat results in its low availability andeffects of active forms of vitamin D, due to significance; low serum vitamin D levels [27]. There is evidence that vitamin D inhibits fat accumulation, increases insulin synthesis; decreases insulin resistance and T2DM control [28]. This current study evidence supports the use of vitamin D as a pathway to treat obesity and T2DM.

CONCLUSIONS

This study found that subjects with diabetes mellitus suffer from being overweight;however, it was negatively correlated with vitamin D levels in the young and middle-age groups. To avoid the effects of vitamin D deficiency, obese diabetic patients should be supplemented with adequate doses of vitamin D. Furthermore, patients with Diabetes Mellitus should be monitored for serum vitamin D deficiencyand adequate dose of vitamin D must be supplemented.

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