Section: Biochemistry

Original Research Article

STUDY OF ANTHROPOMETRY, THYROID PROFILE, VITAMIN D LEVELS AND MAGNESIUM IN NEWLY DIAGNOSED TYPE 2 DIABETES MELLITUS PATIENTS

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ABSTRACT

Background: The purpose of our research was to investigate the potential correlation between reduced levels of vitamin D and the prevalence of thyroid illness. This research is a cross-sectional case-control analysis that investigated the levels of 25(OH) D in individuals with thyroid conditions, both with T2DM and in a control group. **Materials and Methods:** The current study is an observational study with cross sectional design. A total of 200 samples were obtained by the Department of Biochemistry. Out of 200, 100 samples were drawn from the individuals diagnosed with T2DM and rest 100 was taken from the normal individuals, the study and its research protocol was approved by the Institutional Ethics Committee. The venous blood sample was obtained, and the serum was separated and kept at a temperature of 70 °C until it could be examined. The commercially available kit was used to quantify the vitamin D metabolite, serum 25-hydroxyvitamin D (25OHD). Thyroid function was evaluated by quantifying thyroid stimulating hormone (TSH), free-T3 (FT3), and free-T4 (FT4) levels using immunochemiluminescent tests performed by an automated instrument. **Result:** The clinical biochemistry values for individuals with T2DM showed significantly lower levels of vitamin D and higher levels of FBG, HbA1c, systolic blood pressure, diastolic blood pressure and TSH as compared to control subjects. **Conclusion:** There is a significant correlation between vitamin D insufficiency and the prevalence of thyroid problems in people with T2DM. This research demonstrates a correlation between the rise in thyroid illnesses and the growth in metabolic syndrome, vitamin D insufficiency, HbA1C levels, diabetes, and obesity.

INTRODUCTION

Type 2 Diabetes Mellitus is a metabolic disorder characterized by hyperglycemia arising because of inability of the body to use insulin adequately with increasing incidence both in the developing as well as developed nations.[1,2] In this entire global scenario, India continues a major global burden of Type 2 Diabetes Mellitus (T2DM).[3-5] In India, the prevalence of T2DM ranges between 5–17%, with higher prevalence rates in the southern parts of the country and in urban areas.[6-8] Progressive cultural and social changes like ageing populations, increasing urbanization, dietary changes, reduced physical activity and unhealthy behavior contribute to the increasing trends of T2DM. The recent trends suggest that the burden of the disease is rising exponentially and affecting people belonging to all the socio-economic classes equally suggesting that the Indians have a genetic predisposition to develop diabetes.[9,10] The other well established risk factors include lack of physical inactivity, poor nutrition practices and obesity, insulin resistance, deranged fatty acid metabolism, mitochondrial dysfunction and endoplasmic reticulum stress. Apart from these, there are increasing evidence suggesting that Vitamin D along with Magnesium deficiency also has a potential role to play in the pathophysiology of Type 2 Diabetes Mellitus.[11-14] The recent times has seen an emerging trend of vitamin D deficiency among the Indians irrespective of the age and gender factor and hence an important risk factor for development of insulin resistance and T2DM.[15-17]

Apart from T2DM, vitamin D insufficiency and its relation with numerous illnesses, such as cancer, cardiovascular disorders, autoimmune diseases, endocrine diseases, and metabolic diseases, is receiving significant attention as this hormone acts as an immune modulator, and hence lack of it negatively impact autoimmune thyroid disease. Many previous

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researchers have documented positive connections between vitamin D insufficiency and thyroid dysfunction in individuals with type 2 diabetes mellitus. Moreover, clinical practice has documented the correlation between vitamin D insufficiency and thyroid illnesses, which are the most prevalent endocrinological medical problems.[18-20] T2DM heightens the long-term susceptibility to thyroid dysfunction. T2DM and hypothyroidism are the leading causes of death and illness in both affluent and developing nations.[21] The purpose of our research was to investigate the potential correlation between reduced levels of vitamin D and the prevalence of thyroid illness. This research is a cross-sectional case-control analysis that investigated the levels of 25(OH) D in individuals with thyroid conditions, both with T2DM and in a control group.

MATERIALS AND METHODS

The current study is an observational study with cross sectional design. A total of 200 samples were obtained by the Department of Biochemistry. Out of 200, 100 samples were drawn from the individuals diagnosed with T2DM and rest 100 was taken from the normal individuals, the study and its research protocol was approved by the Institutional Ethics Committee. Duly signed informed written consent form was obtained prior to commencement. The World Health Organization (WHO) and the International Diabetes Federation (IDF) define the diagnosis of DM as having a fasting venous blood glucose (FBG) concentration of 7.0 mmol/L or higher and/or a postprandial blood glucose (PPG) concentration higher than 11.1 mmol/L. A participant was assigned to the control group (consisting of individuals without diabetes) if their fasting blood glucose (FBG) level was below 7.0 mmol/L (126 mg/dL), their glycosylated hemoglobin (HbA1c) level was below 48 mmol/mol (6.5%), and they did not disclose taking any prescription diabetic drugs.

Process of blood collection and examination: The venous blood sample was obtained, and the serum was separated and kept at a temperature of 70 °C until it could be examined. The commercially available kit was used to quantify the vitamin D metabolite, serum 25-hydroxyvitamin D (25OHD). The processed samples were then analyzed using the competitive binding radioimmunoassay (RIA) method. The subjects were categorized into two distinct classifications: 1) Insufficient levels of Vitamin D, with a 25(OH) D concentration below 20 ng/mL; 2) Adequate levels of Vitamin D, with a 25(OH) D concentration over 20 ng/mL, as recommended by many researchers.[19,22,23]

Thyroid function was evaluated by quantifying thyroid stimulating hormone (TSH), free-T3 (FT3), and free-T4 (FT4) levels using immunochemiluminescent tests performed by an automated instrument. The measurement of TSH was conducted using an immunoassay technique. The assessment of FT3 and FT4 is crucial in the diagnosis of thyroid diseases, since the levels of these hormones are influenced by changes in binding protein concentrations. Accurate assessment of hormone concentration is crucial for free thyroid hormone measurement, especially in the face of substantial variance.

This research included several criteria, including socio-demographic characteristics, lifestyle behaviors, and biochemical test findings. Patients were classified as physically active if they engaged in walking or cycling for a duration exceeding 30 minutes per day.

Data analysis was done using the Statistical Package for the Social Sciences (IBM SPSS Statistics for Windows, Version 25.0). The statistical significance of differences in mean values between two continuous variables was assessed using the Student's t-test for normally distributed data and the Mann-Whitney test for non-normally distributed data. The chi-square and Fisher's exact tests are used to determine significant differences between two or more category groups.

RESULTS

Socio-demographic and behavioral characteristic were compared across the case group [A] and the control group. [B] [Figure 1] both the groups were comparable in terms of age and gender. While low physical activity, higher BMI, positive family history of T2DM and hypertension was statistically reported in group A as compared to group B.

The clinical biochemistry values for individuals with T2DM showed significantly lower levels of vitamin D and higher levels of FBG, HbA1c, systolic blood pressure, diastolic blood pressure and TSH as compared to control subjects. These differences were statistically significant ($P < 0.001$). [Table 1]

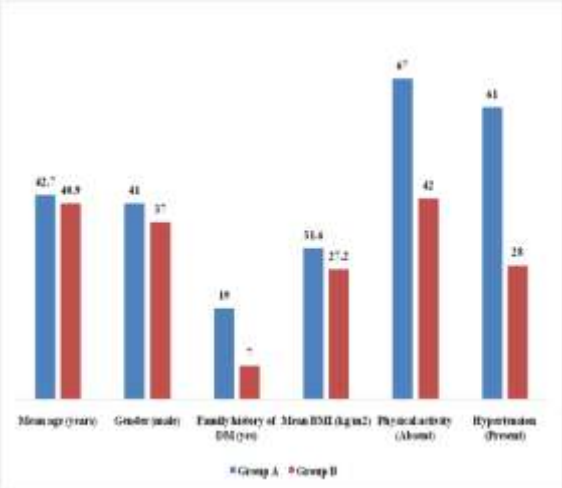

Figure 1: A bar diagram showing comparison of the basic chrematistics of the cases and control population [Group A vs. Group B].

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Table 1: A table showing distribution of biochemical parameter done among the case and the control population [Group A vs. Group B]

Biochemical parameter	Cases [Group A] N=100		Control [Group B] N = 100		P value
	Mean	SD	Mean	SD	
Vitamin D [ng/ml]	17.7	2.4	26.1	4.7	<0.05
FBG [mmol/l]	8.2	1.1	6.2	2.7	<0.05
HbA1c [mmol/l]	7.5	1.4	5.6	1.1	<0.05
SBP [mm of Hg]	131.4	10.5	113.2	7.4.	<0.05
DBP [mm of Hg]	100.1	10.3	87.6	2.4	<0.05
TSH [mIU/l]	2.6	0.3	2.1	0.7	<0.05
fT3 [mIU/l]	1.8	0.9	1.6	0.4	<0.05
fT4 [mIU/l]	1.3	0.5	0.9	0.3	<0.05

DISCUSSION

T2Dm is an emerging global pandemic and now the most widespread NCD globally, affecting a considerable number of adult populations. The recent past has witnessed a mountain of evidence suggesting raised prevalence of Vitamin D deficiency [VDD] and its association with development of other chronic disease including T2DM. Moreover, VDD and T2DM are well acknowledged as a co-morbidity and predisposing factor for thyroid disorder.[22] The present research concludes that VDD is significantly more prevalent among individuals diagnosed with T2DM. Furthermore, elevated levels of TSH have been linked to decreased levels of 25hydroxyvitamin D (25-OHD). Furthermore, decreased levels of TSH have been linked to elevated levels of 25-hydroxyvitamin D (25-OHD). Furthermore, a direct correlation has been shown between TSH and 25-OHD levels in individuals with type 2 diabetes mellitus. Higher levels of 25OHD with suppressed TSH levels may be attributed to enhanced absorption of 25-OHD in a hyperthyroid condition. The metabolism of 25OHD is likewise controlled in a reciprocal manner by thyroid hormones. Examination of the skin in individuals with hypothyroidism has shown a reduction in the thickness of the outer layer of the skin (epidermis) and an excessive accumulation of keratin (hyperkeratosis). Consequently, the body may have difficulties in effectively utilizing vitamin D.[23] The present research included a matched case control design to investigate the correlation between vitamin D and thyroid illness in individuals with T2DM. The presence of low levels of vitamin D has been shown to be associated with elevated levels of thyroid antibodies in both adults and adolescents.[24-26] This aligns with the present findings of the research. Hence, it is crucial to implement efficient measures to regulate vitamin D and T2DM in order to decrease the prevalence of thyroid disorders among individuals in the middle age bracket, which might potentially impact their overall well-being. It is important to acknowledge that vitamin D insufficiency/deficiency may have a role in the development of both diabetes mellitus (DM) and thyroid illness. However, it is possible for vitamin D insufficiency to potentially be a result of these disorders. The use of oral anti-diabetic drugs and adherence to therapeutic dietary restriction may have an impact on the vitamin D levels of individuals with diabetes. Furthermore, thyroid dysfunction has the potential to alter the intake, absorption, or metabolism of vitamin D.

CONCLUSION

There is a significant correlation between vitamin D insufficiency and the prevalence of thyroid problems in people with T2DM. This research demonstrates a correlation between the rise in thyroid illnesses and the growth in metabolic syndrome, vitamin D insufficiency, HbA1C levels, diabetes, and obesity. While it is evident that the incidence of thyroid cancer has been increasing at a faster rate compared to other types of cancer, this may be attributed to factors such as the rise in obesity, diabetes, and sedentary lifestyle.

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