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A Cross-Sectional Study of Vitamin D and Random Blood Sugar Level Among Health Check Individuals in a Healthcare Center of Dhaka, Bangladesh

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Abstract:
Introduction: *Vitamin D is believed to help improve the body's sensitivity to insulin-the hormone responsible for regulating blood sugar levels and thus reduce the risk of insulin resistance, which is often a precursor to type 2 diabetes. Vitamin D deficiency leads to reduced insulin secretion. Supplementation with vitamin D has been shown to restore insulin secretion in animals. Researchers have also found an indirect effect on insulin secretion.*
Materials and Methods: *Competitive immunoluminometric assay was used to assess vitamin D in blood; and glucose oxide manual method and semi auto analyzer were used to quantitate random blood sugar in the blood of the study subjects.*
Results: *Among 406 study participants 22.9% were males and 77.1% were females. We found 74.1% participants with normal RBS level, 17.3% were with pre-diabetics and more than 11.1% were with diabetes. In respect to vitamin D level in blood 3.9% participants were with severely deficient, 57.5% were deficient, 29.3% were insufficient, 9.6% were normal and no participants were found with vitamin D toxicity.*
Conclusion: *We found that test subjects were with deficient and insufficient vitamin D but only 17.3% were found in the pre-diabetic stage. From our study we did not able to say that low vitamin D is associated with elevated random blood sugar. To find any statistical correlation more samples and more research are required.*
Keywords: *Vitamin D, RBS, Diabetes.*

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I. Introduction

Vitamin D isn't just necessary to keep bones strong, for muscle movement, and to keep immune system working.[9] It appears equally important for healthy thyroid function as well as cardiovascular health and now there is clearer evidence that it may help to reduce the chances that diabetes will occur.[4, 8, 12, 13]

The many positive health impacts of vitamin D have dominated the supplement world in recent years. Similarly, the growing worldwide epidemic of type 2 diabetes has also been in the spotlight – with an estimated 400 million people affected currently, and this number expected to be 642 million by 2040.[18] As type 2 diabetes rates continue to soar, there is an urgent need to find effective ways to tackle this disease. Vitamin D supplementation has emerged as a possible solution (1). But how effective is it really?

Known as the "sunshine vitamin", vitamin D is created in your skin in response to direct sunlight .[5, 7] However, the amount of vitamin D created can be hindered by a variety of factors including cloud cover, time of day, and smog. Vitamin D is also found in small amounts in some foods such as oily fish (mackerel, sardines and tuna),[5, 7] as well as foods fortified with vitamin D such as dairy products, breakfast cereal, and orange juice. Most foods however, are not a great source of vitamin D,[5, 7] which has resulted in many taking supplements to boost their vitamin D levels. In fact, almost 34% of Canadians took some kind of supplement that contained vitamin D in 2015.[17]

Many people with diabetes are low in vitamin D.[15] This is an important finding because vitamin D is known to help regulate insulin levels.[10] New studies have assessed if vitamin D supplementation helps in the management of type 2 diabetes.[18]

According to findings published in *PLoS One*,[13] it appears that the lower the level of vitamin D in blood, the higher your risk of developing diabetes. The researchers followed 903 people over 12 years, tracking their vitamin D status and identifying which individuals were diagnosed with prediabetes or diabetes.

The participants who were followed by Garland and his team were part of the ongoing Rancho Bernardo Study, a National Institutes of Health population-based trial of older adults, which included patients who were middle-income Caucasians living in a southern California suburb; the average age was 74 years on average at the start of the vitamin D portion of the study.[13]

These participants were confirmed as healthy, having no signs or symptoms of pre-diabetes or diabetes, initially.[13] During the study, the researchers measured blood levels of vitamin D from over the first two years and gave the men and women a fasting blood glucose test every two years. If the fasting blood glucose test was high (100 milligrams/deciliter or above), an oral glucose tolerance test was done to confirm the likelihood of diabetes.

By the end of the follow-up portion of the study, 47 people were diagnosed as having developed diabetes and 337 had been identified with prediabetes. Based on these results, Garland and his team confirmed that the higher the vitamin D in the blood, the less likely they were to get diabetes.[13]

In trying to understand the study findings, it is important to appreciate that experts disagree on what a normal blood level for vitamin D should be,[6] but for the purposes of this study, the researchers identified a minimum healthy level of serum 25-hydroxyvitamin D to be 30 nanograms per milliliter (ng/ml). That level is 10 ng/ml above the level recommended by National Academy of Medicine, a health advisory group to the US government.[14]

Data from the different sources showed that vitamin D has strong correlation with blood sugar. In our study we will focus on the prevalence vitamin D deficiency or insufficiency among males and females, and along with it status of random blood sugar among study participants.

II. Materials and Methods

Study group

Serum samples were collected from 407 health check individuals from hospital.

Study Place and Time

The study took place in Crescent Hospital, Uttara, Dhaka, Bangladesh from May 2019 to December 2019.

Vitamin D Assay

MAGLUMI 25-OH Vitamin D (CLIA) kit (Shenzhen New Industries Biomedical Engineering Co., Ltd., China) was used for the quantitative determination of 25-OH Vitamin D in human serum. The method, competitive immunoluminometric assay, can be used for samples over the range of 3-150ng/ml.[2]

Competitive Immunoluminometric Assay

Used a purified 25-OH Vitamin D antigen to label ABEI, and used 25-OH Vitamin D monoclonal antibody to label FITC. Sample, Calibrator, or Control, Displacing reagent, FITC Label and magnetic microbeads coated with anti-FITC were mixed thoroughly and incubated at 37 ℃ , forming antibody-antigen complexes; After sediment in a magnetic field, decant the supernatant, then cycle washing for 1 time. Then added ABEI Label, incubation and washing for the 2nd time, sample antigen and ABEI labeled antigen compete to combine with FITC labeled monoclonal antibody, forming antibody-antigen complexes. Subsequently, the starter reagents were added and a flash chemiluminescent reaction was initiated. The light signal was measured by a photomultiplier as RLU within 3 seconds and is proportional to the concentration of 25-OH Vitamin D present in controls or samples.56-59 100µl sample, calibrator or control is mixed with 100µl FITC Label, 50µl Displacing reagent, 20µl Nano magnetic microbeads. 20 min Incubation. 400µl each time Cycle washing. Add 200µl ABEI Label. Incubation for 10 min. 400µl each time Cycle washing and finally Measurement. [2]

Vitamin D Status

Vitamin D supply in adults, based on serum 25OHD concentration, can be divided into the following categories: severe deficiency (<10 ng/ml), medium deficiency (10-20 ng/ml), hypovitaminosis D (20-30 ng/ml), recommended or optimum level (30-76 ng/ml) and toxic level (>100 ng/ml)[60,61]. These categories differ slightly from the World Health Organization and American and Canadian classification, where levels below 10 ng/ml (USA) or below 20 ng/ml (Canada) were considered deficient and levels below 30 ng/ml were classified as insufficient. An optimal level is typically defined as serum 25OHD level between 30-76 ng/ml.[1]

Random Blood Sugar (RBS)

For random blood sugar investigation blood was collected from a vein, typically from the inside of our elbow or from the back of our hand. This investigation was carried out by manual and automated methods. 2ml of Venus blood was collected into BD Vacutainer™ Plastic Blood Collection Tubes with a specific amount of Sodium Fluride/Na2 EDTA. Then wait for few minute. This blood sample was centrifuged for the separation of plasma from blood. Plasma was collected and put on the sample cup for test. For manual method 1ml of (glucose oxide) sugar reagent was taken into a sample test tube and added 10µl blood plasma from the sample cup; and wait for 10minutes. Absorbance was taken after 10minutes by semi-auto analyzer. For automated method aliquot of the blood plasma in the sample cup was put into the analyzer to get the random blood sugar concentration.[1]

RBS status

The reference values for a "normal" random glucose test in an average adult are 80–140mg/dl (4.4–7.8 mmol/l), between 140-200mg/dl (7.8–11.1 mmol/l) is considered pre-diabetes and ≥ 200 mg/dl (≥ 11.1mmol/l) is considered diabetes according to American guidelines (a person should visit doctor or a clinic for additional tests however as a random glucose of > 160mg/dl does not necessarily diabetic).[3]

Statistical analysis

All statistical analyses were done by using SPSS-18 and Microsoft's Excel. Results were interpreted with percentile distribution.

III. Results

Table-1 showed the sex distribution among the test subjects. 22.9% were males and 77.1% were females**.**

Table1: Sex distribution among the subjects (n=406).

Number		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Male	93	22.9	22.9	22.9
	Female	313	77.1	77.1	100.0
	Total	**406**	**100.0**	**100.0**	

Age group distribution among the subjects were shown in the Table-2. Among the test subjects 25.2% were less than or equal to 30 years old, 22.9% were 30-40 years old, 20.2% were 40-50 years old, 15.3% were 50-60 years old, 9.9% were 60-70 years old and 6.0% were 70-80 years old and finally 0.5% were 80-90 years old.

Table2: Age group distribution among the subjects (n=406).

Years		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	<30	102	25.2	25.2	25.2
	<40	93	22.0	22.9	48.1
	<50	82	20.2	20.2	68.3
	<60	62	15.3	15.3	83.6
	<70	40	9.9	9.9	93.5
	<80	25	6.0	6.0	99.5
	<90	2	0.5	0.5	100.0
Total		**406**	**100.0**	**100.0**	

Table-3 showed that 74.1% test subjects were in the normal random blood sugar level in the serum. 17.3% were found with pre-diabetes stage and 8.6% subjects were with diabetic condition.

Table3: RBS level in the blood serum among the study subjects (n=406).

mmol/l		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Normal: 4.4-7.8	301	74.1	74.1	74.1
	Pre-diabetes: 7.8-11.1	70	17.3	17.3	91.4
	Diabetes: >11.1	35	8.6	8.6	100.0
	Total	397	97.8	100.0	
Total		**406**	**100.0**	**100.0**	

Among the study subjects 3.9% showed severely deficient vitamin D level in their blood serum. Deficient found 61.4%, insufficient found 29.3%, normal found 9.6% and no toxicity level found among the test subjects (**Table-4**).

Table4: Vitamin D level in the blood serum among the study subjects (n=406).

ng/ml		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Severely Deficient: <10	16	3.9	3.9	3.9
	Deficient: 10-20	233	57.4	57.5	61.4
	Insufficient: 20-30	119	29.3	29.3	90.4
	Normal: 30-76	38	9.6	9.6	100.0
	Toxic: >100	0	0.0	0.0	100.0
Total		**406**	**100.0**	**100.0**	

IV. Discussion

More research is needed to confirm a connection between blood sugar control and vitamin D levels. But in a study, people with type 2 diabetes had better success in lowering their blood sugar when they followed a diet that included extra vitamin D.[11]

In a study of middle-aged men and women, half the study participants drank vitamin-D-fortified yogurt drinks twice a day with lunch and dinner while the other half drank a placebo drink of just yogurt. After 12 weeks, the people in the vitamin D group not only had lower blood sugar but also showed fewer signs of insulin resistance. The vitamin D group even lost a bit of weight over the 12-week period![16]

More research is needed to know for sure whether vitamin D may have a role in blood sugar control. And it's not clear whether other foods containing D or supplements would produce similar blood sugar benefits. But lots of other research suggests that D may help improve insulin sensitivity and may even be involved in helping regulate insulin secretion from the pancreas- all important parts of blood sugar control. So be sure to get fair share of vitamin D each day.

V. Conclusion

We found that vitamin D was deficient and inadequate in the test subjects, but only 17.3 percent were found in the pre-diabetic stage. We were not able to tell from our research that low vitamin D was correlated with high random blood sugar levels. Further samples and further studies are required to find some statistical correlation.

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