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A Study on the Correlation between Levels of Serum Vitamin D and Pre-Diabetic Individuals

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Mini review

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Abstract

Diabetes and vitamin D are pandemic diseases. To control the incidences of illness a measure is taken to control it before the diagnoses of it. Vitamin D deficiency leads to insulin resistance. Its supplementation in pre-diabetes individuals has shown the association with considerably drop in progression to diabetes in between the age 15 yrs to 55 years. The participants were screened thoroughly and then taken their written consent before enrolling them into the side. No individual was forced for the enrollment into the study. No Type I Diabetes, Type II Diabetes and GDM cases were included. The study was done only on pre-diabetics who were not on medicines. Moreover, only vitamin D supplementation was given orally or injectable as per the patient's choice. The supplementation has shown the reversal of pre-diabetics to normal. The study showed the significant increase in vitamin D and serum calcium levels was observed post intervention in both males and females. There was a significant reduction in fasting blood sugar, post prandial blood sugar and HbA1C post intervention in both males and females indicating that vitamin D supplementation has a beneficial role in the management of insulin sensitivity and blood glucose levels in pre-diabetics ($p<0.001$).

Keywords: Vitamin D; Diabetes; Blood sugar; Glucose; Insulin

Introduction

The population of India is deficient in vitamin D and the incidences reported for pre-diabetes has increased tremendously. Pre-diabetes is associated with the simultaneous presence of insulin resistance and β-cell dysfunction, abnormalities that start before glucose changes are detectable. Observational evidence shows associations of pre-diabetes with early forms of nephropathy, chronic kidney disease, small fiber neuropathy, diabetic retinopathy, and increased risk of macro-vascular disease. Multifactorial risk scores could optimize the estimation of diabetes risk using non-invasive parameters and blood-based metabolic traits in addition to glycemic values. For pre-diabetic individuals, lifestyle modification is the cornerstone of diabetes prevention with evidence of a 40%–70% relative risk reduction.

Review

In 2012, Dutta, et al. studied to predict the connection of serum vitamin D and insulin resistance connection in pre-diabetic individuals. He took 115 individual and screened them and concluded that there is some connection between the two; in India, where the CVD risk is on higher levels. He further stated the prospective study is needed to approve the verdicts [1].

In a 2012 review, researchers looked at studies examining how much vitamin D people and were followed to see if they got T2D later in life. The study concluded people with the highest vitamin D blood levels had a 19% decreased chance of developing T2D compared to those with the lowest levels [2].

Low serum vitamin D levels have been associated with insulin resistance, metabolic syndrome, and type 2 diabetes, and many non-Western immigrants in the Netherlands are vitamin D deficient, obese, and at high risk of diabetes, explained Paul Lips, MD, PhD, from the VU University Medical Center in Amsterdam [3].

Kabadi et al, in his study has proved that the collaboration between vitamin D and body mass index (BMI) has approx. 47% of raised chances of people to be diagnosed as insulin resistant [4].

Clemente-Postigo and coworkers who announced pointedly the VDD in pre-diabetic and diabetic patients while relating it with an individual irrespective of uncontrolled glycemic status. This was neutral towards BMI [5].

Methodology

The study is aimed to see whether the good amount of vitamin D improvise the living being standard by controlling the incidences of vitamin D or not. The study is done in a same institutions. Each enrolled individual is checked for the inclusion and exclusion criteria. Written consent was signed before enrolling them. All parameters are documented very aptly. The blood samples were taken on the first day of their enrolment for BS (F), (PP), HbA1c, 25(OH)D, Serum Calcium. The dose of 60K IU for vitamin D once a week for 10 weeks and 500 mg elemental calcium twice a day for 10 weeks was recommended. And the same tests were repeated after 10 weeks. Vitamin D test was done by sandwich ELISA method. Serum Calcium was done by ARSENAZO III. HbA1c was done by HPLC method and both the blood glucose levels (fasting and post prandial) were done by using Hexokinase.

Results

There was a significant reduction in fasting blood sugar, post prandial blood sugar and HbA1c post-intervention in both males and females indicating that vitamin D supplementation has a beneficial role in management of insulin sensitivity and blood glucose levels in pre-diabetics ($p<0.001$). There was no significant difference in blood parameters between males and females post intervention ($p>0.05$) (Table 1).

	Males (n=78)			Females (n=74)		
	Pre-intervention	Post-intervention	P value	Pre-intervention	Post-intervention	P value
Fasting blood sugar (mg/dl)	110.9±8.5	90.4±7.5	0.001	114.4±9.5	90.0±6.7	0.001
Post prandial blood sugar (mg/dl)	153.7±23.2	118.7±11.0	0.001	158.5±23.2	120.8±13.1	0.001
HbA1c (%)	6.1±0.2	5.1±0.2	0.001	6.2±0.2	5.1±0.2	0.001
Serum 25-hydroxy vitamin D (ng/ml)	11.8±9.2	40.9±9.0	0.001	13.2±9.9	38.7±6.4	0.001
Serum total calcium (mg/ml)	8.5±0.4	9.1±0.3	0.001	8.7±0.6	9.2±0.4	0.001

Table1: Blood parameters pre and post intervention in pre-diabetics when classified according to gender.
Data presented as Mean±SD.

There was a significantly higher decrease in fasting blood sugar in females as compared to males ($p<0.05$) (Table 2).

	Males (n=78)	Females (n=74)	P value
Change in Fasting blood sugar (%)	18.1±8.5	20.9±8.1	0.047
Change in Post prandial blood sugar (%)	21.2±14.5	22.7±11.7	0.466
Change in HbA1c (%)	18.6±12.7	16.7±3.6	0.208
Change in Serum 25-hydroxy vitamin D (%)	403.1±363	354.5±265.2	0.367
Change in Serum total calcium (%)	7.1±6.1	5.7±7.8	0.202

Table 2: Percentage change in blood parameters when classified according to gender.
Data presented as Mean±SD

As seen in Table 3, there was a significant reduction in fasting blood sugar, post prandial blood sugar and HbA1c post-intervention in all 3 BMI categories indicating that vitamin D supplementation has a beneficial role in management of insulin sensitivity and blood glucose levels in pre-diabetics irrespective of weight categories ($p<0.001$). A significant increase in vitamin D and serum calcium levels was observed post intervention in all 3 BMI categories ($p<0.001$) (Table 3).

Data presented as Mean±Sd. *$p<0.05$ for comparison between normal weight and obese pre-diabetics.

	Normal weight (n=28)			Overweight (n=27)			Obese (n=97)		
	Pre-intervention	Post-intervention	P value	Pre-intervention	Post-intervention	P value	Pre-intervention	Post-intervention	P value
Fasting blood sugar (mg/dl)	114.1 ±10.3	88.9 ±7.3	0.001	110.7 ±9.7	90.1 ±7.4	0.001	112.8 ±8.6	90.6 ±7.0	0.001
Post prandial blood sugar (mg/dl)	147.2 ±26.3	120.9 ±10.8	0.001	151.2 ±18.3	118.4 ±13.1	0.001	159.9 ±22.8*	119.8 ±12.3	0.001
HbA1c (%)	6.2 ±0.2	5.2 ±0.2	0.001	6.1 ±0.2	5.0 ±0.2	0.001	6.1 ±0.2	5.1 ±0.2	0.001
Serum 25-hydroxy vitamin D (ng/ml)	12.2 ±8.9	38.2 ±7.7	0.001	13.4 ±10.1	41.2 ±6.5	0.001	12.3 ±9.7	40.0 ±8.2	0.001
Serum total calcium (mg/ml)	8.7 ±0.7	9.1 ±0.3	0.001	8.6 ±0.5	9.1 ±0.3	0.001	8.6 ±0.5	9.1 ±0.3	0.001

Table 3: Change in blood parameters in pre-diabetics when classified according to Nutritional Status (BMI Categories).

Table 4, significantly higher percentage decrease in post-prandial blood sugar was observed in obese pre-diabetics as compared to normal weight pre-diabetics indicating that vitamin D supplementations has a greater effect on controlling blood sugar levels in obese pre-diabetics (Table 4) ($p<0.05$).

	Normal weight (n=28)	Over weight (n=27)	Obese (n=97)
Change in Fasting blood sugar (%)	21.6±1.7	18.1±1.6	19.2±0.8
Change in Post prandial blood sugar (%)	16.2±3.0	21.2±1.6	23.8±1.3*
Change in HbA1c (%)	16.9±0.6	17.4±0.7	17.9±1.2
Change in Serum 25-hydroxy vitamin D (%)	402.7±66	245.3±59	382.2±34.1
Change in Serum total calcium (%)	6.2±1.7	5.6±1.5	6.7±0.6

Table 4: Percentage change in blood parameters when classified according to nutritional status.
Data presented as Mean±SE. *$p<0.05$ for comparison between normal weight and obese pre-diabetics

Conclusion

The study concluded that vitamin D stimulates pancreas to make insulin, which either prolongs the duration of onset of type II DM, or helps in reverting the impaired glucose tolerance levels or impaired fasting glucose levels into normal levels. The study showed the significant increase in vitamin D and serum calcium levels was observed post intervention in both males and females. There was a significant reduction in fasting blood

sugar, post prandial blood sugar and HbA_1C post intervention in both males and females indicating that vitamin D supplementation has a beneficial role in the management of insulin sensitivity and blood glucose levels in pre-diabetics ($p<0.001$).

Limitations of the Study

1. 24 hours recall method will be used for data collection three consecutive days only.
2. Verification of the authenticity of answers regarding the amount and type of food consumed will not be possible.
3. Dietary recall was purely based on their statement.
4. Seasonal variation in the dietary intake was not taken into consideration due to limited time period of the study.

Scope of the Study

1. The scope of the study indicates:
2. The requirement and role of calcium.
3. The requirement and role of vitamin D.
4. The need of medicines in pre-diabetes.
5. The requirement and role of diet in controlling pre-diabetes.
6. The requirement and role of phosphorus.
7. The requirement and role of magnesium.
8. The need of exercise or any other type of physical activity.

Significance of the Study

1. The significance of the study is to:
2. Find the effect of Vitamin D in decreasing insulin resistance.
3. Find the effect of Vitamin D in enhancing insulin sensitivity.
4. Find the effect of Calcium in decreasing insulin resistance.
5. Find the effect of Calcium in enhancing insulin sensitivity.
6. Role of diet.
7. Role of physical activity.

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