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Original Research Paper

Endocrinology

"TO ESTIMATE VITAMIN D DEFICIENCY IN OBESE AND NON OBESE FEMALES WITH TYPE 2 DIABETES MELLITUS IN NORTH INDIA"

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ABSTRACT

Background: Vitamin D deficiency is prevalent among obese individuals. Some authors have postulated that Vitamin D is sequestered in the excess adipose tissue, leading to less bioavailability, whereas others suggest that low Serum 25-hydroxy Vitamin D may be a result of volumetric dilution of vitamin D in the large adipose stores. **Aim:** To study and compare the Vitamin D levels in Obese and Non-obese diabetic female with obese and Non-obese non-diabetic females. **Method & Materials:** The present study was conducted in the Department of Medicine, MLN Medical College & SRN Hospital, Prayagraj to assess Vitamin D levels of diabetic and non-diabetic obese and non-obese females. A total of 115 diabetic female patients attending Clinic fulfilling the inclusion criteria and giving consent were included as Cases and 115 female non-diabetic patients without active or chronic problems attending different departments were included in the study. Serum samples of all the participants were collected for estimation of 25-hydroxy vitamin D (25-OH vitamin D). Quantitative determination of 25- hydroxy vitamin D (25- OH vitamin D) in human serum is done by chemiluminescent microparticle immunoassay (CMIA). **Result:** Majority of Controls had Normal Vitamin D levels (52.2%) , on the other hand only 1.7% cases had normal Vitamin D levels. Vast majority of Cases (98.3%) had Vitamin D deficiency. Higher percentage of Cases were found to have mild and severe vitamin D deficiency as compared to that in controls. [Mild Vitamin D deficiency -12.2% vs. 11.3% in cases and controls respectively and severe Vitamin D deficiency - 86.1% vs. 36.5% in cases and controls respectively] . Difference in vitamin D status of Cases and Controls was found to be significant statistically. Serum Vitamin D levels of Controls (29.18±20.31 ng/ml) was found to be significantly higher as compared to Cases (9.06±6.03 ng/ml). **Conclusion-** Mean serum vitamin D levels were significantly lower in Diabetic females as compared to that in Non-Diabetic females.Obesity was associated with a significantly lower vitamin D levels in both Diabetic females as well as Non-Diabetic females.

KEYWORDS : Vitamin D, Obesity, Diabetes Mellitus

INTRODUCTION -

Vitamin D is a fat-soluble vitamin, it plays a vital role in human physiology but Vitamin D deficiency is prevalent worldwide.[1] Vitamin D can be derived both from dietary sources when ingested in diet as cholecalciferol (vitamin D3) or can be synthesized in the skin as ergocalciferol (vitamin D2) when the skin comes into the exposure of sunlight.

About 90% of the required Vitamin D is synthesized in the skin under sun exposure.[2] Major dietary sources of vitamin D are fish, fortified food, and supplements, Vegetables and grains are poor sources[1]. Our Indian diet generally fails to satisfy the daily requirement of Vitamin D for a normal adult.

Prevalence of vitamin D deficiency in adult Indian females had been reported to be 37.5% to 99.7%. Level of deficiency was higher among pregnant, lactating and primi-gravid females. Common reasons of vitamin D deficiency in Indian females are low dietary calcium and vitamin D intake, Burqa and Purdah system, increased skin pigmentation and application of sunscreens[3].

Definitive role of vitamin D deficiency in pathogenesis of metabolic disorders like Hypertension, obesity and diabetes[4] and malignancies[5], particularly of colon[6,7,8], breast[9,10,11], ovary[12] and prostate gland[13,14,15,16] had been reported.

Vitamin D deficiency is prevalent among obese individuals[17,18,19,20].Some authors have postulated that Vitamin D is sequestered in the excess adipose tissue, leading to less bioavailability, whereas others suggest that low Serum 25-hydroxy Vitamin D may be a result of volumetric dilution of vitamin D in the large adipose stores.[21]

Therefore, present study was proposed to study the association of Vitamin D, diabetes and obesity among North Indian women.

AIM:

To study and compare the Vitamin D levels in Obese and Non-obese diabetic female with obese and Non-obese non-diabetic females.

MATERIAL AND METHODS

Study Site

Department of Medicine, Swaroop Rani Nehru (SRN) Hospital associated with Moti Lal Nehru (MLN) Medical College.

Study Design

Case Control Study.

Study Duration

Twelve months

Study Population

Type 2 Diabetes mellitus diagnosed female patients attending the Department of Medicine, MLN Medical College, Prayagraj were included in the study as Cases while female patients with no active or chronic problems were included as controls.

Inclusion Criteria for Cases

- Patients with diagnosed Type 2 diabetes for at least 1 year.
- Age > 18 years.
- Currently on hypoglycemic agents or insulin.

Exclusion Criteria for Cases

- Patients having metabolic bone disorders including hyperparathyroidism
- Patients taking glucocorticoid or anti-seizure medication for ≥6 months
- Patients having gastric bypass surgery
- Chronic Kidney disease
- Chronic liver disease
- Women having gestational diabetes

- Nursing and lactating mothers
- Women taking calcium and Vitamin D3 supplements
- Controls include non-diabetic age and sex matched patients from other clinics with no active or chronic problems.

Methodology

All the participants were clinically examined, demographic and anthropometric data was collected.

Serum samples of all the participants were collected for estimation of 25-hydroxy vitamin D (25-OH vitamin D). Quantitative determination of 25- hydroxy vitamin D (25- OH vitamin D) in human serum is done by chemiluminescent microparticle immunoassay (CMIA).

Statistical analysis

Data has been represented as frequencies (number) & proportions (percentages) and mean±standard deviation (SD). Chi-square and Independent samples 't'-tests were used to compare the data. A 'p' value less than 0.05 depicted a statistically significant relationship. All statistical analysis was performed using IBM Statistical Package for Social Sciences (SPSS) version 21.0.

RESULTS

A total of 115 diabetic female patients attending Clinic fulfilling the inclusion criteria and giving consent were included as Cases and 115 female non-diabetic patients without active or chronic problems attending different departments were included in the study.

Table 1. Comparison of Vitamin D levels, Vitamin D status, Demographic and Anthropometric profiles of Cases and Controls

SN	Characteristic	Cases (n=115)		Controls (n=115)		Statistical significance	
		Mean	SD	Mean	SD	't'	'p'
1.	Serum vitamin D (ng/ml)	9.06	6.03	29.18	20.31	–10.183	
2.	Vitamin D status	No.	%	No.	%	2	'p'
	Normal (30-80)	2	1.7	60	52.2	77.338	<0.001
	Mild deficiency (10-30)	14	12.2	13	11.3		
	Severe deficiency (<10)	99	86.1	42	36.5		
3.	Demographic and Anthropometric Profile						
i	Age (Years)	46.84	6.43	47.05	6.63	-0.242	0.809
ii	Height (cms)	153.61	4.30	154.67	3.93	-1.952	0.052
iii	Weight (kg)	63.30	12.01	64.26	11.24	-0.580	0.551
iv	BMI (kg/m2)	26.83	5.03	26.87	4.80	-0.066	0.948
v	Waist circumference (cm)	86.41	14.07	85.79	14.57	0.327	0.744

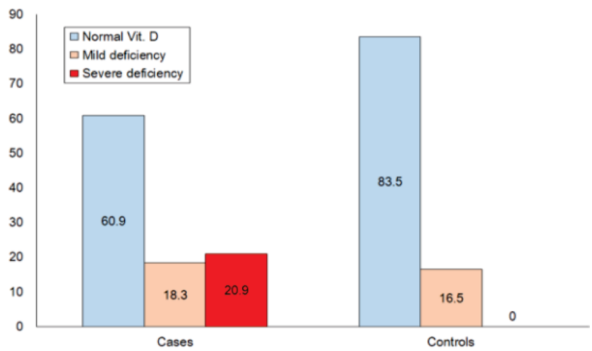
Majority of Controls had Normal Vitamin D levels (52.2%) on the other hand only 1.7% cases had normal Vitamin D levels. Vast majority of Cases (98.3%) had Vitamin D deficiency. Proportion of Cases was higher as compared to Controls having Mild Vitamin D deficiency (12.2% vs. 11.3%) and Severe Vitamin D deficiency (86.1% vs. 36.5%). Difference in vitamin D status of Cases and Controls was found to be significant statistically.

Table 2: Comparison of Vitamin D levels between cases and controls according to their obesity status

SN	Characteristic	Cases		Controls		Statistical significance	
		Mean	SD	Mean	SD	't'	'p'
Obese		n=48		n=51			
1.	Serum vitamin D (ng/dl)	7.48	2.00	8.82	3.07	-2.569	0.012
Non-obese		n=67		n=64			
1.	Serum vitamin D (ng/dl)	10.20	7.54	45.40	11.67	-20.599	<0.001
Within group comparison between obese and non-obese		t=–2.433; p=0.017		t=–21.768; p<0.001			

Table 3: Comparison of Vitamin D Status between cases and controls according to their obesity status

SN	Status	Cases		Controls		Statistical significance	
		No.	%	No.	%	χ2	'p'
Obese		n=48		n=51			
1.	Normal	0	0.0	0	0.0	6.596	0.010
2.	Mild deficiency	1	2.1	9	17.6		
3.	Severe deficiency	47	97.9	42	82.4		
Non-obese		n=67		n=64			
1.	Normal	2	3.0	60	93.8	111.012	<0.001
2.	Mild deficiency	13	19.4	4	6.3		
3.	Severe deficiency	52	77.6	0	0.0		
Within group comparison between obese and non-obese		2=9.663; p=0.008		2=103.780; p<0.001			



Graph 1: Comparison of Vitamin D Status of Obese Cases and Controls

None of the obese subjects (Case or Control) had Normal Vitamin D level. Mild or Severe deficiency was observed in all the patients. Severe level of Vitamin D deficiency was observed in significantly higher proportion of Cases as compared to Controls (97.9% vs. 82.4%).

Among non-obese subjects majority of the Controls (93.8%) had Normal Vitamin D levels and rest had Mild deficiency while among non-obese Cases 77.6% had severe deficieny,

19.4% had mild deficiency, only 3.0% had Normal Vitamin D levels. This difference was found to be significant statistically.

DISCUSSION

In the present study, a strong association of vitamin D levels was seen with obesity in the entire study population as well as in the two groups, that is diabetic and non diabetic females separately. Mean vitamin D levels were significantly higher in obese as well as non-obese controls as compared to obese as well as non-obese cases. We also observed that within the 2 groups, obesity was associated with a significantly lower vitamin D levels in both cases as well as controls. In quantitative terms, among cases, proportion of those with severe vitamin D deficiency was 97.9% in obese as compared to 77.6% in non-obese diabetic women thus showing a significant difference between obese and non-obese groups in cases. On the other hand, among controls, proportion of those with severe vitamin D deficiency was 82.4% in obese as compared to 0% in non-obese non-diabetic women thus showing a significant difference between obese and non-obese groups.

Al-Daghri *et al.*[139] also found significant inverse correlation between BMI and vitamin D levels. They also found that BMI had independent correlation with vitamin D levels and found it as a link with T2DM. In another study, **Vimaleswaran *et al.***[140] found that each each 1 kg/m^2 increase in BMI was associated with 1.15% lower vitamin D levels.

In another study, **Kanchana** and **Pushpa**[144], despite failing to find a significant difference in vitamin D status between diabetic and non-diabetic groups found it to be significantly inversely correlated with BMI in the diabetic patients, thus implying that diabetic status has an independent impact on the relationship of vitamin D levels with BMI.

CONCLUSION

1. Mean serum vitamin D levels were significantly lower in Diabetic females (9.06±6.03 ng/ml) as compared to that in Non-Diabetic females (29.18±20.31 ng/ml).
2. Mean vitamin D levels were significantly higher in obese as well as non-obese Diabetic females as compared to obese as well as non-obese Non-Diabetic females.
3. Within group, obesity was associated with a significantly lower vitamin D levels in both Diabetic females as well as Non-Diabetic females.

Limitation Of The Study

The present study was carried out in a relatively younger population of women and did not ascertain the menopausal status of the women. Both age as well as menopausal status have an impact on both obesity as well as on vitamin D status. Hence, the impact of older age and menopausal status on obesity and vitamin D status remained somewhat unexplored in the present study.

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