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## Serum Retinol Concentration in Type 2 Diabetic Patients

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**Abstract:** The study was conducted to find out the co-relation between serum retinol concentration and type 2 diabetes mellitus receiving antidiabetic treatment. There are conflicting reports in literature about the serum levels of retinol in Non-Insulin Dependent Diabetes Mellitus (NIDDM) patients. Therefore, in the present study serum retinol levels were evaluated in 19 NIDDM patients using High Performance Liquid Chromatography (HPLC) technique. The serum retinol concentrations of 16 of the 19 patients were found to be within the normal limit (30-70  $\mu\text{g dL}^{-1}$ ). However, in 3 patients, the retinol levels were found to be more than the normal concentration. The retinol levels were within the normal range in 84% of the patients. Body Mass Index (BMI) of 90% of the patients were found to be more than the normal values. The higher BMI values observed in these patients indicate that 90% of them are at risk of getting cardiovascular diseases.

**Key words:** Retinol, retinol binding protein, high performance liquid chromatography, body mass index, non insulin dependent diabetes mellitus

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### INTRODUCTION

It has been suggested that diabetic patients have abnormalities in the conversion of carotene to vitamin A (Gouterman and Sibrack, 1980). An increase in plasma retinyl ester has been reported in non-insulin dependent diabetes mellitus (Wako *et al.*, 1986). *In vivo* and *in vitro* studies have shown that both an excess or lack of retinol could alter insulin secretion (Bauernfeind *et al.*, 1974; Blaizot *et al.*, 1978) and abnormalities in insulin level have been reported in type 2 diabetic patients (DeFronzo, 1988). Little is known about the nutritional status of retinol (vitamin A) in diabetic patients. Earlier studies have reported either high (Krempf *et al.*, 1991; Sasaki *et al.*, 1995; Sobczak *et al.*, 1999, Yamakoshi *et al.*, 2002), low (Wako *et al.*, 1986, Ceriello *et al.*, 1997, Merzouk *et al.*, 2003) or normal (Ranjini *et al.*, 1996; Abahusain *et al.*, 1999) levels of retinol in serum/plasma of NIDDM patients. Some researchers have found low retinol (Krempf *et al.*, 1991) and retinol binding protein (Baru *et al.*, 1986) in insulin dependent diabetes mellitus patients. In this study, we estimated the level of serum retinol in NIDDM patients receiving antidiabetic treatment.

### MATERIALS AND METHODS

The study was carried out in 19 patients of type 2 diabetes (11 men and 8 women: mean age $\pm$ SD, 51.1 $\pm$ 10.7 years; mean weight 64.8 $\pm$ 11.3 kg; mean height 158.1 $\pm$ 10.2 cm; mean BMI 26.2 $\pm$ 4.4 kg m<sup>-2</sup>). Medication history including demographic characteristics and the blood glucose level were screened. Signed consent was obtained from all those who participated in the study. Patients irrespective of age and sex were included in the study and diabetes mellitus type 2 was the only inclusion criteria. Patients taking vitamin A,  $\beta$ -carotene supplement or consuming large amounts of carrots were excluded from the study. Mentally retarded patients, drug addicts and unconscious patients and the patients unable to comply were also excluded from the study. This study was approved by the ethical committee of our institution.

For the estimation of retinol, fasting venous blood sample was collected from each patient, serum was separated and stored in an ultrafreezer at -20 $\pm$ 5°C. The analysis was performed by the HPLC method using a C18 column according to the procedure described by Bieri *et al.* (1979). Blood was collected after six weeks of the prescribed antidiabetic therapy.

## RESULTS

The mean fasting blood glucose and serum retinol concentration were found to be  $159.9 \pm 50.2$  mg dL<sup>-1</sup> and  $56.8 \pm 15.3$  µg dL<sup>-1</sup>, respectively. The serum concentration of retinol was found to be within the normal limit (30-70 µg dL<sup>-1</sup>) in 16 patients out of 19 patients. However in 3 patients, the retinol levels were found to be more than the normal concentration (i.e., 72.86, 73.55 and 101.21 µg dL<sup>-1</sup>).

## DISCUSSION

The serum retinol levels in type 2 diabetic patients were found to be higher in three patients (Table 1). This observation indicates that at least in a small proportion of diabetes mellitus type 2 patients, there is an increase in serum retinol concentration. This observation further confirms the findings of Krempf *et al.* (1991) and Yamakoshi *et al.* (2002), who have reported that vitamin A blood concentration was significantly increased in diabetes mellitus type 2 patients while Ceriello *et al.* (1997) have reported decreased plasma levels of retinol in NIDDM patients. In non-insulin dependent diabetes mellitus (NIDDM), lipid or lipo-protein changes in blood are the most likely explanation for high serum retinol concentration.

Hyperinsulinemia might increase the level of vitamin A in the liver, therefore, this observation suggests that

three of the diabetes mellitus type 2 patients who had participated in the study may be suffering from diabetes with hyperinsulinemia. Excess or lack of vitamin A also impairs the insulin secretion from β-cells of pancreas (Krempf *et al.*, 1991). Therefore, clinically we suggest that blood sugar level of these patients may be brought to control by including insulin sensitizers along with other oral antidiabetic.

It is observed that among the study patients more than 55% patients had a Body Mass Index (BMI)  $\geq 25$  kg m<sup>-2</sup>, which means that they are at greater risk of having metabolic and cardiovascular morbidity (Harrison *et al.*, 2001). Patients having BMI between 25-30 kg m<sup>-2</sup> have greater chances of having glucose intolerance.

Further studies can also be done by measuring the insulin level in blood. It can be suggested that type 2 diabetic patients should avoid taking excess of vitamin A, particularly pregnant women. Fish preparations like cod liver oil, excess intake of carrot and vitamin A containing products should be avoided, as it can lead to a progressive increase in the vitamin A levels in the blood of type 2 diabetic patients. Taking cognizance of the conflicting reports available in the literature about the serum levels of retinol in type 2 diabetic patients, a major study in a large population of type 2 diabetes is warranted to correlate their retinol levels with insulin levels.

Table 1: Patient characteristics and their estimated serum retinol concentration

Sample ID	Age (Years)	Sex (M/F)	Weight (kg)	Height (cm)	BMI (kg m <sup>-2</sup> )	Blood sugar level (mg dL <sup>-1</sup> ) (Fasting)	Retinol conc. (µg dL <sup>-1</sup> )	Drugs prescribed
D1	40	F	52	150	23.11	227	47.11	Metformin, Glimepiride
D2	59	F	48	145	22.83	135	59.42	Gliclazide, metformin
D3	58	F	60	151	26.31	132	63.38	Metformin, glibenclamide
D4	50	F	60	147	31.93	150	66.11	Metformin
D5	54	M	71	179	22.16	204	52.86	Pioglitazone, metformin, glimepiride,
D6	54	M	60	158	24.03	154	47.18	Glimepiride, metformin
D7	47	M	85	162	32.39	259	58.18	Glimepiride, pioglitazone, metformin, acarbose
D8	45	F	71	161	27.39	150	36.25	Metformin
D9	43	M	90	160	35.15	124	48.10	Rosiglitazone, metformin
D10	65	F	68	142	33.72	91	44.84	Gliclazide
D11	52	F	54	154	22.77	149	60.95	Metformin
D12	54	M	52	169	18.20	227	31.32	Glimepiride
D13	55	M	67	162	25.53	159	57.01	Pioglitazone, metformin, glimepiride, acarbose
D14	40	M	74	170	25.60	90	51.05	Glipizide, metformin, pioglitazone
D15	58	M	64	148	28.83	105	101.21	Insulin, gliclazide
D16	29	M	65	168	23.00	108	72.86	pioglitazone, metformin, glimepiride
D17	60	M	70	167	25.10	190	50.59	Pioglitazone, metformin, glimepiride
D18	73	M	70	164	26.00	153	73.55	Metformin
D19	35	F	50	147	23.14	232	56.87	Gliclazide, metformin

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