

Original Research Article

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Correlation between thyroxin hormone level, bilirubin and uric acid in diabetic subjects

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ABSTRACT

Background: Levels of thyroxin hormone along with T3, TSH and other markers such as uric acid, bilirubin and glucose are important in diagnosis and medical management of diabetes mellitus and thyroid disorder. Relationship between these parameters are important in both diabetes mellitus and Thyroid gland disease, as both disorders are increasing very fast in Indian population. Present study aimed to analyzed T3, T4, TSH, uric acid and bilirubin in Haroti Region of Jhalawar, Rajasthan in diabetic and non diabetic subjects.

Methods: One hundred diabetes mellitus subjects and 100 healthy control subjects were analyzed for determination of thyroxin, T3, TSH, uric acid and bilirubin by commercial kit method.

Results: One hundred subjects of diabetes mellitus between age 30-60 years male and female were analyzed. It was observed significantly $T3 < 0.001$ $T4 < 0.001$ $TSH < 0.001$ bilirubin < 0.01 in diabetic subjects and found to be significant when compared in both groups. However, uric acid level insignificant in both patients and control groups.

Conclusions: This study demonstrated that thyroxin hormone with T3, TSH and bilirubin and uric acid, are important parameters and their values are significant when compared with healthy subjects in diabetes mellitus and thyroid disorder.

Keywords: Bilirubin, T3, T4, TSH, Uric acid

INTRODUCTION

In diabetes and thyroid disorders conditions involve dysfunction of the endocrine system and thyroid dysfunction can have an impact on glucose control and untreated thyroid disorder and it may affects medical management of diabetes mellitus. The Prevalence of diabetes world wide would be rise in urban population just double as comparison to present scenario and India would be diabetic capital of world up to 2030. Thyroid tetraiodothyronin (T4) is the main hormone secreted in to blood serum by the Thyroid gland and converted in to tri-iodothyronin (T3) by liver and kidney.

Diabetes mellitus is a metabolic disorder and affects all age of population all over the world and characterized by polyuria, polydipsia and polyphasia.¹ India is a country where this syndrome is increasing day by day and India will be diabetic capital of world up to 2025.² Glucose metabolism disturbs in diabetes mellitus and it affects metabolism of lipid and proteins also if untreated. Thyroid hormones are very important marker which associated with carbohydrate metabolism especially glucose metabolism. If thyroid hormone level derranged metabolism of glucose disturb and in diabetes mellitus thyroid hormone play important role in disease development.³ Bilirubin and uric acid are important

biochemical parameters, function as antioxidant and bilirubin formation and transport affected by thyroid hormone.⁴⁻⁶ However, insulin resistance in diabetes mellitus may be a risk factor for development as thyroid nodule.⁷ Increased uric acid level associated with hypothyroidism.⁸

In present study, authors have estimated thyroxine hormone (T4 and T3), TSH, bilirubin and uric acid in diabetic subject and in normal healthy subject and analyzed correlation between these parameters in disease subject and control and their role in diagnosis, prognosis and medical management of diabetes mellitus as well as thyroid disorder.

METHODS

Present study was conducted in department of Medicine in SRG Hospital and Jhalawar Medical College, Jhalawar (Raj.) in 100 clinically diagnosed subjects of diabetes mellitus between age 30-60 years and healthy control groups. This study was done during period between January 2017 to June 2018. Serum separated from blood of study subjects then T3, T4, TSH, bilirubin, uric acid and glucose levels were estimated.

Inclusion criteria

- Male and female subject between age 30-60 years inclusive type 2 diabetes mellitus.
- Subjects must be off all oral hypoglycemic agents 24hours prior to each study dosing day off and investigational drug.
- Subjects must be willing and able to confined to the clinical research lab as per protocol of study.

Exclusion criteria

- Clinical history of presence as respiratory, Hepatic, Cardiovascular, neurological, gastrointestinal or infectious disorder capable of altering absorption, altering, elimination of drugs,
- Positive HIV serology,
- Positive hepatitis B, hepatitis C,
- Neuropsychiatric disease,
- Treatment with insulin therapy,
- Evidence as hematological disease.

T3, T4 and TSH were analyzed by Immunoturbidometric method.⁹ Bilirubin by the method of diazotized sulfonic acid and uric acid analyzed by commercial kit method.^{10,11} All biochemical parameters were performed using Backman-coulter AU680, fully auto analyzer.

Statistical data were analyzed by SPSS Version 20.0. Data were demonstrated as mean \pm SD and P value represents when study group compared with healthy control subjects p value less than 0.001 was considered as statistically significant at 95% confidence intervals.

RESULTS

Among 100 patients 66% were male and 34% female and in control group it was found to be 62% and 38% respectively. The mean age of patients were 51.38 years and control groups mean age were found to be 52.50 years.

Table 1 shows the comparison of biochemical parameters among control group and patients group and it was found to be significant (glucose level, TSH, T4, T3 and bilirubin). However, uric acid level was Insignificant.

Table 1: Comparison of biochemical parameters in patient and control group.

Parameters	Patients (mean \pm SD)	Control	P value
Glucose (mg/dl)	203 \pm 14.32	81.32 \pm 4.31	<0.001
TSH (mIU/mL)	15.56 \pm 10.10	2.871 \pm 1.50	<0.001
T4 (ng/mL)	35.41 \pm 15.55	84.38 \pm 15.89	<0.001
T3 (ng/mL)	0.11 \pm 0.50	1.15 \pm 1.0	<0.001
Bilirubin (mg/dl)	1.51 \pm 0.52	0.81 \pm 0.23	<0.001
Uric acid (mg/dl)	5.010 \pm 2.10	4.35 \pm 2.97	>0.001

In present study the (mean \pm SD) level of glucose in diabetic patients was 203 \pm 14.32mg/dl, (mean \pm SD) level of TSH 15.56 \pm 10.10 μ IU/mL, (mean \pm SD) T4 35.41 \pm 15.55ng/ml, (mean \pm SD) T3 0.11 \pm 0.50ng/ml, (mean \pm SD) bilirubin 1.51 \pm 0.52mg/dl and (mean \pm SD) uric acid was found to be 5.010 \pm 2.10mg/dl.

The p value of glucose, TSH, T4, T3 and bilirubin of diabetes mellitus patients and healthy control group when compared it was significant with p value <0.001 of each parameter however p value of uric acid in both male and female was found to be significant (p>0.001) (Table 1).

However, in control group level of glucose 81.32 \pm 4.31mg/dl, TSH 2.871 \pm 1.50 μ IU/mL, T4 84.38 \pm 15.89ng/ml, T3 1.15 \pm 1.0ng/ml, bilirubin 0.81 \pm 0.23 mg/dl, uric acid 4.35 \pm 2.97mg/dl.

Table 2: Reference range of study group and control group.

Parameters	Range
Glucose (mg/dl)	70-110mg/dl (fasting)
TSH	0.4-4.5 μ IU/mL
T4	55-127ng/mL
T3	0.69-2.15ng/mL
Bilirubin	0.2-1.0mg/dL
Uric acid	Male 3.0-7.0mg/dL Female 2.0-5mg/dL

Reference range of the study subjects shown in Table 2. Reference range of (patients and control) of diabetes subjects such as glucose in range 70-110mg/dl, TSH 0.4-4.5 μ IU/mL, T4 55-127ng/mL, T3 0.69-2.15ng/mL,

bilirubin 0.2-1.0mg/dL, uric acid male 3.0-7.0mg/dL female 2.0-5mg/dL.

DISCUSSION

Thyroid disease correlated with diabetes both type 1 and type 2. The Thyroid gland synthesizes and release Thyroxin (T4) and tri-iodothyronine (T3) in response to stimulation by thyroid stimulating hormone which is secreted by adenohypophysis alteration in thyroid production may be caused by disorders affecting the hypothalamus, which secrets thyrotropin releasing hormone (TRH) in response to circulating T4 and T3 levels, the pituitary gland or the thyroid gland itself, such alteration affects all body systems along with metabolic syndrome "X" diabetes mellitus.¹² In present study, authors determined thyroxin hormone (T4), T3, TSH, uric acid and bilirubin along with glucose in diabetic subjects. Table 1 showing level of thyroxin (T4) were found to be significantly decreased ($P<0.001$) as compared to control subjects and T3 ($P<0.001$) level also lower significantly ($P<0.001$). These results were agreements with other workers.^{13,14} According to Chacker L, thyroid hormone are important marker for body energy expenditure and metabolism, low thyroid hormone related with not only body mass index but also insulin sensitivity and glucose tolerance.

However, Carraris GJ reported prevalence thyroid disease in the population 6.6% with hypothyroidism.¹⁴ Level of TSH in this study found to be increased significantly ($P<0.001$) when compared with euthyroid subjects (Table 1) which is similar to studied reported in literature.^{15,16} Thyroid disorder and diabetes both mutually affects each other and demonstrated in literature.^{17,18} Increased hepatocyte plasma membrane GLUT2 (glucose transporter) which is responsible for liver glucose output and impaired carbohydrate metabolism.¹⁹ However Handisurya A et al, evaluated B cell function and insulin sensitivity in subclinical hypothyroidism and overt hypothyroidism before and after thyroxin (T4) replacement therapy and concluded partially ameliorate the insulin secretion improved insulin sensitivity.²⁰ Serum total bilirubin in present study significantly increased ($P<0.001$) compared to euthyroid subject (Table 1) bilirubin function as antioxidant properties and scavenge, peroxyl radicals.²¹

However, low Free T4 levels within euthyroid subjects and decreased bilirubin level in type 2 diabetes mellitus demonstrated in literature and it may enhance arteriosclerosis susceptibility in type 2 diabetes mellitus by decreasing serum bilirubin level.²² Uric acid is function as antioxidants not only thyroid disorder and diabetes mellitus but also in other disease such as cancer.²³ In present study, uric acid level in patients of diabetes mellitus found to be insignificant when compared with non diabetic healthy subject ($P>0.001$) our result similar to with studied by other worker.²⁴ According to Yokogoshi Y et al, hyperuricemia and

hypouricemia affects endocrine production of hormone such as thyroxin, T3 and TSH and described hyperuricemia due to decreased kidney excretion is related to hypothyroidism diabetic keto-acidosis, hyperparathyroidism diabetes insipidus and hypouricemia caused increased kidney uric acid excretion which related to hyperparathyroidism.²⁵

However, some studies demonstrated positive correlation with metabolic syndrome but negatively correlated with diabetes.^{26,27}

CONCLUSION

Authors concluded in their study that thyroid gland hormone thyroxin (T4), T3 and TSH, bilirubin and glucose were significantly associated in diabetic subjects and well correlated with hypothyroidism and both diseases are interrelated and uric acid level found to be insignificant in Harodi reason of Jhalawar (Rajasthan).

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Conflict of interest: None declared

Ethical approval: The study was approved by the Institutional Ethics Committee

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