Medical Science Journal for Advance Research

Copyright © The Author(s)
Vol. 4 , No. 3 , August 2023
e-ISSN: 2774-4892

Effect Of Diabetes Mellitus On Thyroid Gland Physiology And Hormone

Rusul Arif Abd Ali [1], Zahraa Kareem AL-mayali[2], Wijdan Rajh Hamza Al-Kraity[3]

[1]*Department Medical Laboratory Technique, Al-Furat Al-Awsat Technical University , Kufa Technical Institute , Najaf, Iraq.*
[2]*Department Of Basic Science, Faculty Of Dentistry, University Of Kufa , Najaf, Iraq ,*
[3] *Faculty Of Medicine, University Of Kufa, Najaf, Iraq.*
E-mail: rusul.shallan@atu.edu.iq, zahraak.almayali@uokufa.edu.iq, wijdanr.alkraity@uokufa.edu.iq

ABSTRACT

Backgraund: *Thyroid gland is considered biggest ductless gland in human, consist of many follicular cells called colloid that responsible for production of glycoprotein thyroglobulin. Itis secrete T3,T4, TSH and calcitonin hormone that increase the metabolic rate of the body, growth and differentiation. thyroid hormone acting a role in regulatory metabolism of glucose and pancreatic role, but diabetes mellitus changed thyroid function. Such as, "TSH to thyrotropin-releasing hormone response" it is reduced in diabetes, that lead to accompanying reduced T3 level and hypothyroidism, together hypothyroidism and hyperthyroidism lead to insulin resistance. In this study show significant decrease in Hb , RBC,WBC and Hba1c level in male and female patient as compare with control, also show significant increase in Glucose level in both male and female patients as compare with control, and significantly decrease in TSH T3 and T4 level in female and male patients as compare with control. Thyroid hormones cause immediate effect on the blood parameter by inducing the precursors of the erythrocyte and indirectly by stimulating erythropoietin manufacture, also diabetes effect on thyroid function by changing the thyroid-stimulating hormone (TSH) level and weakening the alteration of thyroxine (T4) to triiodothyronine (T3) in the peripheral tissues.*

Keywords: Thyroid gland, T3, T4, TSH.

Article Information

Received: June 22, 2023; Revised: July 30, 2023; Online: August , 2023

INTRODUCTION

Thyroid gland is a portion of the body endocrine system. It is the biggest structure specify for endocrine function in human and have a butterfly - formed gland within numerous vein, attached about the front of the pharynx nearby the larynx. (Salvatore *et al*., 2018). Thyroid gland consist of huge numbers of closed follicle (100 to 300 micrometer in diameter). The follicles occupied with colloid and line with cuboidal epithelial cells.

The major constituent of colloid is the large glycoprotein called thyroglobulin each particle of thyroglobulin consist of about 70 tyrosine amino acid (Guyton and Hall, 2016) . Thyroid gland absorption iodine ion from the food and release thyroid hormones, iodine containing compound that act direct role in rate of body metabolism. Whole processes, regulatory of temperature, protein regulation, carbohydrate and fat catabolism in all cells. Thyroid keep releasing of growth hormone, skeleton maturation, and heart rate strength and output. Also stimulate central nervous system growth and creation of many enzymes,

https://doi.org/10.46966/msjar.v4i03.142
This work is licensed under a Creative Commons Attribution 4.0 International License
Published by: READ INSTITUTE

Thyroid is essential for muscle tone (Fancy *et al*.,2010). Secretion T3 &T4 that increase the metabolic rate of the body, thyroid excretion is regulated by (TSH). Secretes calcitonin which involved in calcium metabolism. Around 93 percent of the metabolically activated hormones is thyroxine and 7 percent is triiodothyronine. Nearly all the thyroxine is finally converted to triiodothyronine in the tissues. Triiodothyronine is around four times as strong as thyroxine, raised thyroxine secretion increased the rate of glucose metabolism, so cause elevated of insulin secretion by the pancreas. (Guyton and Hall , 2016). Thyroid stimulating hormone (from the anterior pituitary gland) raises thyroid secretion. Thyroid hormones biogenesis and metabolism is controlled by at least three aspects: TSH-induced stimulation, iodine obtainability, and deiodinases action. TSH secretion is enhanced by TRH, which is in turn formed by neurons of the paraventricular nucleus of the hypothalamus, and stops thyroid shortage (Hoermann *et al*., 2015).

Both hypothyroidism and hyperthyroidism are more. Circulating thyroid hormones affect numerous different organs and cells, have a main influence on glucose, protein metabolism and lipid,, and can degenerate glycaemic control in T2DM (Kalra *et al*.,2019).

T2DM in thyroid dysfunction is supposed to be triggered via changed gene expression of a collection of genes, in addition to physiological irregularities that result in reduced glucose uptake expand, disposal in muscles, splanchnic glucose absorption, increased hepatic glucose production. Furthermore, equally hyperthyroidism and hypothyroidism can effect insulin tolerance. Insulin tolerance can grow in subclinical hypothyroidism as a result of a reduced amount of insulin-enhance glucose transmission caused by a translocation of the glucose transporter type 2 (GLUT 2) gene. The insulin tolerance and hyperinsulinemia resulting from diabetes can effect culminate in goitrous alteration of the thyroid gland (Hussein and AbdElmageed ,2021).

Thyroid hormone act to regulatory of glucose metabolism and pancreatic role, whereas diabetes mellitus able to change thyroid action. Such as, “TSH to thyrotropin-releasing hormone response” can be found to reduce in diabetic patients, beginning associated with decreased T3 levels and hypothyroidism. It can be offer during diabetes decreased T3 levels can reduction the alteration of T3 from T4 on the source of research showed to detect hyperglycemia prompted reversible decrease in hepatic thyroxine concentricity and deiodinase action. Additional studies have exposed that raised T3 levels even for little period can initiate insulin resistibility; in that way contributory to T2DM (Gursoy and Tuncel, 1999). Hypothyroidism (Hashimoto’s thyroiditis) otherwise thyroid over action (Graves’ disease) can be examined to be related with diabetes mellitus (Kadiyala *et al*.,2010).

MATERIALS AND METHODS

The collection of samples was conducted from 60 patients for the study, 30 males and 30 females and 30 control aged between 25 to 50 years. The patients were diagnosed with thyroid defect and diabetes mellitus for both sexes based on the history, clinical examination to determine the (Hba1c, TSH,T3 and T4 in serum from bilabo France) also determine the (HB, WBC, RBC) by CBC apparatus .

Statically analysis

The data were analyzed by using windows software packages Graphpad prism v6, data were offered as the mean± (SD). Statistical analysis of comparison between the patients and healthy groups were tested by by t-test. It carried out the correlation between the parameter's correlation coefficient of Pearson.

 Copyright © The Author(s)

A level of statistically significant determination by P-value < 0.05.

Table 1 : Hematological changes in patient with thyroid disorder.

Parameter	Patient Male=20	Control Male	P value	Patient Female=20	Control Female	P value
Hemoglobin g/dl	12.8±5.6	14.2±3.11	5.01E-06*	12.2±1.9	13.2±1	3.14E-10*
RBC	5.09±2.12	5.5±0.4	0.00231*	4.6±91.2	4.9±0.2	0.004*
WBC	7.08±1.4	4.04±667.2	4.25E-12*	11.7±3.6	4.04. ±60	4.32E-12*
Hba1c%	8.65±0.012	5.2±0.005	2.62E-07*	7.8±0.005	5.6±0.005	6.25E-08*

*mean , significant different, P- value

Biochemical change in patient with thyroid disorder

The result in (table 2) show significant increase in Glucose level in both male and female patient as compare with control. And significant decrease in TSH ,T3 and T4 level in both male and female patient as compare with control.

Table 2: Change in level of blood glucose and TSH , T3 and T4 level in patient with thyroid disorder.

Parameter	Patient Male=20	Control Male	P value	Patient Female=20	Control Female	P value
Glucose	157.8±5.6	143.2±3.11	0.001*	159.2±1.9	142.25±1	5.92E-7*
TSH	0.23±0.26	2.05±1.36	0.0046*	0.3±0.314	2.7±0.7	9.79E-07
T3	1.04±0.02	2.15±0.7	0.0011*	1.05±0.03	2.150±0.7	0.004*
T4	78.5±5.97	82±10.5	0.332	78±5.5	80±10.5	0.367

***mean , significant different, P- value**

DISCUSSION

The thyroid gland plays actual vital function in the body metabolism, generally inclusive the hematopoiesis. Blood conditions are commonly viewed in patients with thyroid disorders since thyroid hormones possess a very vital role in the propagation and the metabolism of RBCs and wholly other blood elements. Thyroid hormones own a direct affect on the blood parameters by inducing the precursors of the red blood cells and indirectly by stimulating erythropoietin manufacture (Ahmed and Mohamm, 2020). The result that obtains shows significant increase in Glucose level in both male and female patient as compare with control, and significant decrease in TSH , T3 and T4 level in both male and female patient as compare with control. Thyroid hormones possess anvital role in metabolic activity in humans and reduced Levels of these hormones that results hypothyroidism. Hypothyroidism lead to overall decrease in metabolism of body. Diabetes and thyroid disorders are the two commonable endocrine diseases. Thyroid hormones possess some function in the regulation of pancreatic role and carbohydrate metabolism, further diabetes effects thyroid

Copyright © The Author(s)

function tests to some changeable extents. jointly thyroid and insulin hormones become tightly engaged in cellular metabolism, abnormal levels of these hormones effect the function of anther hormone. Weakly control diabetics possess “Low T3 state” characterize by decrease in serum total and free T3 levels, since of weakly response to TRH or loss of normal nightly TSH peak (Gronich *et al*., 2015; Nilsson and Fagman, 2017).Diabetes mellitus effects thyroid action by alteration the thyroid-stimulating hormone (TSH) level and weakly the conversion of thyroxine (T4) to triiodothyronine (T3) in the peripheral tissues (Ahmed,2014). Thyroid hormone acting on different organs raises gastrointestinal movement and stimulating glucose absorption. In the liver, it raises the action of phosphoenolpyruvate carboxykinase (PEPCK), an enzyme that catalyze gluconeogenesis. Hepatic gluconeogenesis can happen during the direct effect of the thyroid hormone or indirectly through glucagon or catecholamine. The catalyze glycogenolysis and raised hepatic glucose output enhanced hyperinsulinaemia and glucose intolerance, that lead to peripheral insulin resistance. Diabetes and exaggerates the hyperglycaemia in T2DM raising the hazard of diabetic complication. In adipose tissues, thyroid hormone raises lipolysis. The raised free fatty acid level cause insulin resistance. Raised lipolysis and increased hepatic b-oxidation, complex by an insulin-reduction state, can cause ketoacidosis (Wang, 2013; Nishi, 2018)

CONCLUSIONS

We concluded thats relation between diabetes and thyroid disorder .Diabetic effect on thyroid hormone.

REFERENCES

- **Abrahamson**, M.; Olafsson, I.; Plasdottir, A.; Ulvsback, M.; Lund Wall, A.; Tensson, O. and Grubb, A., (1990). Structure and expression of the human cystatin C gene. Biochem J.,268(2): 287-94.
- **Ahmed,** S.S. and Mohammed, A.A., (2020) . Effects of thyroid dysfunction on hematological parameters: Case controlled study. Ann Med Surg (Lond). Jul 11;57:52-55.
- **Gronich,** N. Spyros, N. Deftereos, Lavi, I. Andreas. S. Persidis,. Abernethy, R .and Rennert, G. (2015). Hypothyroidism Is a Risk Factor for New-Onset Diabetes: A Cohort Study ., Diabetes Care .38:1657–1664.
- **Gursoy,** N. T .and Tuncel, E.(1999). The relationship between the glycaemic control and hypothalamus-pituitary-thyroid axis in diabetic patients. Turkish J Endocrinol Metab., 12:163-8.
- **Guyton,** A.C. and Hall, J.E. (2016). Guyton and Hall Textbook of Medical Physiology. (13th ed.). Elsevier. International Edition. pp: 939-950.
- **Hoermann,** R. Midgley, J.E. Larisch, R. and Dietrich, J.W. (2015). Homeostatic control of the thyroid-pituitary Axis: Perspectives for diagnosis and treatment. Front Endocrinol (Lausanne) 20: 6–177.
- **Kadiyala,** R. Peter, R. and Okosieme,O. E.(2010) “Thyroid dysfunction in patients with diabetes: clinical implications and screening strategies,” International Journal of Clinical Practice, vol. 64, no. 8, pp. 1130–1139**.**
- **Kalra,** S. Aggarwal, S. and Khandelwal, D . (2019). Thyroid Dysfunction and Type 2 Diabetes Mellitus Screening Strategies and Implications for Management., Diabetes Ther (2019) 10:2035–2044.

 Copyright © The Author(s)

- **Mohammed,** H. S. and AbdElmageed, R. (2021) The Relationship Between Type 2 Diabetes Mellitus and Related Thyroid Diseases. Cureus 13(12): e20697. doi:10.7759/cureus.20697.
- **Nilsson,** M. and Fagman, H. (2017). Development of the thyroid gland. Development 144: 2123–2140.
- **Nishi,** M.(2018). Diabetes mellitus and thyroid diseases .Diabetol Int.;9:108–12.
- **Salvatore** B., G. Martino, Messina, Italy Giovanni Tuccari, Antonio Ieni, and Roberto Vita, (2018). Thyroid Gland: Anatomy and Physiology.
- **Wang,** C. (2013). The relationship between type 2 diabetes mellitus and related thyroid diseases. J Diabetes Res;390534.

Copyright © The Author(s)